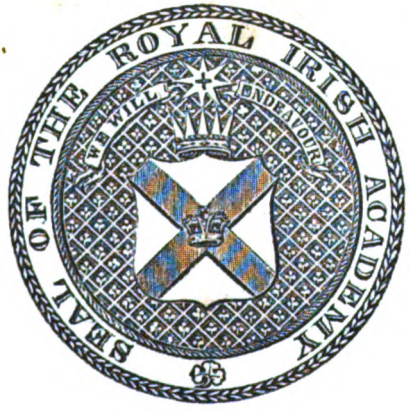
PROCEEDINGS

OF THE

ROYAL IRISH ACADEMY.

VOL. VII.



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VOLUME VII.

1857–1861.

APPENDICES.

PROCEEDINGS

OF

THE ROYAL IRISH ACADEMY.

MONDAY, NOVEMBER 9, 1857.

JAMES HENTHORN TODD, D. D., President, in the Chair.

On the recommendation of the Council the following Resolutions were adopted:—

1. To authorize the Treasurer to pay a sum of £41 5*s.* 11*d.*, to liquidate the Balance of the cost of printing the Museum Catalogue and arranging the Museum,—this sum being in addition to the sum of £250 voted on the 16th March last.

2. That all moneys derived from the sale of the Catalogue, after the expenses of Advertising, &c., be devoted to the publication of the second part of that work.

Rev. R. Carmichael read a paper on some Brief Methods in the Integral Calculus.

Sir W. R. Hamilton gave an account of some researches of his own on the Theory of Definite Integrals.

MONDAY, NOVEMBER 30, 1857. (STATED MEETING.)

JAMES HENTHORN TODD, D. D., President, in the Chair.

In consequence of the unavoidable absence of the author, the following paper by the Rev. T. R. Robinson, D. D., was read by the President—

ON THE LIFTING POWERS OF ELECTRO-MAGNETS.

This paper constituted the third part of Dr. Robinson's researches on the lifting power of the Electro-magnet. In it he examines the dependence of this power on the length and inductivity of the magnetic circuit which is formed when the poles are connected by a keeper. Whatever lessens the inductivity, lessens the magnetic power. If the circuit be incomplete, or if the middle of the keeper or of the magnet be brass, the power decreases to 0·70 or 0·08, or even to 0·02 of its normal amount. Plates of brass 0·12 thick interposed between the keeper and poles produce a similar effect; and even the minute interval which re-

mains when they seem in contact is sufficient to destroy $\frac{1}{14}$ of the entire power.

As iron does not transmit magnetic induction without diminution, the same decrease of power is caused by either increasing the circuit or placing the helices at a greater distance from the poles. In the first case, varying the circuit from 12^i to 32^i reduces the power to $\frac{1}{2}$, in the second changing the distances from 0^i·1 to 10^i brings it to 0·87.

If the helices be on one arm only, the poles are unequally excited, the adjacent one more, the remote less, than would be done by the same amount of excitation equally divided between the two arms.

Tables of these results are given, from which he at first hoped to ascertain the law connecting the power with these variables. The problem appears too complicated to be solved by experiment alone, but he offers them as useful data both for theoretic research and practical application.

Various magnets are compared: in general, the lifting power is greater the shorter the magnet, and the closer the spires are brought to its poles; if it be intended to act at a distance, or to magnetize hard steel, it should be long, and uniformly covered with spires.

Beyond 2^i diameter, or even less, the central part of the magnet seems not to contribute to its power.

The power decreases with a rise of temperature if the magnet be iron, the rate varying with its length and section; if of hard steel, it increases, and much more rapidly.

Both with iron and steel there remains magnetism if the exciting current be withdrawn; in the latter case it is permanent and of large amount, and is not destroyed by reversing the current (unless that be of a certain power), even though it produce a temporary reversal of polarity while passing. The power of steel is with ordinary exciting forces far less than that of iron, but with higher they tend to equality.

If a table of the successive powers of a magnet and the corresponding exciting forces be examined, it is seen that they are not proportional, except approximately at the beginning of the series. The increase of the first for a given increase of the second diminishes constantly, and so as to show that in every instance there is a maximum which no amount of current force or number of spires can pass. The precise relation between the power and exciting force has not yet been determined, but he finds that the following empirical formula represents very well, except for the very lowest powers, the action of the seven magnets with which he worked—

$$L = \frac{A\psi}{B + \psi},$$

in which A is the maximum power; ψ the exciting force measured by the quantity of the current × number of spires; and B a constant which may be called the modulus of the magnet, and seems to possess some remarkable properties. It is the ψ which produces a power = $\frac{1}{2}$A, and below which the permanent magnetism is not reversed completely. Below it, also, what he calls residual excitation, that which remains

after the current ceases, and till the keeper is raised, varies; above it, it is constant.

The paper concludes with a summary of its contents and those of the two preceding it.

A perfect copy of Charles Brooking's map of Dublin, published in 1728, with a view of the city, and fronts of the public buildings, was presented by Miss Wilkinson.

A list of donations of books presented was read, and thanks voted to the donors.

MONDAY, DECEMBER 14, 1857.

James Henthorn Todd, D. D., President, in the Chair.

The Rev. Robert Carmichael read a Paper on the Singular Solutions of Partial Differential Equations.

William Kelly, M. D., R. N., read the following Paper on—

THE ANNUAL VARIATIONS OF ATMOSPHERIC PRESSURE IN THE GULF OF ST. LAWRENCE.

The Table which accompanies this Paper is an abstract from the "Meteorological Journal of the Naval Surveying Party" on the St. Lawrence. The observations from which it is taken extend over nine years, from 1841 to 1850. They were made on board the Gulnare surveying vessel, from the end of May in each year, to the middle of October; and during the remainder of the year at Charlotte Town, Prince Edward Island, where the party wintered.

Two ordinary marine barometers were employed in making these observations. The first got out of order in June, 1845, and the second was not obtained until the September following. The indications of the latter were somewhat lower than those of the first, which agreed generally with other barometers of the same construction. There was no apparent difference, however, in the range of the instruments, which, it is scarcely necessary to say, was less than the true range; not only on account of the varying level of the mercury in the bag, according as it ascends or descends in the tube; but also from hygrometric causes acting on the bag itself; the instruments having been kept in the moist air of a vessel at sea during the summer, and in the dry air of a house warmed by stoves during the winter.

From the mean of all the observations we find that the atmospheric pressure is least in January, February, and March; that it increases slowly in April and May, and that there is a very slight decrease (·01) in June; that the pressure is greatest in July, August, and September, after which it decreases gradually through the three remaining months of the year.

The annual course of atmospheric pressure which we find here, on the north-east coast of America, derives interest from the fact that a similar

course has been as yet observed only at Sitka, on the extreme north-west of the continent, and in Europe at considerable mountain elevations. Nothing apparently connected with it, either by similarity or contrast, has been observed on the mainland of North America; but in the sea to the north of the continent, which in following the coast-line may be said to lie between Norfolk Sound and the Gulf of St. Lawrence, we find an annual course of atmospheric pressure, decidedly different from that which obtains in these seas.

Summary of Barometric Observations made in Charlotte Town, and the southern parts of the Gulf of St. Lawrence, between 1841 *and* 1850.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1841						29·964	29·958	30·115	30·044	29·837	29·729	29·816
1842	29·789	29·838	29·899	29·895	29·842	29·986	30·044	30·172	29·943	29·899	29·852	29·853
1843	29·946	29·725	29·663	29·927	29·977	29·900	29·960	30·120	30·020	29·843	29·857	29·920
1844	29·657	29·928	29·923	30·070	29·927	29·970	29·933	30·036	30·063	29·985	29·800	29·777
1845	29·894	29·856	29·895	29·900	29·944	. . .	. . .	. . .	29·790	29·983	29·695	29·712
1846	29·568	29·590	29·716	29·776	29·736	29·808	29·750	29·817	29·803	29·873	29·704	29·510
1847	29·610	29·623	29·520	29·593	29·790	29·847	29·903	29·969	20·883	29·821	29·764	29·774
1848	29.820	29·485	29·682	29·782	29·704	29·773	29·909	29·910	29·802	29·783	29·765	29·784
1849	29·617	29·887	29·813	29·583	29·817	29·769	29·872	29·892	22·975	29·820	29·690	29·590
1850	29·730	29·560	29·470	29·590	29·720	29·748	29·797	29·724	29·791			
Means	29·787	29·722	29·725	29·791	29·829	29·863	29·903	29·972	29·901	29·872	29·762	29·748

Mean of all the Observations reduced to the Level of the Sea.

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
29·781	29·766	29·769	29·835	29·873	29·863	29·903	29·972	29·901	29·894	29·806	29·792

From the observations carried on for three years, on board H. M. S. Investigator, in Melville Sound, and those of Captain Parry, at Melville Island, we find that the barometer was always lowest in July, August, and September; and comparatively high, although not highest, in January, February, and March. The low state of the barometer in the former months was marked in all Parry's voyages; but from his observations, as well as from those made in the Investigator, the greatest height was in April and May.

It would seem that the annual course of atmospheric pressure, which prevails all over Asia (and which is the reverse of that observed in the Gulf of S. Lawrence), extends beyond the shores of Siberia, and is met in a modified form, on the American side of the Arctic Sea.

The President read a letter addressed to him by the Baron de Bonstettin, containing inquiries respecting ancient pipes discovered in excavations in Ireland.

The following antiquities were presented to the Museum:—

1. An iron spear-head found in the county of Fermanagh. Presented by Miss Richardson.
2. A small cinerary urn, found near Cabinteely, on the land of the donor. It was discovered in the centre of a small chamber filled with a mixture of clay and bone-dust, and covered with a large flag, and about two feet of earth. Presented by J. H. Jessop, Esq.
3. A small glass bottle, found in Ardglass, county of Down. Presented by Rev. J. H. Todd, D. D., President.
4. Five modern Indian coins, and a small ingot of silver. Presented by William Kennedy, Esq.
5. Several copies of the new Index to the Ordnance Map of Ireland, on the scale of one inch to the statute mile, showing the state of publication on the 30th of November, 1857. Presented by Captain Leach.

MONDAY, JANUARY 11, 1858.

HUMPHREY LLOYD, D.D., Vice-President, in the Chair.

ALEXANDER T. BLAKELEY, Esq.; Maurice Henry Collis, M.B.; Howard B. Montgomery, M.D.; and John Purser, Jun., Esq.; were elected Members of the Academy.

The REV. DR. LLOYD read a paper—

ON THE DETERMINATION OF THE INTENSITY OF THE EARTH'S MAGNETIC FORCE IN ABSOLUTE MEASURE, BY MEANS OF THE DIP CIRCLE.

THE received method of determining the intensity of the earth's magnetic force is unsuited to the high magnetic latitudes, the error of the deduced force, arising from a given error of inclination, becoming very considerable when the latter approaches to 90°. To remedy this defect the author suggested, some years since,* another process, in which the total intensity is found *directly* by means of the dip circle,—the *product* of the earth's magnetic force into the magnetic moment of the magnet being determined by the position of equilibrium of the dipping-needle, when loaded with a small weight, and the *ratio* of the same quantities being found by removing the needle, and employing it to deflect another substituted in its place. Subsequent considerations, however, led him to propose that the dip-circle should be employed only in the *latter* part of the process, and that the observation should be completed by the known method.

* See "Proceedings," January 24, 1848.

In the present communication the author shows in what manner this complication may be avoided, and the original proposal carried out. It is of great importance to the scientific traveller that the instruments which he has to carry should be reduced, as far as possible, in number and weight, and that their adjustments should be few and simple; and these objects, it is believed, will be attained by the use of the method now proposed.

The equation of equilibrium of a dipping-needle, when loaded with a small weight acting in opposition to magnetism, is

$$M(Y\cos\eta - X\cos\alpha\sin\eta) = Wr; \qquad (1)$$

in which X and Y denote the horizontal and vertical components of the earth's magnetic force, M the magnetic moment of the needle, α the magnetic azimuth of the plane in which it moves, η its inclination to the horizon, W the added weight, and r the radius of the pulley by which it acts. And when this needle is removed, and applied to deflect another substituted in its place, the equation of equilibrium of the latter is

$$Y\cos\eta' - X\cos\alpha'\sin\eta' = MU; \qquad (2)$$

α' and η' denoting, as before, the azimuth and inclination of the needle, and U being a function of the distance of the centres of the two needles, and of certain integrals depending on the distribution of free magnetism in them.

When the planes in which the needles move coincide with the magnetic meridian, or $\alpha = 0$, $\alpha' = 0$, the left-hand members of these equations are reduced respectively to $MR\sin(\theta - \eta)$, $R\sin(\theta - \eta')$; R denoting the total force, and θ the inclination. Wherefore, multiplying, we have

$$R^2\sin(\theta - \eta)\sin(\theta - \eta') = UWr; \qquad (3)$$

an equation which gives the force, R, in terms of the observed angles, θ, η, and η', and of the quantities U, W, and r.

But the angles, θ, η, and η', are liable to error, arising from the friction of the needles on their supports; and the corresponding error of the deduced force varies inversely as the sine of the angle of deflection, $\theta - \eta$, or $\theta - \eta'$. It is, therefore, requisite for accuracy that these angles should be considerable. There is no difficulty in augmenting the angle of deflection as much as we please in the first part of the process, in which the deflection is produced by a weight. But in the second the case is different; and, with the slender needles here employed, a large deflection can only be attained by placing the deflecting needle at a very short distance from the moveable one. The most convenient arrangement appears to be to attach the former to the moveable arm of the divided circle which carries the verniers, and at right angles to the wires of the microscopes: so attached, it must always be rendered perpendicular to the deflected needle in the course of the observation, although in a different plane.

The quantity denoted by U, in this position, is a function of the distance of the centres of the two needles, and of the ratios of certain integrals which depend upon their magnetic distribution. It may be shown that the variations of these ratios, arising from the gradual changes of magnetism of the needles, may be disregarded; so that, if the distance be invariable, the function U will be constant. This is a point of considerable importance; for it follows from it that, even if the value of U be unknown, R will be relatively determined by a process which is *independent of the changes in the magnetic moments of the two needles*. Hence, if the value of the force be found at any one place, by any independent means, it will be absolutely known at all.

But the value of the constant U may be found by deflection, by the instrument itself, and the method therefore rendered rigorously *absolute*. In using the dip-circle for this purpose, it will be convenient to produce the equilibrium by turning the instrument in azimuth until the deflected needle is vertical; for, in this case, the deflecting magnet is always horizontal, and can be placed in the usual position with respect to the deflected magnet, without difficulty. For this purpose the apparatus is provided with a gun-metal bar, having a rectangular aperture, by means of which it passes over the box containing the deflected magnet, and rests on two supports fixed outside on the level of the agate planes. The deflecting magnet is to be placed on this support, at different known distances, and on each side of the deflected magnet, its axis being in the plane in which the latter moves; and the apparatus is to be turned in azimuth until the deflected needle is vertical. In this case equation (2) becomes

$$-X\cos\alpha = MV;$$

in which V is of the form

$$V = \frac{2}{D^3}\left(1 + \frac{p}{D^2} + \frac{q}{D^4} + \&c.\right).$$

The quantities p and q are to be found in the usual manner, by repeating the observation at several known distances, and eliminating among the resulting equations. This being done, the deflecting magnet is to be removed from the bar, and placed in its ordinary position between the microscopes; and the observation is to be repeated. If α_0 denote the corresponding azimuth,

$$-X\cos\alpha_0 = MU;$$

whence

$$U = V\frac{\cos\alpha_0}{\cos\alpha}.$$

The method here proposed appears to offer the following advantages to the travelling observer :—

1. It is applicable, with equal accuracy, at all parts of the globe.
2. It dispenses with the employment of a separate instrument for

the determination of the magnetic intensity, and with the separate adjustments required in erecting it.

3. The constants to be determined—the magnitude of the added weight, and the radius of the pulley by which it acts—can be ascertained with more ease and certainty than those which are required in the method of vibrations, and are less liable to subsequent change.

4. The observations themselves are less varied in character than the usual ones, and may be completed in a shorter time.

The Rev. Dr. Lloyd also read a paper—

ON AN IMPROVED FORM OF THE THEODOLITE MAGNETOMETER.

Dr. Lloyd exhibited to the Academy an improved form of the Theodolite Magnetometer, constructed under his direction by Mr. Jones of London, for the Magnetic Survey of the British Islands now in progress.

The principle of the improvement consists in observing the celestial object, whose azimuth is known, *by reflexion*, and in transferring the necessary adjustments to the small mirror used for that purpose. A light gun-metal frame, 13 inches long, and 3 inches wide, is attached to the upper plate of the theodolite. Near one end of this frame are two Y supports, placed longitudinally, to receive the observing telescope; and near the other are two similar supports, placed transversely, to receive the cylindrical axle to which the mirror is attached. The magnetometer box is placed between, over the centre of the divided circle. The telescope, accordingly, remains *horizontal*, and is always in adjustment for the observation of the collimator magnet; and the image of the celestial object is brought to the cross of wires in its focus, by turning the apparatus in azimuth, and, at the same time, causing the mirror to revolve. The axle is furnished with a slow motion for the purpose.

There are three adjustments required:—

1. The axle to which the mirror is attached must be horizontal when the instrument is levelled. This is tested by a small riding-level. It may be effected permanently, with sufficient exactness, by filing one of the Y's.

2. The *mirror* must be parallel to the axis of the cylindrical axle to which it is attached. This is tested by reversing the axle in its Y's, and by noting the reflected division of a scale cut by the wire in the focus of the telescope, before and after reversal. The adjustment is effected by means of three screws at the back of the mirror.

3. The line of collimation of the telescope must be perpendicular to the axis. This may be tested by observing a well-defined distant object in the horizon, first by reflexion, and afterwards directly; the deviation of the line of collimation from the normal to the mirror is half the supplement of the angle through which the telescope is moved. The adjustment may be most readily made by moving the wire-plate in the focus of the telescope.

Sir William R. Hamilton read a paper "On some General Theorems in the Calculus of Definite Integrals."

MONDAY, JANUARY 25, 1858.

James H. Todd, D. D., President, in the Chair.

The Rev. William Reeves, D.D., read a paper "On the Cathach of Columcille" (deposited in the Museum of the Academy by Sir Richard O'Donnell, Bart.)

John Kells Ingram, LL. D., read a paper—

ON THE OPUS MAJUS OF ROGER BACON.

After some introductory observations on the unjust neglect with which the writings of Roger Bacon have hitherto been treated, the author proceeded as follows:—

In the course of my studies I have been able to clear up one unsettled question respecting the works of this eminent man; and I have thought it probable that the Academy would be interested by any contribution, however small, towards our knowledge of a subject so imperfectly understood.

The "Opus Majus" has always been regarded as the most important of Bacon's writings. It was written in the year 1267, and sent to Pope Clement IV. in consequence of the desire expressed by that Pontiff that Bacon would communicate to him the substance of his researches. A beautiful MS. of the work exists in the Library of Trinity College, Dublin, and from this MS. it was edited by Samuel Jebb, at London, in 1733. It is to this edition, or to the reprint of it at Venice, in 1750, that all the historians of philosophy have referred. The work, as published by Jebb, contains six parts, the subjects of which are as follows:—

In the first Bacon points out the four universal causes of human ignorance; in the second he treats of the relation of philosophy to theology; in the third, of grammar and the knowledge of languages; in the fourth, of mathematics, including astronomy and geography; in the fifth, of *perspectiva*, or optics; and in the sixth, of experimental science.

When Bacon had composed the "Opus Majus," he drew up a second treatise, similar in substance, which he called his "Opus Minus," and which he also transmitted to the Pope. His object in doing so was partly to guard against the risk of the "Opus Majus" being lost, from the dangers which then beset travellers, and partly to present to his Holiness, in a condensed and improved form, its most essential contents. Not satisfied with this precaution, he prepared a third version of his great work, which he named his "Opus Tertium," "ad intellectum et perfectionem utriusque operis præcedentis," and this also he transmitted to Clement. The two latter works have never been printed, but several copies of, at least, portions of them exist in the manuscript collections of Great Britain and continental Europe.

In the course of M. Victor Cousin's researches on the history of philosophy, he was led to examine a MS. of Bacon which existed in the library at Douai. He found that it contained a considerable portion of the "Opus Tertium." A lacuna which existed in this portion was supplied from a MS. in the British Museum, and the whole was carefully studied by M. Cousin. He was thus led to arrive at several very interesting conclusions respecting the life and writings of Bacon. His account of the "Opus Tertium," containing many extracts from the original, is to be found in the "Journal des Savants" for March, April, May, and June, of the year 1848. On the Introduction to the work, M. Cousin enlarges at great length. It gives a general outline of the plan of the whole work, and indicates the several subjects which were treated in the different parts of it. Among the other contents,—and to this I call your particular attention,—it mentions a regular and detailed treatise on moral philosophy. No such treatise is found in the Douai manuscript, which is imperfect at the end. But the statement that such a treatise formed part of the "Opus Tertium," would naturally lead us to suppose that the "Opus Majus" contained a similar treatise, for the two works, so far as we can compare them, run parallel to each other. M. Cousin, however, puts an end to all doubt on this question, by producing several passages of the "Opus Tertium," in which a seventh part of the "Opus Majus" is distinctly referred to, as containing discussions on moral subjects; and he therefore justly regards it as a fact established by his researches that the edition published by Jebb is incomplete, and that the "Opus Majus," in its integrity, had never been given to the world.

But thereupon arose a further interesting question, which M. Cousin was not in a condition to solve. It had been stated by Bale and Pits that Bacon was the author of a Treatise on Moral Philosophy. M. Cousin found, from the "Catalogi Codicum MSS. Angliæ et Hiberniæ," that a Treatise on Moral Philosophy was actually contained in the Library of Trinity College, Dublin; and, indeed, Jebb himself, while he describes in his preface the "Opus Majus" as *in sex partes distributum*, adds that the author "libros de prognosticis ex stellis et de multiplicatione specierum apposuit et *Tractatum de Morali Philosophia ad calcem adjunxit*." Thus, as M. Cousin went on to say, the question was raised,—can it be that the Treatise on Moral Philosophy, contained in the Dublin Library, is really the missing seventh part of the "Opus Majus"? "On voit par là de quelle importance il serait de rechercher le traitè manuscrit de philosophie morale, ... car ce traitè serait tres-vraisemblablement la septieme partie de l' Opus Majus." And M. Cousin proceeds to recommend the examination of this moral treatise, and its publication, if it should turn out to be what he anticipated, to the scholars of the *English* Universities:—"Puisse cette entreprise, à la fois utile et facile, sourire au patriotisme de quelque savant d' Oxford ou de Cambridge!"

My attention was called to these articles of M. Cousin by a very clear and well-written summary of his conclusions, which appeared in the first

volume of "Notes and Queries." It then occurred to me that my position as a member of Trinity College, Dublin, gave me the means of setting at rest this question, which has hitherto remained unanswered. And my principal object in making this communication to the Academy is to announce that, by a careful examination of the manuscript, I have been enabled to establish, that M. Cousin's anticipation is perfectly correct. The "Opus Majus" not only *had*, but in the Dublin manuscript still *has*, a seventh part devoted to moral philosophy.

This seventh part is of considerable length: the six parts printed by Jebb fill 406 pages in the manuscript; the seventh occupies 92 pages. It is written by the same hand as the earlier portion, and, like it, is filled with contractions. It begins on the same page on which the sixth part terminates. In fact, there is every appearance of perfect continuity with what precedes. It is headed, "Incipit septima pars hujus persuasionis, de Morali Philosophia"—a formula quite similar, with the single change of the number and subject, to those prefixed to the preceding parts. The first words are, "Manifestavi in præcedentibus," —which imply something before them. These are striking indications, exhibiting themselves at once on inspection. It might, however, be urged, that the latter only shows the treatise to form a part of some larger work, not necessarily of the "Opus Majus," and that the former might have arisen from the mistake of a transcriber; and Jebb's omission of the treatise in his edition naturally made me slow to attach importance to these *prima facie* evidences. But when the treatise is examined throughout, the truth becomes apparent. Every allusion to preceding matter, and such allusions are frequent, becomes perfectly clear on the hypothesis that we are reading a part of the "Opus Majus." It would be easy to multiply proofs of this kind: at present I will mention only a few, which, however, appear decisive:—

In the opening pages of the treatise Bacon enumerates the subjects treated in the first six parts of the "Opus Majus," in the order in which they occur in that work, and in doing so speaks of their utility "relate ad Dei Ecclesiam et cætera tria prænarrata." Now to understand this phrase we must go back to the first page of the "Opus Majus," where this sentence occurs:—"Per lumen sapientiæ ordinatur Ecclesia Dei, respublica fidelium disponitur, infidelium conversio procuratur, et illi qui in malitia obstinati sunt, valent per virtutem sapientiæ reprimi. . . . . Omnia vero quæ indigent regimine sapientiæ ad hæc quatuor reducuntur." The idea of these four ends is reproduced frequently through the "Opus Majus," and may be said to be woven into its texture. And the reference, "cætera tria prænarrata," is strictly similar to those throughout the whole "Opus Majus," in which the opening passage is recalled,—such, for example, as that which is found in page 58 of Jebb's edition,—"sicut ad Ecclesiam Dei et cætera tria comparantur."

Again, in fol. 242 of the manuscript, when proving the necessary existence of seven sects only, including that of Antichrist, he says:—"*Superius* in comparatione Mathematicæ ad Ecclesiam revolutæ sunt

sectæ." Now the passage here referred to is found in a part of the "Opus Majus" devoted to that general subject, and may be read at page 160 of Jebb's edition.

In fol. 245 of the MS., speaking of the reception given by a Tartar emperor to the monk William, author of a treatise "De moribus Tartarorum," he adds, "de quo superius tactum est in his quæ de locis mundi dicta sunt." He here plainly refers to a passage at page 232 of Jebb's edition, in the part of the "Opus Majus" which relates to geography.

Again, in fol. 246, a passage occurs which fixes the date of the treatise. Six hundred and sixty-five of the destined years of the duration of Mahometanism are there said to have elapsed, which, by changing Arabian lunar years of the era of the Hegira into solar years of the Christian era, gives us the date 1267. To this statement Bacon adds the words, "sicut superius in mathematicis est notatum." Now the same chronological statement is found at page 167 of Jebb's edition, with this difference only, that while in Jebb the phrase used is "nunc est annus sexcentesimus sexagesimus quintus," in the moral treatise the phrase is, "Jam transierunt anni sexcenti sexaginta quinque," indicating, apparently, that one of these years had closed in the interval between the composition of the two passages.

But if it should be urged that these correspondences, and the use of such words as *prius* and *superius*, may be explained on the hypothesis that the moral treatise is not *a part* of the "Opus Majus," but that, according to Jebb's expression, it was *ad calcem adjunctus*, let me refer you to a passage in fol. 205, where, after making a statement of the prophets and patriarchs having treated divine things not only theologically, but philosophically, he adds, "sicut in secunda parte *hujus operis* probatum est." Now the corresponding passage is found in the second part of the "Opus Majus," at page 30 of Jebb's edition.

It is thus, I think, fully established that the moral treatise of which I have been speaking is really the Seventh part of the "Opus Majus." When I consider the weight of the evidence which has led me to this conclusion, the omission of it by Jebb, in his edition, appears to me one of the most curious circumstances in literary history.

And here I cannot refrain from observing that serious injustice has been done to Bacon by the suppression of this portion of his work in the printed copies. For the cardinal idea which presided over his whole construction is thus kept out of view, or at least obscured. This idea was, the supremacy of moral science over the rest of the intellectual system. The earlier and simpler sciences he regarded as deserving of study, chiefly because they are the necessary preparation for Morals, the supreme and final science. This view, often put forward throughout the book, is nowhere more nobly stated than in the following decisive sentence, which occurs in the Seventh part:—"Non quæruntur scientiæ cæteræ nisi propter istam quæ est humanæ sapientiæ dominatrix."

I will now proceed to give a very rapid sketch of the general divisions of the Seventh part. And my object in doing so is to establish

the second conclusion at which I have arrived, namely, that the Seventh part, though extending to more than ninety folio pages, is yet imperfect in the Dublin manuscript. This I did not at first suspect. There is indeed no "Explicit" at the end of the manuscript, which closes at the middle of the page; but that might be an accidental omission; and in the sense of the concluding passage there is nothing, at first view, to indicate an abrupt termination. The final words, "Et quid potest homo plus petere in hac vita?" might even seem not inaptly to mark the completion of the great edifice. But, on further examination, using the lights supplied by M. Cousin's account of the "Opus Tertium," I have arrived at the conclusion that there is a deficiency at the end of the manuscript.

A few brief quotations will best indicate the general plan of the moral treatise which forms the Seventh part. After some excellent introductory observations on the relation between moral philosophy and the preceding sciences, he goes on to enumerate the several heads or branches of the subject to be successively treated:—"Hæc scientia primo docet componere leges et jura vivendi, secundo docet ea credi et probari, et homines exhortari ad operandum et vivendum secundum illas leges." He proceeds to state the subdivision of the first head into three:—"Prima pars dividitur in tres, nam primo naturaliter occurrit ordinatio hominis in Deum et respectu substantiarum angelicarum, secundo ad proximum, tertio ad seipsum." And accordingly these three branches of moral duty are the subjects of the first three divisions of the treatise. Thus, having spoken in the first of our duty to God, in fol. 210 he commences the second division with the words,—"Secunda pars descendit ad leges et statuta hominum inter se." This division is very brief, occupying only two pages. Then begins the third, which is thus characterized:—"Tertia vero pars scientiæ moralis et civilis est de moribus cujuslibet personæ secundum se, ut honestas vitæ in quolibet habeatur, et turpitudo vitiorum relinquatur propter futuram felicitatem et horrorem æternæ pœnæ." This division is of great extent, abounding in lengthened quotations from the ancient ethical writers, particularly Seneca, with some of whose works the author says he had recently met for the first time. "Protraxi," he proceeds, in fol. 240, "hanc partem Philosophiæ moralis gratis propter pulchritudinem et utilitatem sententiarum moralium, et propter hoc quod libri raro inveniuntur a quibus erui has morum radices, flores, et fructus." "Nunc autem volo accedere ad partem quartam hujus scientiæ." And in the fourth division the question is considered, what sect is to be adopted and followed by mankind,—in other words, what is the true religion? Having proved Christianity to be the faith which the human race ought to receive, he proceeds to establish that doctrine of the Christian faith which he says most requires to be defended, "eo quod quidam negant et aliis est dubium, alii cum difficultate recipiunt, quibusdam durum videtur, alii imperfecte sentiunt, pauci de facili et cum plena pace et suavitate animi tenent, et est hoc sacramentum altaris." And then follows a discourse on the doctrine of the Eucharist, with which the treatise ends.

Now I think it is pretty plain that Bacon's own programme has not been carried out if the treatise, as existing in the manuscript, is to be taken as complete. For though that portion of the second general head which represents moral philosophy as "docens leges et jura vivendi credi et probari," may be regarded as sufficiently elaborated, the other part, in which it is spoken of as "docens homines exhortari ad operandum et vivendum secundum illas leges," is certainly not forthcoming.

But the suspicion thus awakened becomes certainty when we examine some passages of the "Opus Tertium," of which M. Cousin has given an account. For, in the Introduction to that work, of which I spoke before, in which a prospective view, as you will remember, is given of the subsequent portions of the work, the divisions of the moral part are enumerated. Of these there are stated to be six. The first (I use M. Cousin's abstract, for he does not quote the original Latin) related to the belief and conduct of man with respect to God, to the future life, &c.; the second was on public law, on the public worship of God, and on the government of states; the third was on the beauty of virtue and the deformity of vice; the fourth, on the different religions of the world, for the purpose of proving that one only is true, and ought to be universally diffused; the fifth contained exhortations to the performance of the duties imposed by the religion whose truth had been established; and the sixth had reference to the organization of tribunals and the administration of justice. Now, bearing in mind that the "Opus Tertium" follows the plan of the "Opus Majus," we may assume that the arrangement adopted in the former was used in the latter work also And accordingly, you will observe that the first four divisions just mentioned strictly coincide with those which I described as occurring in the Seventh part of the "Opus Majus." It may, therefore, I conclude, be safely announced that the fifth and sixth divisions of the Seventh part are wanting in the Dublin manuscript.

It would, perhaps, be premature to print the Seventh part until the necessary researches have first been made to ascertain whether or not it can be completed from manuscripts in British or foreign libraries. In the meantime, having made considerable progress in the study of the portion which the Dublin manuscript comprises, I hope before long to lay before the Academy a full account of its contents, extracting everything which appears interesting either from its intrinsic merit, or as affording information on the state of learning and philosophical opinion in the thirteenth century.

I cannot conclude without repeating my protest against the continued neglect with which the writings of this great man have hitherto been treated. Many tracts attributed to him are to be found in our manuscript collections, which ought now at length to be examined, arranged, and published, with the necessary historical and other elucidations. From my own observations on the initial sentences of these tracts, which are sometimes given in the catalogues, I am convinced that many of them are simply extracts from the three great works which he addressed to Pope Clement. And I believe that if the "Opus Majus,"

the "Opus Minus," and the "Opus Tertium," were printed in a form as complete as the existing copies would permit, but little would remain in manuscript that proceeded from the hand of Roger Bacon.

A list of Presentations to the Library was read, and thanks returned to the several donors.

MONDAY, FEBRUARY 8, 1858.

JAMES HENTHORN TODD, D.D., President, in the Chair.

SAMUEL L. HARDY, M. D., was elected a Member of the Academy.

On the recommendation of the Council, it was resolved that the Treasurer be authorized to sell a portion of the funded Stock of the Academy, not exceeding £50, in order to make up the sum required for payment for the Cunningham Medals awarded in the present year.

The PRESIDENT read a paper—

ON SOME ANCIENT IRISH DEEDS.

THESE deeds are mostly in the Irish language and character, of the fifteenth, sixteenth, and seventeenth centuries. They are of the nature of deeds of mortgage, wills, covenants, deeds of arbitration, indentures, deeds of partition, conveyance of land; and some of them are Brehon Law judgments.

No. 1—Is dated A.D. 1450, and also by the local historical fact, "the year in which Donoch O'Brien died."

It is a deed of mortgage by deed poll, but differs from our modern deeds of mortgage in that it does not convey the lands. It consists of five parts. In Part I. it is recited that Donnell Oge O'Kearney had possession of the lands of Ballymote, or rather a half quarter of them, for a debt due to him by the owners, Teige Mac Sida (Mac Sheedy), [Mac Namara], and his son. But Teige and his son seem to have been in debt to Donoch O'Brien [first Earl of Thomond ?], whose bailiffs entered the lands of Ballymote, then in the possession of Donnell Oge O'Kearney, and carried off three valuable mares. Arbitrators were appointed, and Teige Mac Sheedy and his son were condemned to pay five marks to O'Kearney. As security for these five marks, Mac Sheedy, the son, mortgages a half quarter of Ballymote to O'Kearney.

In Part II. it is stated that Mac Sheedy, the son, had been murdered by Donnell Oge Mac Namara, but had by his will left his property to his brother and chief, Donnell Derg [or the red], subject to the debts due to O'Kearney.

Part III. is a further mortgage. Donnell Derg, and the two sons of Lochlainn O'Curry, had stolen two pigs from O'Kearney; an arbitration was agreed to, and a fine of half a mark given for the pigs, with three *uinge* as costs, and one *uinge* as a twelfth, or umpires' fees. To meet these charges, Donnell Derg mortgages the lands to the amount of one mark.

These facts enable us to fix the price of pigs in that golden age in Ireland. The mark was two-thirds of £1, or 13*s.* 4*d.*, and consequently the two pigs, being valued at half a mark, were worth 3*s.* 4*d.* each. The other half mark was equal to four *uinge*, or ounces, and one *uinge* is called *the twelfth*, i. e., the twelfth of a pound [of gold?]. An *uinge* must, therefore, have been 1*s.* 8*d.*

Part IV. The pig transaction does not seem to have permanently broken friendship between O'Kearney and Donnell Derg; for the former appears to have lent the latter a sum of money, secured by a further mortgage on the lands.

Part V. Donnell Derg, however, engaged in gambling, but lost eight marks, and his person appears to have been seized by Hugh Roe Mac Namara, and Owen of the Money, the successful gamblers. He was ransomed by Teige Mac Donnell Mac Namara, who gave a good steed for him to the gamblers; so that the price of a good steed in those days was about £5 6*s.* 8*d.*

Mac Namara, however, owed O'Kearney one *uinge* of gold and six marks for three milch cows; and the rescued gambler, Donnell Derg, mortgaged his lands still further to the prudent O'Kearney, to discharge this portion of his debt to Mac Namara. The lands concerned in this document are situated near Sixmilebridge, county of Clare, and the same remark applies to the next two deeds.

No. 2—Is another deed, of the nature of a mortgage on the lands of Kill Fiontanain, dated August 11, 1612.

No. 3—Is a statement of the debts or demands of Conor Mac Teige upon the clan Mac Craith, out of the lands of the Lower Corbally. (No date.)

No. 4.—The will of Mortogh Mac Mahon, written after his death by the testamentary priests who were present at his death-bed; it is little more than an acknowledgment of his debts due to Donn Mac Gorman. (Not dated.) He appears to have lived in the neighbourhood of Kilrush, county of Clare.

No. 5.—A deed of mortgage (1549), on the lands of Donnell Oge O'Kearney (see No. 1), to Mac Con Mac Lochlainn, son of Sida [M'Namara]. [The date shows that the Donnell Oge O'Kearney here mentioned must have been the son or grandson of the personage mentioned in No. 1.]

No. 6.—An endorsement on No. 5, dated also 1549, containing a power of redemption, and liberty to O'Kearney to carry off manure from the land, "if there be manure upon it."

No. 7. A deed of arbitration respecting the lands of Garry Orrtha, between Conor Mac Teige and Mac Craith Mac Teige, dated A.D., 1587.

No. 8.—An endorsement on the former, much obliterated.

No. 9.—A deed of indenture, dated 1551, conveying half the land and inheritance of Murchu, son of Conor, son of Murchu, son of William, of Bally Sidhnoidh for ever, to Philip and Conor, the two sons of Conor, son of Teige, and their heirs after them; and a sort of mortgage of the

other half of his land to Philip and to Dermot, to whom Murchu promises to pay a rent, whenever "he is able to sit in the land," and if not able "to sit" in it, then Philip and Dermot were to pay him a rent. This document is subscribed by Murchu O'Mulregan, Conor O'Dwyer, William O'Davoren, Shane O'Dwyer, and Philip O'Dwyer.

No. 10.—A mortgage, dated 1587, to Conor, son of Teige [O'Dwyer?] and Eogan, son of Donnell, on the lands of Matthew, son of Murchu [O'Mulregan].

No. 11.—A mortgage, dated 1576, to Conor, son of Teige, son of William [O'Dwyer], on two-thirds of the lands of Dromainn-an-Chunna, from Matthew, son of Murchu, son of Conor [O'Mulregan]. This deed contains two singular covenants:—1st. That Matthew is to have an invitation at Easter and Christmas, "upon Conor, and upon Eoghan, son of Donnell." And 2nd. "If it shall happen to Matthew to fall into poverty or distress, Conor and Eoghan are to give him food and clothing, Conor paying two-thirds, and Eoghan one-third, of the burthen, and Matthew doing the utmost service to them on that account."

No. 12.—A mortgage, not dated.

No. 13.—An endorsement on No. 12, dated 1531. These are of no particular interest, except that the payment is made in cows, and no mention made of money. The parties seem to belong to the same families of O'Dwyer and O'Mulregan, who are concerned in Nos. 9, 10, and 11. Nos. 7 to 13 inclusive relate to a district in the county of Tipperary, on the borders of the county of Limerick.

No. 14.—A deed in Latin, nearly obliterated.

No. 15.—A deed of arbitration, in Irish, dated 8th Oct. 1584, containing a very full and formal statement of the names of the parties concerned, the cause of controversy, and the decision of the arbitrators. The original is in Mr. Curry's collection, and is a very remarkable and valuable specimen of a decree of arbitrators under the Brehon Law between two parties of the O'Kennedys of Lower Ormond, county of Tipperary.

No. 16.—This is very nearly in the form of a modern deed poll, dated 19th July, 1611. It is a lease for twenty-one years, of the western half of the lands of Moy Lacha, parish of Kilrush, barony of Clonderala, county of Clare, from Turloch Roe Mac Mahon, to Shane, son of Teige O'Gilltinane, and after the expiration of the term of twenty-one years, "until redeemed by the payment of ten pounds of the crowned money of the Saxons, of good metal and pure silver." This deed contains a formal clause of re-entry, the appointment of a bailiff to give possession, and a covenant for peaceable possession.

There is also a remarkable covenant in which Turloch Mac Mahon, the lessor, acknowledges himself bound "to put this writing into the force of the law of the Saxon king, as the law adviser of the above Shane may advise."

The originals of this and of the five following are in Mr. Curry's collection.

No. 17.—A curious document, evidently founded on Brehon Law, but

not dated. It is a statement of certain personal and other injuries inflicted upon Teige, son of Sioda, or Mac Sheedy, by Fingin, son of Mac Con, and his family. It is a kind of bill of indictment.

No. 18.—A deed of arbitration for certain injuries inflicted on Donnell, son of Rory, by the sons of Lochlainn, son of Fingin, son of Donnchadh [Mac Namara.] These personages appear to have lived in the neighbourhood of Cratloe (county of Clare); and the outrages which gave occasion to the arbitration were committed "in the summer in which Murchadh O'Brien and Donnchadh O'Brien went to England."

The deed was executed in 1550. Nos. 17 and 18 relate to the Mac Namaras mentioned in No. 1.

No. 19.—This document, dated 1591, is a curious compact, in which the descendants of Melachlainn O'Lochlainn of Ballymachane [in Burren, county of Clare], acknowledge themselves bound to Donnchadh O'Brien, by the terms of a compact made with their family by Connor, son of Turloch O'Brien, grandfather of the then Earl of Thomond. In this covenant they acknowledge themselves tenants of certain lands and vassals under the Earl; and he, on the other hand, concedes to them what would now be called tenant-right:—

"I, the Earl of Thomond, acknowledge upon my honour that I have promised that whenever lands or castles belonging to these people shall be brought to an end" [meaning, it is presumed, by the expiration of their lease or tenancy], "I will give them the appraisement of Boece [Mac Egan] and John O'Tierney and Eoghan O'Daly."

No. 20.—A deed of partition, dated April 3, 1675, between Aedh and Cosney, the sons of Gillananoemh Oge O'Davoren, of certain lands of their ancestors, situate in the district of Burren, county of Clare. This document provides that if any part of the lands be lost to the parties, they are to balance the loss with each other, in the same way as in the original partition. Also, that neither party has a right to put away his portion in pledge or perpetuity, so that the other cannot redeem it; also, that if any part of the lands be in pledge, whoever is first able to redeem it shall hold it until redeemed by the other; and if one party shall fail to have heirs, the other shall succeed to his portion of the property. Lastly, that if there be any part of Aedh's land which he is unable to occupy, Cosney shall, if able, occupy it without let or hindrance from Aedh.

No. 21.—An agreement between Donnell Oge O'Kearney and Graine, daughter of Mac Con [Mac Namara]. Donnell had a mortgage upon the lands of Graine [situate near Six-mile-bridge, county of Clare], to the amount of eleven uinge, with a right to two free cows; the lady being advanced in years, gives up her rights and her lands to Donnell, on the condition that he supports her, with power to her son, and to him only, to redeem the lands after her death; but if there be manure or buildings on the lands, they shall be appraised and redeemed according to appraisement. Here is another recognition of tenant-right. This document is dated 1522.

No. 22—Is a copy of a deed, made by Mr. Curry from the original,

in the British Museum (Egerton, No. 139, p. 179). It is an agreement dated 1510. Lochlainn Riabhach O'Mullona [Mullowney] mortgaged his lands to Shane O'Radan for four cows, in calf, and a good male pig; and Shane O'Radan gives Connor O'Gleeson the privilege of having four free cows on the land until it is redeemed.

No. 23.—This is a judgment of four Brehons in a controversy respecting land. The Brehons were of the family of O'Deoradan, Domhnall, Cathal Ferganainm, and Giolla Patrick; and the contending parties were, Gerald, son of Cathal Carrach; Brian, son of Murtoch; and Donnchadh, son of Crimhthan. Witnesses were examined upon oath, and the Brehons, acting upon their testimony, decide; and in an appendix to their decision minutely describe the boundaries of the land. The decision is as follows:—

"And in accordance with that" [viz., the evidence], "the Brehons gave it as a judgment that Gerald should have possession of the land, and that neither Teige nor Donnchadh should have any claim on it from that time forth. And the one-eighth part of the sheaf of that year was awarded to Donnchadh in payment for his labour."

This decision is dated 1560, showing that the Brehon Law continued to be practised in some parts of Ireland to that period; and it can be proved to have continued at least 100 years later. The original is in the Library of Trinity College (H. 3, 18, p. 455). The lands and parties mentioned in this document belonged to the county of Wexford.

No. 24—Is a letter of confraternity, in Latin, granted by Patrick Culvyn, local Prior of Dublin, of the order of Friars Eremite of St. Augustine, to John Stackpoole, and Genet Gwyth, his wife. Dated 31st of August, 1507.

Dr. Todd then made some remarks on the historical and antiquarian value of the deeds described, and exhibited to the Academy some of the deeds, together with a MS. book containing transcripts (made by Mr. Curry for the University Library), in which the whole are written, without the contractions of the originals, and rendered accessible to ordinary readers of Irish.

The following antiquities were presented to the Museum:—

By Alderman Fergus Farrell:—An ancient cinerary urn, and fragments of another, found with human bones, about three feet under the surface, and covered with a large stone, in the shape of a millstone, on the lands of Carrickbanagher, county of Sligo.

By W. R. Wilde, Esq.:—1. A bronze bridle ornament, from Emly [Imleach Brocadha, so called from St. Brocadius, a disciple of St. Patrick], near Castlerea, county of Roscommon. 2. A pair of pampootees, from the Island of Aran.

By Dr. Dowsley, of Clonmel:—A cast in plaster from the Roman oculist's stamp, found in the county of Tipperary, and referred to in the "Catalogue of the Museum," at page 126.

Lord Talbot de Malahide presented fourteen several volumes of the works of Dominic Sestini on Numismatics, printed at Milan, Florence, Pisa, and Berlin.

MONDAY, FEBRUARY 22, 1858.

JAMES HENTHORN TODD, D. D., President, in the Chair.

THE REV. GEORGE SALMON read a paper by MR. CAYLEY,—

ON THE THEORY OF RECIPROCAL SURFACES.

THE present note is intended to be supplementary to Mr. Salmon's memoir "On the Degree of a Surface reciprocal to a given one" (Trans. R. I. A., vol. xxi. pp. 461–488; 1857). I find that Mr. Salmon's equations admit of a transformation which appears important in reference to the geometrical theory, and the object of the note is to present the system of equations under the new form.

Mr. Salmon writes—

n, the order of the surface.

a, the order of the tangent cone drawn from any point to the surface.

δ, the number of the double edges of the cone.

κ, the number of its cuspidal edges.

b, the order of any double curve upon the surface.

k, the number of apparent double points of the double curve.

t, the number of triple points on the double curve.

c, the order of any cuspidal curve on the surface.

h, the number of apparent double points of the cuspidal curve.

β, the number of intersections of the double and cuspidal curves which are stationary points on the cuspidal curve.

γ, the number of intersections which are stationary points on the double curve.

i, the number of intersections which are not stationary points upon either curve.

ρ, the number of the points where the double curve is met by the curve of contact of the tangent cone.

σ, the number of the points where the cuspidal curve is met by the curve of contact.

And the accented letters denote the corresponding singularities of the reciprocal surface, or, if we choose that they should refer to the given surface, and its tangential or *class* singularities, then we have—

n', the class of the surface.

a', the class of the curve of intersection by any plane.

δ', the number of double tangents of the curve.

κ', the number of its cusps.

b', the class of the node-couple developc.

k', the number of apparent double planes of the node-couple developé.

t', the number of triple planes of the node-couple developé.

c', the class of the spinode developé.

h', the number of the apparent double planes of the spinode developé.

β', the number of common tangent planes of the node-couple and spinode developés, stationary planes of the spinode developé.

γ', the number of common tangent planes, stationary planes of the node-couple developé.

i', the number of the common tangent planes which are not stationary planes of either developé.

ρ', the number of the common tangent planes of the node-couple developé, and the tangent cone.

σ', the number of the common tangent planes of the spinode developé, and the tangent cone.

The terminology made use of is that of my paper "On the Singularities of Surfaces" ("Cambridge and Dublin Mathematical Journal," vol. vii., 1852). To explain it, I need only remark that the term node is used as synonymous with double point, and the term spinode as synonymous with cusp; a spinode plane is a tangent plane meeting the surface in a curve, having a spinode at the point of contact; and a node-couple plane is a double tangent plane, or plane meeting the surface in a curve having two nodes; the term developé is used instead of developable surface.

To collect all the formulæ, it is proper to write also—

r, the class of the cuspidal curve.

q, the class of the double curve.

r', the order of the spinode developé.

q', the order of the node-couple developé.

Where q' is what Mr. Salmon, who only uses it incidentally in referring to a result of Professor Schläfli's, calls, after him, A.

Mr. Salmon obtains, between the twenty-eight quantities—

$$n,\ a,\ \delta,\ \kappa,\ b,\ k,\ t,\ c,\ h,\ \beta,\ \gamma,\ i,\ \rho,\ \sigma,$$
$$n',\ a',\ \delta',\ \kappa',\ b',\ k',\ t',\ c',\ h',\ \beta',\ \gamma',\ i',\ \rho',\ \sigma',$$

the twenty-one equations,

$$a = a',$$
$$a' = n(n-1) - 2b - 3c,$$
$$\kappa' = 3n(n-2) - 6b - 8c,$$
$$\delta' = \tfrac{1}{2}n(n-2)\,(n^2-9) - (n^2-n-6)\,(2b+3c) + 2b(b-1) + 6bc + \tfrac{9}{2}c(c-1),$$
$$a\,(n-2) = \kappa + \rho + 2\sigma,$$
$$b\,(n-2) = \rho + 2\beta + 3\gamma + 3t,$$
$$c\,(n-2) = 2\sigma + 4\beta + \gamma,$$
$$a\,(n-2)\,(n-3) = 2\delta + 2ab + 3ac - 4\rho - 9\sigma,$$
$$b\,(n-2)\,(n-3) = 4k + ab + 3bc - 9\beta - 6\gamma - 3i - 2\rho,$$
$$c\,(n-2)\,(n-3) = 6h + ac + 2bc - 6\beta - 4\gamma - 2i - 3\sigma,$$

$$n' = n(n-1)^2 - n(7b+12c) + 4b^2 + 9c^2 + 8b + 15c - 8k - 18h + 18\beta + 12\gamma + 12i - 9t,$$

$$a = n'(n'-1) - 2b' - 3c',$$
$$\kappa = 3n'(n'-2) - 6b' - 8c',$$
$$* \quad \delta = \tfrac{1}{3}n'(n'-2)(n'^2-9) - (n'^2-n'-6)(2b'+3c') + 2b'(b'-1) + 6b'c' + \tfrac{9}{2}c'(c'-1),$$

$$a'(n'-2) = \kappa' + \rho' + 2\sigma',$$
$$b'(n'-2) = \rho' + 2\beta' + 3\gamma' + 3t',$$
$$c'(n'-2) = 2\sigma' + 4\beta' + \gamma',$$

$$a'(n'-2)(n'-3) = 2\delta' + 2a'b' + 3a'c' - 4\rho' - 9\sigma',$$
$$b'(n'-2)(n'-3) = 4k' + a'b' + 3b'c' - 9\beta' - 6\gamma' - 3i' - 2\rho',$$
$$c'(n'-2)(n'-3) = 6h' + a'c' + 2b'c' - 6\beta' - 4\gamma' - 2i' - 3\sigma',$$

$$* \quad n = n'(n'-1)^2 - n'(7b'+12c') + 4b'^2 + 9c'^2 + 8b' + 15c' - 8k' - 18h' + 18\beta' + 12\gamma' + 12i' - 9t';$$

to which may be joined—

$$q = b^2 - b - 2k - 3\gamma - 6t,$$
$$r = c^2 - c - 2h - 3\beta,$$
$$q' = b'^2 - b' - 2k' - 3\gamma' - 6t',$$
$$r' = c'^2 - c' - 2h' - 3\beta'.$$

Considering the twenty-one equations, and taking as data n, b, c, β, γ, h, k, then, by means of the several equations, other than the two equations marked (*), we may express in terms of the above data a, δ, κ, t, i, ρ, σ, n', a', δ', κ', b', c', ρ', σ', $2\beta' + 3\gamma' + 3t'$, $4\beta' + \gamma'$, $4k' - 3i'$, $6h' - 2i'$; the quantities which enter into the first of the marked equations are then all given in terms of the above data, and it is clear that the equation must be satisfied identically: the quantities which enter into the second of the marked equations are given in terms of the data and of t', i', and it is not clear, *a priori*, but that the equation might lead to a relation between the data and t', i'; it will, however, appear in the sequel that the equation must be satisfied identically, independently of any particular values of t', i'. Thus, Mr. Salmon's theory does not determine the values of these two quantities, nor, consequently, the values of β', γ', h', k'; it does, however, determine the values of the combinations $4\beta' + \gamma'$, $8k' - 18h'$. But the twenty-one equations between the twenty-eight quantities may be replaced by seventeen equations between the twenty quantities—

$$n,\ a,\ \delta,\ \kappa,\ b,\ c,\ \rho,\ \sigma,\ 4\beta + \gamma,\ 8k - 18h,$$
$$n',\ a',\ \delta',\ \kappa',\ b',\ c',\ \rho',\ \sigma',\ 4\beta' + \gamma',\ 8k' - 18h',$$

this will clearly be the case if it is only shown that the equation which gives n' can by the other equations be transformed into one of the form in question; for a similar transformation will, of course, apply to the equation for n, and then we have only to reject the equation containing

t, and to replace the two equations which contain i, by the equation given by the elimination of this quantity, and in like manner to reject the equation containing t', and to replace the two equations containing i', by the equation given by the elimination of this quantity, and the system will be reduced to the required form.

The reduction of the equation which gives n' is effected as follows, we have—

$$(2b + 3c)(n - 2)(n - 3) = 8k + 18h + a(2b + 3c) + 12bc - 36\beta - 24\gamma - 12i - 4\rho - 9\sigma,$$

$$3b(n - 2) = 6\beta + 9\gamma + 9t + 3\rho;$$

and thence—

$$(2b + 3c)(n - 2)(n - 3) + 3b(n - 2)$$
$$= a(2b + 3c) + 12bc + 8k + 18h - 12i + 9t - \rho - 9\sigma - 30\beta - 15\gamma$$
$$= a(2b + 3c) + 12bc + 8k + 18h - 12i + 9t - 18\beta - 12\gamma - \rho - 9\sigma - 3(4\beta + \gamma);$$

and consequently—

$$-8k - 18h + 18\beta + 12\gamma + 12i - 9t$$
$$= \{a - (n - 2)(n - 3)\}(2b + 3c) - 3b(n - 2) + 12bc - \rho - 9\sigma - 3(4\beta + \gamma),$$

which (observing that the left-hand side is precisely the combination of terms which enters into the equation for n') shows that the reduction is possible; to complete it, putting for a its value $n(n - 1) - 2b - 3c$, we have—

$$-8k - 18h + 18\beta + 12\gamma + 12i - 9t$$
$$= b(5n - 6) + c(12n - 18) - 4b^2 - 9c^2 - \rho - 9\sigma - 3(4\beta + \gamma);$$

and substituting this value in the equation for n', we obtain

$$n' = n(n - 1)^2 - b(2n - 2) - 3c - \rho - 9\sigma - 3(4\beta + \gamma).$$

Some of the other equations admit of simplification: the equation

$$a(n - 2)(n - 3) = 2\delta + a(2b + 3c) - 4\rho - 9\sigma,$$

if we put for a its value $n(n - 1) - 2b - 3c$, becomes—

$$(4n - 6 - 2b - 3c)(n - 2)(n - 3) = 2\delta - 4\rho - 9\sigma,$$

and the prescribed combination

$$(2b - 3c)(n - 2)(n - 3) = 8k - 18h + a(2b - 3c) - 4\rho + 9\sigma,$$

gives in like manner, putting for a its value

$$(-n^2 + n + 4b)(n - 2)(n - 3) = (8k - 18h) - 4\rho + 9\sigma.$$

The system of seventeen equations then is—

$$a = a'$$
$$a' = n(n-1) - 2b - 3c,$$
$$\kappa' = 3n(n-2) - 6b - 8c,$$
$$\delta' = \tfrac{1}{3}n(n-2)(n^2-9) - (n^2-n-6)(2b+3c) + 2b(b-1) + 6bc + \tfrac{9}{2}c(c-1),$$

$$a(n-2) = \kappa + \rho + 2\sigma,$$
$$c(n-2) = 2\sigma + (4\beta+\gamma),$$

$$(4n-6-2b-3c)(n-2)(n-3) = 2\delta - 4\rho - 9\sigma,$$
$$(-n^2+n+4b)(n-2)(n-3) = (8k-18h) - 4\rho + 9\sigma,$$

$$n' = n(n-1)^2 - b(2n-2) - 3c - \rho - 9\sigma - 3(4\beta+\gamma),$$
$$a = n'(n'-1) - 2b' - 3c',$$
$$\kappa = 3n'(n'-2) - 6b' - 8c',$$
$$*\ \delta = \tfrac{1}{3}n'(n'-2)(n'^2-9) - (n'^2-n'-6)(2b'+3c') + 2b'(b'-1) + 6b'c' + \tfrac{9}{2}c'(c'-1).$$

$$a'(n'-2) = \kappa' + \rho' + 2\sigma',$$
$$c'(n'-2) = 2\sigma' + (4\beta'+\gamma'),$$

$$(4n'-6-2b'-3c')(n'-2)(n'-3) = 2\delta' - 4\rho' - 9\sigma',$$
$$(-n'^2+n'+4b')(n'-2)(n'-3) = (8k'-18h') - 4\rho' + 9\sigma',$$

$$*n = n'(n'-1)^2 - b'(2n'-2) - 3c' - \rho' - 9\sigma' - 3(4\beta'+\gamma').$$

We may here take as data n, b, c, $4\beta+\gamma$, $8k-18h$, the equations exclusively of the two marked (*), then give a, δ, κ, ρ, σ, n', a', δ', κ', b', c', ρ', σ', $4\beta'+\gamma'$, $8k'-18h'$; and then, since all the quantities entering into the two excepted equations are expressed in terms of the data, these equations are satisfied identically, and it is easy to see that this proves what was before assumed, viz., that in the system of twenty-one equations, the second of the equations marked (*) is satisfied identically.

Several of the other quantities may be expressed without difficulty in terms of the data n, b, c, $4\beta+\gamma$, $8k-18h$: we in fact have (besides a, a', κ', δ', which are originally so expressed)—

$$2\sigma = (n-2)c - (4\beta+\gamma),$$
$$8\rho = (16n-24)b - (15n-18)c - 2(4b^2-9c^2) + 2(8k-18h) - 9(4\beta+\gamma),$$
$$8\kappa = 8n(n-1)(n-2) - (32n-56)b - (17n-46)c + 2(4b^2-9c^2) - 2(8k-18h) + 17(4\beta+\gamma),$$

$$2\delta = n(n-1)(n-2)(n-3) - (4n^2-20n+24)b - (6n^2-15n+18)c + 12bc + 18c^2 + (8k-18h) - 9(4\beta+\gamma),$$

$$8n' = 8n(n-1)^2 - (32n-40)b - (21n-30)c + 2(4b^2-9c^2) - 2(8k-18h) + 21(4\beta+\gamma),$$

$$= 4n(n-1)(n-2) - (16n-28)b - (10n-26)c + (4b^2-9c^2) - (8k-18h) + 10(4\beta+\gamma),$$

but the expressions for the remaining quantities, viz., b', ρ', σ', $4\beta' + \gamma'$, $8k' - 18h'$ would be very complicated. If we suppose that b, c, $4\beta + \gamma$, $8k - 18h$, vanish, or, what is the same thing, attend only to the terms which contain n alone, we have—

$$2b' = n(n-1)(n-2)(n^3 - n^2 + n - 12),$$
$$\rho' = n(n-2)(n^3 - n^2 + n - 12),$$
$$\sigma' = 4n(n-2),$$
$$4\beta' + \gamma' = 4n^2(n-2)(n^3 - 3n^2 + 3n - 3),$$

$$8k' - 18h' = n(n-2)(n^{10} - 6n^9 + 16n^8 - 54n^7 + 164n^6 - 288n^5 + 403n^4 - 482n^3 + 348n^2 - 242n + 60),$$

which agree with the values which Mr. Salmon has obtained for β', γ', h', k' by means of the twenty-one equations, and the additional equations (peculiar to the case in question, of a surface of the degree n without singularities, and which are obtained by him from independent considerations), $i' = 0$, and $\beta' = 2n(n-2)(11n-24)$.

The system of seventeen equations completely accounts for the reduction of the order of the given surface considered as the reciprocal of the reciprocal surface, but the omitted equations are important for other purposes. We may by means of them express i, t in terms of the data for the system of twenty-one equations, viz., n, b, c, β, γ, h, k; and, effecting this, and annexing the corresponding values of i', t', we have the supplementary system—

$$4i = (5n-6)c - 6c^2 + 12h - 5\gamma,$$
$$24t = -(8n-8)b + (15n-18)c + 2(4b^2 - 9c^2) - 16k + 36h + 20\beta - 15\gamma,$$
$$4i' = (5n'-6)c' - 6c'^2 + 12h' - 5\gamma',$$
$$24t' = -(8n'-8)b' + (15n'-18c') + 2(4b'^2 - 9c'^2) - 16k' + 36h' + 20\beta' - 15\gamma,$$

to which I annex also, without transformation, the four equations for q, r, q', r', viz.:—

$$q = b^2 - b - 2k - 3\gamma - 6t,$$
$$r = c^2 - c - 2h - 3\beta,$$
$$q' = b'^2 - b' - 2k' - 3\gamma' - 6t',$$
$$r' = c'^2 - c' - 2k' - 3\beta.$$

The last two of which, neglecting singularities, give—

$$q' = 4n(n-2)(n-3)(n^2 + 2n - 4),$$
$$r' = 2n(n-2)(3n-4),$$

which are the values given by Mr. Salmon. I remark, in conclusion, that there is considerable difficulty in the geometrical conception of the points i and the planes i', and the subject appears to require further examination. In the case of a surface of the order n without multiple lines, we have not only $i = 0$ (which is a matter of course), but also $i' = 0$. In my paper before referred to, I showed, or attempted to show, by geo-

metrical reasoning, that the common tangent planes of the spinode develope and the node-couple develope are stationary planes of the one or the other of the two developes, that is, $i' = 0$, and the reasoning seems correct as far as it goes, but it was not shown how the demonstration would (as it ought to do) fail in the case of a surface having a double or cuspidal curve. I showed also that in the case where the common tangent plane is a stationary plane of the spinode develope (that is for the planes β'), the spinode curve and the node-couple curve touch instead of simply intersecting, it would seem that the tangent plane at such point is to be counted once, and not twice, in reckoning the number β' of such tangent planes; the like remark applies, of course, also to the points of intersection β of the double and cuspidal curves.

The Rev. Dr. Lloyd read a paper—

ON THE EFFECT OF A DISTANT LUMINARY, SUPPOSED MAGNETIC, UPON THE DIURNAL MOVEMENTS OF THE MAGNETIC-NEEDLE.

It has been usual to ascribe the ordinary diurnal variations of the magnetic needle to the influence of solar heat, either operating directly upon the magnetism of the earth, or generating thermo-electric currents in its crust. The credit of these hypotheses has been of late somewhat weakened by the discovery of a *lunar* diurnal variation in the three magnetic elements; while, at the same time, new laws of the *solar* diurnal change have been established, which are thought to be incompatible with the supposition of a thermic agency. There has been, accordingly, a tendency of late to recur to the hypothesis that the sun and moon are endued with magnetism, whether inherent or induced; and it is, therefore, of importance to investigate the effects which bodies, so constituted, would produce on a needle at the earth's surface, and to compare them with those observed. In the present communication the author has endeavoured to solve this question, on the supposition that the assumed magnetism of these luminaries is original and permanent. The results prove the insufficiency of the hypothesis to explain the phenomena.

We shall suppose, for simplicity, that the centre of the acting magnet is in the plane of the equator. So far as the diurnal change is concerned, we may suppose it to be fixed; accordingly, we may take that centre as the origin of co-ordinates, the line connecting it with the centre of the earth as the axis of x, and the plane of the equator as the plane of (xy). Then, if (x, y, z) be any point of the fixed magnet, μ the quantity of free magnetism contained in the element ds of the magnet at that point, m a magnetic element on the earth's surface, and (a, b, c) its co-ordinates, the force exerted by μ on m is

$$\frac{m\mu ds}{\rho^2};$$

in which ρ denotes the mutual distance of the points (a, b, c) and

(x, y, z). And the components of the total force exerted by the magnet on the magnetic element are

$$m\int\frac{(a-x)\mu ds}{\rho^3}, \qquad m\int\frac{(b-y)\mu ds}{\rho^3}, \qquad m\int\frac{(c-z)\mu ds}{\rho^3}.$$

The earth's radius and that of the luminary being small in comparison with their distance, the foregoing expressions are found to be reducible to

$$\frac{2mM\cos\alpha}{D^3}, \qquad \frac{-mM\cos\beta}{D^3}, \qquad \frac{-mM\cos\gamma}{D^3};$$

in which D denotes the distance of the centre of the magnet from the centre of the earth, and α, β, γ the angles which its axis makes with the three axes of co-ordinates, and in which

$$M = \int\mu s ds,$$

the integral being taken between the limits $s = \pm l$, l being half the length of the acting magnet.

Now, in place of a single magnet, let there be an indefinite number, distributed in any manner throughout the acting magnetic body. Then, the radius of this body being small in comparison with its distance, the variations of D, both in magnitude and direction, may be neglected, and we have, for the three components of the acting forces,

$$X = \frac{2mP}{D^3}, \qquad Y = \frac{-mQ}{D^3}, \qquad Z = \frac{-mR}{D^3};$$

in which

$$P = \Sigma(M\cos\alpha), \qquad Q = \Sigma(M\cos\beta), \qquad R = \Sigma(M\cos\gamma).$$

In order to determine the effects of these forces upon a freely suspended horizontal magnet, they must be resolved into three others,—two of them in the plane which touches the earth at the point m (one in the meridian, and the other perpendicular to it), and the third in the direction of the earth's radius. The moment of the two former to turn the needle is equal to the moment of the earth's force by which it is opposed, or by $mU\Delta\delta \sin 1'$, in which U is the horizontal component of the earth's force, and δ the magnetic declination. We thus obtain an expression of the form,

$$\Delta\delta = \frac{1}{D^3 U}(A + B\sin\theta + C\cos\theta);$$

in which A, B, and C are known functions of P, Q, R, and of the latitude and magnetic declination at the place of observation. Similar results are found for the changes of the two components of the terrestrial magnetic force.

From these results we learn that—

1. The effect of a distant magnetic body consists of two parts, one of which is *constant* throughout the day, while the other varies with the *hour-angle* of the luminary.

2. Each of these parts varies *inversely as the cube of the distance* of the luminary.

3. The variable part will give rise to a *diurnal inequality*, having one maximum and one minimum in the day, and subject to the condition—

$$\Delta_\theta + \Delta_{\pi+\theta} = 0.$$

This law does not hold with respect either to the solar or to the lunar diurnal variation.

Thus, in the solar diurnal variation of the declination, the changes of position of the magnet throughout the night are comparatively small, and do not correspond (as required by the foregoing law) to those which take place at the *homonymous* hours of the day. The phenomena of the lunar diurnal variation are even more opposed to the deduced law, the variation having *two maxima* and *two minima*, of nearly equal magnitude, in the twenty-four lunar hours, and its values at homonymous hours having, for the most part, the *same sign*. Hence the phenomena of the diurnal variation are not caused by the direct magnetic action of the sun and moon.

Mr. Henry Conybeare communicated a short notice of the works recently erected for the purpose of supplying the city of Bombay with water.

It was stated by Dr. Stokes that Mr. Groux, a gentleman having congenital fissure of the sternum, was at present in Dublin, and that the Academy would confer a great benefit on medical and anatomical science if they would appoint a commission to inquire into his case. It was then resolved that the Council be requested to consider the propriety of appointing a commission to examine and report on the case of Mr. Groux.

The Secretary announced the presentation by her Majesty's Government of a collection of 514 volumes of Statutes, Journals of the Houses of Parliament, London Gazettes, and Newspapers, as a donation to the Library of the Academy.

Resolved,—That the thanks of the Academy be presented to Colonel Larcom, by whom this large donation to the Library has been made to the Academy.

TUESDAY, MARCH 16, 1858.

JAMES HENTHORN TODD, D.D., President, in the Chair.

THE Secretary of the Council read the following Report from the Council:—

REPORT.

IN presenting their Annual Report for the Session of 1857–58, the Council regret that they cannot congratulate the Academy on any large publication of Transactions during the past year,—in fact, that department of our printing has been during that period wholly suspended. The cause of this is to be found not in any diminution of intellectual activity on the part of our members, but in the state of the finances of the Academy, combined with the fact that during the past year we have undertaken, and partly completed, the work of forming and publishing a Catalogue of our Museum. The very large expense which has attended the publication of the Part now in the hands of members has left us no available surplus which might be devoted to the publication of "Transactions." The whole of this subject has been carefully considered by the Council, who are clearly of opinion that a permanent or even lengthened suspension of the publication of our Transactions would be fatal to the interests of the Academy.

In order, then, to provide for the immediate resumption of this important work, the Council have arrived at certain Resolutions, which will be laid before you on this evening. Should you agree to the recommendations contained in those Resolutions, the Council think that the publication of our Transactions may be at once resumed, and hope that no further interruption will occur in this work, which is undoubtedly the most important function of the Academy. The present state of the unpublished portion of our "Transactions" is as follows:—

In Science, we have printed papers by Lieutenant Rennie, Professor Downing, Mr. Salmon, and Mr. Forster.

In Polite Literature, by Dr. Hincks and Dr. Wills.

In Antiquities, by the President.

The amount of matter thus printed, but not published, is:—In Science, 64 pages; in Polite Literature, 48 pages; in Antiquities, 58 pages. Total, 160 pages.

There has been some diminution in the number of papers read before the Academy during the past Session, as compared with that of 1856–57. Still, we have had some communications of much interest. In Mathematics, we have had papers from Sir William R. Hamilton, John T. Graves, Esq., A. Cayley, Esq., and Rev. Robert Carmichael; in the Sciences of Observation and Experiment, from Dr. Lloyd, Dr. Robinson, Professor Hennessy, Dr. Kelly, G. J. Stoney, Esq., and M. Donovan, Esq.; in Polite Literature, from J. Huband Smith, Esq., Dr. Hincks, and Dr. Ingram; in Antiquities, from the President and Dr. Reeves.

The subject of the "Museum Catalogue" has been before alluded to. The first Part is already published, and it has been resolved to devote the proceeds of the sale of that Part to the publication of a second, in the preparation of which much progress has been made. As there are no other funds available for that purpose, it now rests mainly with the members of the Academy to decide whether this important work shall be completed, or whether it shall be allowed to remain imperfect.

The Council have to observe that, prior to March, 1857, the Academy had a very large and valuable collection of Antiquities, perhaps the largest national collection in Europe except that in Copenhagen; but we had no classified or arranged Museum; neither were the architectural details of the building at all adequate to the preservation or display of our national treasures.

In this position, and in order to meet the circumstances of the visit of the British Association to Dublin, Mr. Wilde undertook the arrangement, classification, and cataloguing of the Museum gratuitously, and with the result the Academy is acquainted. The Board of Works expended a sum of about £400 in completing the glass-cases, improving the roof so as to admit sufficient light, making an additional fire-proof safe, painting and decorating the Museum. The Board of Works also built (at the top of the house) a photographic gallery, as originally proposed some years ago.

The Collection, independent of gold and silver ornaments, coins, medals, and ecclesiastical antiquities, has been arranged, and a Catalogue of about 2800 articles has been published; the remaining articles are now in process of being catalogued, and Mr. Wilde hopes to have that part completed and made ready for the press during the summer vacation.

For the concluding part of the Catalogue 140 illustrations have been drawn on wood, and 102 engraved and paid for. The MS. Catalogue is now in process of completion, irrespective of any cost to the Academy, out of the price of Part I., which it is expected will also pay for the completion of the illustrations, provided the members who have not already subscribed will do so. Thus, in process of time, should the Academy be in funds, and inclined to complete the history of the collection, it will only have to pay for the printing and paper.

During the past year we have lost twelve members by death:—

Robert Ball, LL.D.; elected 23rd February, 1834.
Admiral Sir Francis Beaufort; elected 22nd October, 1832.
Thomas Clarke, Esq.; elected 30th November, 1853.
Edmund Davy, Esq., F.R.S.; elected 22nd October, 1827.
Charles Doyne, Esq.; elected 26th May, 1834.
Edmund Getty, Esq.; elected 13th January, 1845.
William T. Lloyd, Esq.; elected 13th January, 1840.
Nicholas P. O'Gorman, Esq.; elected 10th February, 1845.
Michael M. O'Grady, M.D.; elected 23rd May, 1846.
Miles John O'Reilly, Esq.; elected 25th February, 1833.
Thomas Weaver, Esq., F.R.S.; elected 29th January, 1816.
Thomas Wilson, Esq.; elected 12th April, 1841.

One illustrious name has been removed by death from the list of our Honorary Members. The Academy needs not to be informed how great a loss the scientific world has sustained in the death of M. CAUCHY.

Thirty-one members have been elected since the last annual meeting. Their names are :—

James Cleland, Esq.
Captain George A. Leach, R.E.
Denis Florence Mac Carthy, Esq.
William Moore, M.D.
James H. Sawyer, M.D.
James A. Lawson, Q.C., LL.D.
Daniel G. Griott, Q.C.
Captain Charles Preston Molony.
Thomas O'Hagan, Q.C.
Bindon Blood Stoney, C.E.
James Whitehead, M.D.
Lord Stuart de Decies.
Lord Massareene and Ferrard.
Right Hon. Richard Atkinson, Lord Mayor of Dublin.
Denis Crofton, Esq.
Robert Corbet, Esq.
Samuel A. Cusack, Esq.
George Victor Du Noyer, Esq.
Alfred Furlong, Esq.
Henry Grattan, Esq.
Thomas Hayden, Esq.
George Paul Helsham, LL.D.
Rev. Alfred T. Lee, M.A.
Major-General Sir Chas. O'Donnell.
William K. Sullivan, Esq.
E. Percival Wright, M.B.
Alexander T. Blakely, Esq.
Maurice Henry Collis, M.B.
Howard B. Montgomery, M.D.
John Purser, Jun., Esq.
Samuel L. Hardy, Esq., M.D.

The Report having been amended, at the suggestion of Dr. Petrie and others, by the omission of a clause in which it was stated that the Museum of Copenhagen "was completed before ours was commenced,"—

It was Resolved,—That the Report of the Council be adopted.

The Ballots for the annual election of President, Council, and Officers having been scrutinized in the face of the Academy, the President reported that the following gentlemen had been duly elected :—

PRESIDENT.—James H. Todd, D.D.

COMMITTEE OF SCIENCE.—Sir Robert Kane, M.D.; Rev. Humphrey Lloyd, D.D.; Rev. George Salmon, M.A.; Rev. Samuel Haughton, M.A.; William H. Harvey, M.D.; Rev. J. H. Jellett, M.A.; James Apjohn, M.D.

COMMITTEE OF POLITE LITERATURE.—Rev. W. H. Drummond, D.D.; Rev. Charles Graves, D.D.; John Kells Ingram, LL.D.; John O'Donovan, LL.D.; Rev. Samuel Butcher, D.D.; John F. Waller, LL.D.

COMMITTEE OF ANTIQUITIES.—George Petrie, LL.D.; William R. Wilde, Esq.; Joseph Huband Smith, M.A.; Charles Haliday, Esq.; John T. Gilbert, Esq.; Rev. William Reeves, D.D.; Lord Talbot de Malahide.

TREASURER.—Rev. Joseph Carson, D.D.

SECRETARY TO THE ACADEMY.—Rev. Charles Graves, D.D.

SECRETARY TO THE COUNCIL.—Rev. John H. Jellett, M.A.

SECRETARY OF FOREIGN CORRESPONDENCE.—W. R. Wilde, Esq.

LIBRARIAN.—Rev. William H. Drummond, D.D.

CLERK, ASSISTANT LIBRARIAN, AND CURATOR OF THE MUSEUM.—Mr. Edward Clibborn.

The President nominated, under his hand and seal, the following Vice-Presidents:—Rev. Humphrey Lloyd, D.D., Rev. William Reeves, D.D., Rev. George Salmon, M.A., John Kells Ingram, LL.D.

It was Resolved, on the recommendation of the Council:—

1. That the regular publication of our Transactions is absolutely essential to the welfare of the Academy.

2. That, in order to enable the Council to carry on this important work without interruption, it be recommended to the Academy to suspend, for the present, the Annual Grants of £100, each, to the Library and Museum, there being no other funds available for the purpose.

3. That the amount of the Grants annually voted to the increase of the Library and Museum be regulated by the funds in hands, after paying for the publication of the Transactions.

An Address to His Excellency the Lord Lieutenant, on his return to Ireland, was read and adopted.

MONDAY, APRIL 12, 1858.

JOHN KELLS INGRAM, LL. D., Vice-President, in the Chair.

REV. CHARLES B. GIBSON, Edmund T. Palmer, and Thomas Brooke, Esqrs., were elected Members of the Academy.

The CHAIRMAN read the following Address, presented on the 19th of March last, to his Excellency the Earl of EGLINTON and WINTON, Lord Lieutenant, &c. &c., of Ireland:—

"MAY IT PLEASE YOUR EXCELLENCY,—In my own name as President, and in that of the Council and Members of the Royal Irish Academy who accompany me, I have solicited this interview with your Excellency, for the purpose of presenting to you our respectful congratulations on your arrival in Dublin, to occupy for the second time the high and responsible office of Lord Lieutenant of Ireland. Your Excellency's former residence amongst us has made you acquainted with the literary and scientific institutions of this city; and it is therefore unnecessary for us to inform you that the Royal Irish Academy has been incorporated, and has laboured for more than seventy years, to promote the study of science, *belles lettres*, and the antiquities of Ireland. We trust that we are not guilty of any presumption when we express our conviction that the institution of this Academy has been eminently useful to Ireland. It has fostered and rewarded the pursuit of science and sound learning; it has brought together on a common ground men who have differed widely on political and religious questions, and the meetings of the Academy have ever exhibited that mutual forbearance and good will which are necessary for the calm discussion of scientific questions, and morally so desirable in this country. We have established, principally from the private contributions of our members and the liberality of individual donors, a Museum of Irish Antiquities, which has now acquired some reputation as illustrating the manners and customs of the nations that formed one of the great waves of migration of the human race. We have recently published a Descriptive Catalogue of one of the departments of this Museum, with a view to make its contents known to the learned of Great Britain and of Europe, and the immediate completion of the work is only delayed by the limited funds at our disposal. We have formed also a Library, to which her Majesty's Government has lately made some very valuable donations, by giving us the topographical and antiquarian materials collected for the Ordnance Survey of Ireland, and more recently some duplicate volumes of very useful newspapers and important Parliamentary papers removed from the Irish Office in London. Our Library consists chiefly of the transactions of sister scientific Academies—British and foreign—and of such books and manuscripts as relate particularly to the history, the literature, and the antiquities of Ireland. All Members can borrow books from our Library, and it is open, with necessary restrictions, to all who are properly introduced. By our Charter your Excellency is appointed, *ex officio*, the Visitor of the Royal Irish Academy, and

we trust you will find leisure from your more important and higher duties to relax occasionally by doing us the honour of attending some of our meetings, and examining the remains of ancient Irish art and literature which are preserved in our Museum and Library. We beg to express our anxious hope that the period of your Excellency's administration in Ireland may prove an era distinguished by the promotion of peace and prosperity, the development of the industrial resources of the country, and the advancement of those literary and scientific pursuits to which the Royal Irish Academy is more especially devoted."

His Excellency returned the following reply :—

"Gentlemen,—It gives me much pleasure to meet a deputation from so distinguished a body, and to receive your congratulations on my re-appointment to the government of Ireland. The years that have passed since I was in Dublin have not driven from my recollection the history of your Society, or the knowledge of the beneficial effect which such a Society as yours has in promoting scientific attainments, not only in the city, but over the whole country. Any institution or any pursuit which brings together with a common or a praiseworthy object men who differ in religion and political questions is well worthy of support; and as I am by my official position the Visitor of your Academy, I hope I may have an occasional opportunity of relaxing and improving my mind by a glance at the curiosities which you have amassed."

John R. Kinahan, M. D., read the following paper—

ON OLDHAMIA, A GENUS OF CAMBRIAN FOSSILS.

In certain schistose beds of the Cambrian series, as seen at Bray Head and other places in the county of Wicklow, and at Howth in the county of Dublin, are found masses of peculiar markings, which the eye readily recognises as casts of an animal belonging either to the Polyzoan or Hydrozoan alliance. Although at first sight there may, especially to an untutored eye, appear to be some resemblance between these markings, and the multiform shapes which masses of crystal assume, yet a consideration of their symmetrical regularity of form, their constancy of direction with regard to the bedding, their frequent occurrence and permanency of character in even dissimilar beds, situate at great distances from each other; their association with traces of the remains of animals of aquatic habits; and their close agreement in form with beings living at the present day,—lead us to dismiss as untenable every theory which would assign to them aught save an organized origin. Geologists of the present day, without hesitation, admit Oldhamia—as the genus founded for the reception of these fossils, in 1848, by Edward Forbes is called, in honour of Professor Oldham, who first noticed their existence

Fig. 1.

in 1844 (*vide* "Proceedings of the Geological Society of Dublin," vol. iii., p. 66)—among the list of fossils. But, although the former animal nature of these beings is now admitted, their exact position in the scale is by no means free from doubt; nor need we wonder at this when we recollect that but a few years since the two great families—to both of which Oldhamia has been referred by different observers, viz., the Polyzoan Mollusca and the Hydrozoan Acrita—were confounded together, and that in many cases (widely different as the animals composing these two classes are in the structure and relations of their organs), even among recent species it is impossible *d priori* to declare, from the skeletons alone, whether we have a Polyzoan or a Sertularian under examination, and we are only able to solve the question by reference to the soft parts of the animals. The only author who has, as far as I can learn, written on the subject, whose opinion is worth any attention, is the late Professor E. Forbes, and if I venture to differ from his published opinions, it is because my conclusions are based on a careful study of the rocks and fossils, on a more extended scale than had been made by him. At the same time I freely admit that it is extremely difficult to adduce any arguments in favour of the Hydrozoan nature of these fossils which will appear conclusive on paper, this conclusion being the result of a careful consideration and comparison of such details of structure as the fossils

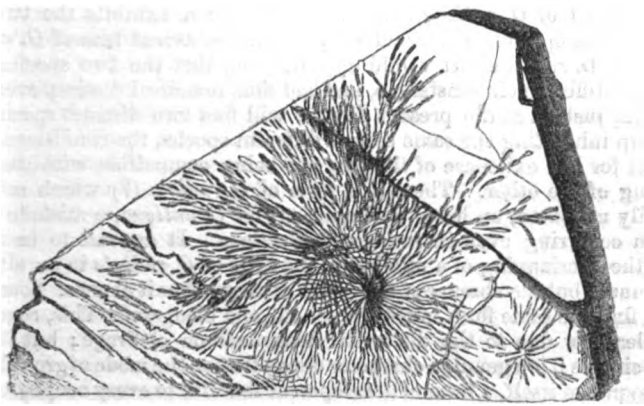

Fig. 2.

afford, and based on characters of a general nature, drawn from appearances, even tangible enough to the eye, but utterly impossible to be described with precision. I cannot discover or appreciate what the characters are which lead Professor Forbes, "speaking of their possible Polyzoan nature," to use the words, an alliance more in accordance with the minute structure; careful casts, taken from *Old. antiqua* and from specimens of *Sertularia argentea* imbedded in plaster, are so much alike, that some years since they would certainly have been pronounced not merely generically, but even specifically, identical.

Two distinct forms at least of these fossils exist, both of which were named by Professor E. Forbes, and have been described somewhat at length by me in a paper read before the Geological Society of this city (*vide* "Proc.," vol. viii.). They differ so much that I almost question the convenience of associating them under the same genus, one (Fig. 1) being furnished with a distinct axis, from either side of which alternately ranged branches proceed at regular intervals (*O. antiqua*), whilst the other (Fig. 2) is destitute of any axis, made up of many stems of irregular length, springing from a common point, so that the fossils flattened from above present the form of a star, more or less regular according as the axes are equal in length or not. Some of these are so irregular, however, that the radial character is almost lost, and they might be taken for another species; but I think specimens sufficiently intermediate in character exist to refute this view. There is no difference in the mode of the occurrence of these species,—masses of the animals compressed together in layers and intermingled in the beds of what evidently once was sandy mud. Occasionally we find scattered fans of *O. antiqua*, or single stems of *O. radiata*, and sometimes we get the whole mass so compressed and confused as to render it impossible to make out the parts distinctly. The species are generally found apart. I possess one specimen a quarter of an inch thick, in which a bed of *O. radiata* overlies a bed of *O. antiqua*, so that the specimen exhibits the two species on its opposite sides, and I have found scattered fans of *O. antiqua* among *O. radiata*. It would appear, then, that the two species lived under different circumstances, and had thus remained distinct even after death, just as at the present day we will find two distinct species of a group inhabiting the same seas at different epochs, the conditions which fit it for the existence of the one not being compatible with the well-being of the other. There is a form of *O. radiata* (?) which might be easily mistaken, on hasty examination, for *O. antiqua*, a mistake I have seen occurring even in museum collections. It appears to be formed by the overlapping of a number of the tufts of *O. radiata* in an alternate manner; but the absence of the rachis distinguishes it at once. Sometimes we find the same form much drawn out and elongated. This, sometimes at least, is due to the distortion dependent on cleavage; but in other specimens it is a genuine character dependent on the mode of growth of the Polypidom itself, a form of development familiar to every zoophytologist. The cells in which these animals dwelt appear to have been in *O. antiqua* biserial and alternate; in some specimens of *O. radiata* a similar arrangement is remarkably evident, but in others belonging to the second form described, and in which the termination of each of the axes is enlarged, this arrangement is not so evident. Springing from the axils of these cells in one or two of my specimens of *O. radiata* are somewhat elliptical bodies, which, although not strongly marked, are, I think, sufficiently so to satisfy me in considering them as oviferous capsules; I have not detected these organs in *O. antiqua*. One form of *O. radiata* presents the appearance of long, unbranched axes. This is an appearance also well known among recent Hydrozoa.

These are the more important points I have been enabled to make out regarding this genus as established by Forbes, and, taking into consideration the close approximation, almost amounting to identity in form, which exists between these and the Sertularia, their mode of growth, as far as we can judge, and place of occurrence, being so similar,—so much so that a superficial examination would lead one to pronounce them identical,—I think we are justified in considering these rather Sertularian Polypidoms than Polyzoan Cænæcia,—a view of the genus which, I am convinced, further research among living forms will eventually prove to be the correct one.

G. JOHNSTONE STONEY, A. M., read the following—

NOTES ON THE MOLECULAR CONSTITUTION OF MATTER. NO. I.

THE extraordinary power of the general method in Mechanics which we owe to the genius of Lagrange has tempted several mathematicians to try its strength in studying the unknown forces which enter into the molecular constitution of matter. In the applications of this method which have been hitherto made, as well as in other mathematical investigations into molecular forces,* the body under consideration has been supposed in its usual condition to consist of molecules:—

1°. At rest—

2°. Resembling one another, and similarly placed, each acting on its neighbours within a certain range—

3°. By forces adequately represented by functions multiplying the masses of the attracted and attracting molecules—

And which are such that the action on any one molecule may be represented by integrals extended through the sphere of action. In order that these integrations may be legitimate, it is necessary—

4°. That the sphere of action round each molecule include an immense number of other molecules, no one of which contributes more than an infinitesimal part to the total action on the central one; and—

5°. That the contributions from any two consecutive molecules be almost undistinguishable either in direction or amount.†

These hypotheses involve some remarkable results, the examination of which will enable us to limit the area of our search in prosecuting the study of molecular physics.

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* See CAUCHY: "Sur l'équilibre et le mouvement d'un système de points matériels sollicités par des forces d'attraction ou de repulsion mutuelle."—Cauchy's *Exercises de Mathematiques*, tom. iii., p. 202; and "De la Pression ou Tension dans un Système de points materiels."—*Ib.*, p. 224. NAVIER: "Sur les lois du mouvement des fluides."—*Memoires de l'Institut*, tom. vi., p. 389; and "Sur les lois de l'équilibre et du mouvement des corps solides élastiques."—*Ib.*, tom. vii., p. 375. POISSON: "Sur les équations générales de l'équilibre et du mouvement des corps solides élastiques et des fluides."—*Journal de l'Ecole Polytechnique*, Cahier XX., p. 1. HAUGHTON: "On the Equilibrium and Motion of Solid and Fluid Bodies."—*Trans. Royal Irish Academy*, vol. xxi., part 2. JELLETT: "On the Equilibrium and Motion of an Elastic Solid."—*Ib.*, vol. xxii., part 3.

† The last two hypotheses, which must be insisted on if the method of integration be

I°. Conceive a medium of uniform density within a closed space, and possessing a constitution fulfilling the conditions required by these hypotheses. Conceive within this medium a canal of finite and uniform section which returns into itself. There will then be nothing to prevent the part of the medium which is within this canal from yielding to any force tending to make it glide lengthways. It is evident from hypotheses (4) and (5) that no obstacle to this motion will arise from the molecular forces acting on the superficial portions of the canal, and, *d fortiori*, that none will arise from those acting farther within it. Hence, the medium is a fluid.

II°. Again, conceive the medium within the closed space to consist of two parts of different densities in contact with one another. Then, in order that it may be capable of retaining a constitution such as is supposed, the molecular forces must be such as will make the part of greater density diffuse into the other. For the sphere of action round some molecules will consist of two segments of unequal density. Now, a segment of the greater density must exert either a greater attraction on the central molecule than an equal and similarly situated segment of less density or a greater repulsion. For if it exerted neither, it would follow, from hypotheses (3), (4), and (5), that the density might be increased or decreased to any extent without opposition from the molecular forces,—a state of things wholly unknown in nature. Again, it cannot have a greater attraction; for it would follow that, even if the conditions at the surface of a uniform medium could be such as to establish a state of equilibrium, this equilibrium could only be unstable; so that on the most trifling inequality of density occasioned by a deranging cause, the parts of less density would flow into those of greater; so that the whole medium would ultimately collapse into one or more points, or until some forces not consistent with the hypotheses came into play; or else it would get into a state of permanent internal motion inconsistent with hypothesis (1). The only remaining alternative,* that the segment of greater density exercises a greater *repulsion*, leads to no such impossible results. It might only require the parts of greater density to flow towards those of less, and thus make a state of uniform density one of stable equilibrium with a pressure against the containing vessel. Hence the medium is an *elastic* fluid or a gas.

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adopted, exclude many continuous functions; thus, using F to denote the mutual action of two molecules, and r for the interval between them, if the law of force be such that r^2F becomes infinite for $r = 0$, the central elements of the integral will contribute unduly to it, so that such a value as—

$$F = \mu \frac{a^2}{r^2} \left\{ 1 - A\frac{a}{r} + B\frac{a^2}{r^2} - \&c. \right\},$$

where μ is the coefficient of gravity, A, B, &c., constants, and a a line of fixed length, is not admissible if the method of integration be retained; yet this law, and others like it, would, it is evident, lead to several of the most obvious properties of matter.

* A *less* attraction or repulsion from a segment of *greater* density has not been considered, since it is at once inconsistent with hypothesis (3).

III°. Next let the medium be of uniform density within a closed space, and imagine any plane crossing this space; then the pressure per square inch of the part of the medium lying on one side of this plane against the part lying on the other side may be seen to be a function of the density as follows:—Let m be a molecule sufficiently near to the plane on one side to be within the range of molecular repulsion of particles lying at the other side, and describe round m a sphere including all the molecules which act on it. Part of this sphere will, therefore, lie beyond the plane, and from hypotheses (3), (4), and (5), we find that the action on m arising from that segment of the sphere will vary directly as the density; since to alter the density is the same thing as to increase or decrease in a fixed ratio the number of molecules acting from each element of volume of the segment. The same reasoning applies to the action from the second side of the plane on any other molecule on the first side which is sufficiently close; and as the number of molecules thus acted on will also increase directly as the density, and as the interpolated molecules will, from hypothesis (5), be acted on to the same amount, and in the same direction, as the original molecules between which they lie, it follows *that the pressure per square inch within the medium will vary as the square of the density.**

IV°. This pressure will of course be transmitted to the walls of the containing vessel, so that it becomes necessary to consider the conditions which must hold at the boundary of the medium. For this purpose three cases must be distinguished. The first arises along the surface of contact of two media, which obey, in the forces which they exert on one another, conditions consistent with our hypotheses. In this case, if the density of either medium vary after a state of equilibrium has been established, that of the other must vary in like proportion, otherwise the medium of increased density will force back the other. Again, if the range or law of the *mutual* molecular action of the two media differ from what hold with respect to the action of the molecules of either medium among themselves, it is evident that the density of this medium cannot be uniform, but must be different from its average value in the vicinity of the other medium. This alteration in the density of the superficial stratum will react on the stratum behind, and so on, producing a strained condition of the density throughout the medium,† which would even in some cases go the length of occasioning the precipitation of that medium upon the surface of the other. Another case, which is quite distinct, will arise when the medium is confined by a containing vessel, the walls of which are both rigid and immovable, but which acts

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* In the particular hypothesis of modified action introduced by Professor Jellett there will be another term containing the fourth power of the density.

† Somewhat like the strains which are found to exist in substances which need careful annealing. Thus, it is well known that if a chip be broken from a sharply defining object-speculum or lens of a telescope, the strains which held the fragment in its place being annihilated, the distribution of the density and strains throughout the whole of the rest of the mass are so altered that the accuracy of the defining power is lost.

on the medium within, not merely from its superficial layer of molecules, but from all those lying within a certain distance of the surface in such a way that no one molecule of the containing vessel contributes more than an infinitesimal part to the effect on a molecule of the medium. Up to a certain density and pressure the medium will be contained by such a vessel; but as soon as the density is made to exceed this limit, the medium will begin freely to permeate the vessel, and escape. The remarks made with reference to the last case apply equally to the present one, so long as the medium continues of sufficiently low density to be restrained. The third case of limiting conditions arises where the medium is kept in by the wall of a containing vessel which it can neither press back nor penetrate. That this may be so, the outward motion of the *superficial* layer of molecules of the medium must meet with an absolute obstruction from the repulsion of the inner layer of molecules of the containing vessel. The forces thus coming into play would be at variance with hypothesis (4); on which account it is needless here to trace further the consequences of their action, several of which are, besides, sufficiently obvious.

This kind of examination might, indeed, be continued almost indefinitely, and extended to the crystalline texture of the medium and other branches of the subject; but enough has been done for my present end, which is to draw attention to the fact, that *no known ponderable material* possesses a constitution of the kind which has been supposed, and, consequently, that we are forced to admit, as demonstrated, the following points with reference to this obscure branch of Physics:—

1°. That no known ponderable matter consists of a continuous substance similar in all its parts.

2°. That by continuing the subdivision of *solids*, as far as is consistent with the parts being similar, similarly placed, and acting alike, either the whole, or at least a controlling part, of the action on each such molecule must be contributed by a finite number of those in its vicinity. The validity of this conclusion is not disturbed by attributing to the elementary molecules such motions as may constitute sound, heat, light, and electricity, and the statement is evidently *à fortiori* true of the parts of the elementary molecules.

3°. If liquids are separable into elementary molecules of the kind described in the last paragraph, similar to one another, similarly placed and acting alike, then the statement of that paragraph may be repeated, word for word, with reference to them; but if, as seems perhaps more likely, there is going on between the elementary molecules of liquids a constant interchange of their parts, then the language must be somewhat modified, although the conclusion remains substantially the same.

The case of gases is somewhat different. The examination which has been made above shows, no doubt, in the case of gases, as it does for either solids or liquids, that their constitution cannot be that of a *stationary* system, each molecule of which acts, but to a trifling extent, on each of those around it. But it does not show that it may not be such a system in a state of vivid molecular motion. The closer investigation

of this hypothesis opens a new branch of the subject. Already, however, a positive step appears to have been made by *demonstrating* that in solids and liquids each molecule is acted on to a finite extent by those in its immediate neighbourhood.

Sir William R. Hamilton read a paper, "On some Transformations of Diverging Lines."

A collection of twenty-five ancient articles, consisting of bronze pins of several forms, the axis of a spinning bobbin, and two needles, all found near Gweedore, county of Donegal, were presented.

MONDAY, APRIL 26, 1858.

JAMES HENTHORN TODD, D. D., President, in the Chair.

J. BEETE JUKES, Esq., read a paper "On the Lower Palæozoic Rocks of the South-East of Ireland and their associated Igneous Rocks."

Rev. Professor Haughton read a paper on the same subject, and described certain minerals as abounding in these rocks, which had been hitherto unnoticed in common granites of Ireland.

The Secretary read a letter from the Chairman of the Local Committee at Baltimore, inviting the Members of the Academy to attend a Meeting of the American Association for the Advancement of Science, to be held in that city.

George V. Du Noyer, Esq., presented a series of drawings of antiquities, made by himself, from bronze and iron antiquities in the Museum at Rouen, in September last.

Fleetwood Churchill, M. D., on the part of Dr. Lockhart, presented five porcelain seals, collected by that gentleman during his residence in China. Two of them have inscriptions exactly the same as the seals Nos. 2 and 51 engraved in the late Mr. Getty's work on Chinese Seals found in Ireland.

The Secretary announced the presentation of a medal by the Royal Norwegian University of Christiania, struck in honour of Dr. Christopher Hansteen having completed a term of fifty years as Professor of Astronomy in that University.

MONDAY, MAY 10, 1858.

JAMES HENTHORN TODD, D. D., President, in the Chair.

REV. CHARLES GRAVES, D. D., read a paper "On a System of Imaginaries analogous to those employed by Sir William R. Hamilton in his Calculus of Quaternions."

The PRESIDENT read the following paper—

ON THE CONTENTS OF CERTAIN ANCIENT TOMBS IN THE NEIGHBOURHOOD OF ANET, IN SWITZERLAND.

I MENTIONED to the Academy on a former occasion that I had received a letter from M. le Baron de Bonstetten, of Berne, making some inquiries respecting the earthenware pipes, several specimens of which are preserved in our Museum. My answer to him was, that I could not regard these pipes as more ancient than the sixteenth century, and, consequently, that the idea of supposing them in any way connected with the Celtic race was wholly untenable.

The Baron has since been kind enough to send me an account of the opening of some ancient tombs at Anet, near Berne, in Switzerland, which is of considerable interest, as tending to establish some fundamental principles of archæological investigation.

First, however, let me say that the Baron has fallen into the very common error of supposing that the small wedge-like hatchets, commonly called *Celts*, are peculiar to the Keltic race. The name *Celt* ordinarily given to them has propagated this error; but that word is only the Latin *Celtes*, or *Celtis* (from *cælare*, to carve or engrave), which occurs in the Latin Vulgate, Job, xix. 24:—"Quis mihi det ut [sermones mei] exarentur in libro stylo ferreo, et plumbi lamina vel *Celte* sculpantur in silice?"* But the name of the Keltic family of nations, in its correct orthography, is wholly different, Gaoidhel, Γαλαται, Gadelii.

Thus M. de Bonstetten records it as a fact which he appears to think inconsistent with his own very just conclusion of the non-Celtic origin of the tombs, of which I shall speak presently, that M. Müller, of Nidau, in the year 1848, opened a tomb on the hill of *Jolimont*, near Anet, in which were found a small bronze figure, "dont la costume bizarre n'a rien de romain;" a stone hammer, "et une de ces haches, ou coins en bronze communement appelés haches celtiques." If continental antiquaries call these implements "haches celtiques," it is evident that they have fallen into the error of imagining that the name Celt (i. e. *Celtes*, a chisel) is connected with the Celtic, or more properly Keltic, family of the human race.

The opinion of M. de Bonstetten, in which I entirely concur, is, that the tombs opened by him in the neighbourhood of Anet are to be assigned to a period subsequent to the introduction of Christianity into that country, that is, subsequent to the latter part of the sixth century; and I am inclined to believe them, for the reasons I shall give presently, very much later.

The real importance of the Baron de Bonstetten's discoveries, in reference to the science of Archæology, does not appear to have been fully perceived by himself. But I shall be better able to explain what I

* It is curious that some MSS. and printed editions of the Vulgate (as that of Rob. Stephanus, Paris. 1528) have "vel certe sculpantur," a reading which is, no doubt, the true one, as being in accordance with the LXX. and with the Hebrew.

mean when I have given you a short account of the results of his investigations.

He found among the ruins of the ancient Chateau of Fœnis, about a league to the north of the village of Anet, near Berne, ten large tumuli, erected upon a wooded hill which overlooks Anet, and from which there is a view of the lakes of Morat, Neuchatel, Bienne, and of the chain of mountains from the Titlis to Mont Blanc. Six of these mounds were ranged at some feet from each other, on the crest of the hill, in a line running from east to west. The remaining four formed a semicircle at the end of this line. The mounds varied in dimensions from 6 to 15 feet in height, and 40 to 60 paces in circumference.

The first circumstance noticed by the Baron, which distinguishes these tombs from the Celtic and British sepulchral monuments of the same kind is, that the stones forming the chamber of the tomb appeared to have been cemented together with mortar.

Another circumstance is, that some of these tombs contained two or three bodies, not laid together in the same chamber, as in our Celtic tombs, but in a lower, middle, and upper chamber, separated from each other by layers of stones or flags, the roof of the lowest chamber forming the bottom of the second, and so on. M. de Bonstetten remarks that he did not find in any case more than three such chambers, and that in the upper chamber were usually found, in addition to the remains of the third corpse, the ashes of burnt bones, on a bed of fine sand. The whole structure was surrounded and covered with small stones, giving the monument the form of a conical mound, resembling our cairns.

It is probable, from this account, that two different customs of sepulture may have coexisted at the time when these tumuli were constructed, —that of cremation, and that of burial, properly so called,—and that the burnt remains were in general placed at the top. Could it be that the Christians, in reverence for the hope of the Resurrection, were buried without cremation, and that the heathen serfs, or *pagani*, were burnt?

In confirmation of this opinion, it is to be observed that there were found in the same tomb articles which had evidently been subjected to the action of fire, and other articles which, from their very nature, could not have been in fire. Thus, in the first tomb, M. de Bonstetten found "bracelets de bronze, presque consumées par le feu," and also a wooden ring, a large ring of amber, and rings of bronze connected together by linen or worsted threads, the remains of which were visible, forming a sort of light coat of mail, intended evidently for ornament rather than for defence. In other tombs he found the remains of chariots in wood, a buckler, with the remains of the leather of which it was composed, rings of wood and of amber, leather harness, and other things which evidently could never have been subjected to the action of fire.

But it will be better to describe very briefly what was actually found in these tombs before we make any general remarks on their contents.

Tomb I.—After digging seven feet, large flags were found, covered with a black paste-like substance (probably decayed animal matter), mixed with fragments of bones, whether human or animal M. de Bonstetten does not inform us. At the northern side were found fragments

of rings or bracelets of hollow bronze, which, as already remarked, were almost wholly consumed by fire, a wooden ring, and a large ring of amber, resting on a layer of gray dust; also, as above mentioned, the remains of a garment of linen or coarse stuff, ornamented with small rings of bronze, similar to those used in coats of chain-armour. At the east end of the tomb were found the remains of an armlet of hard wood, covered with a black varnish, and the remains of a bronze plate, which appeared to have been originally fastened upon leather, and seemed to have formed part of the breast-plate of a coat of armour. It was delicately engraved, in zig-zag lines, forming elliptic and semi-elliptic ornaments, and it had still two rings, intended apparently for fixing it upon the shoulder. Some fragments of pottery were also observed.

It would seem, therefore, that this was a tomb the occupant of which had been interred by cremation, the burnt remains having been deposited in urns of pottery along with the unburnt armour of the deceased; and these deposits having been covered with flags, the remains of some other bodies, which seem to have been also burned, were spread on the top. The existence of wood and leather seems incompatible with a very high antiquity.

Tomb II.—At a depth of four feet were found two rings of bronze, covered with a fine rust, and, one foot lower, a fibula; one foot lower still, or six feet from the surface, an iron hook, apparently the remains of a spur; and a small ring of iron; together with fragments of pottery and large iron circles, with nails and wood inside, which M. de Bonstetten supposes to have been the remains of the wheels of a chariot.

Tomb III.—This tomb was only six feet in length and forty paces in circumference. At a depth of two and a half feet were found two bronze armlets, two bracelets, a bronze band or collar for the neck, which M. de Bonstetten supposes to have been a female ornament, and other fragments of bronze, engraved in relief or stamped.

The collar was a thin plate or flexible lamina of bronze, with the hooks or fastenings still remaining which held it at the back when placed round the neck. It is ornamented in the same style of zig-zag which has already been noticed on the breast-plate found in Tomb I., the zig-zag lines being disposed in semicircles, right lines, and triangles.

The armlets are of a kind not found, so far as I know, in any Celtic monuments: they are hollow cylinders of bronze, intended apparently to cover the arm from the wrist to within an inch or two of the elbow-joint, and the bronze appears to have been fastened to an internal cylinder of wood, at least in the case of one of them, of which one-half was perfect, and which contained a small bracelet (I presume in bronze, although M. de Bonstetten does not say so), and the remains of a wooden handle, which M. de Bonstetten supposes to have been part of a distaff.

On reaching the level of the ground, M. de Bonstetten perceived that in the centre of the tumulus the earth had been moved, and on digging down he found the flags of a second tomb, on which lay the umbo of a shield. It was ornamented with concentric circles of bronze, engraved in chevrons, and fastened round the umbo by thongs of leather, passing through the triangular ornaments of the bronze circles, and sewing them

to the body of the shield, which seems to have been also of leather, from the fatty and black paste-like substance with which the flags were covered. There were also found, along with the remains of the shield, a small buckle, a bracelet (of bronze, I suppose), a thick armlet of wood, not varnished, as some of the other wooden articles were, and a ring of amber.

Tomb IV. contained only some remains of bones, and a piece of oxidized iron.

Tomb V.—At two feet from the summit was found a layer of sand and burnt bones; two feet lower, in another layer of sand, towards the N. W. side of the tumulus, were fragments of coarse pottery, mixed with pieces of charcoal and bones, the remains of a bracelet of wood, covered with thin bronze, three smaller bracelets in bronze, a clasp (bronze) of delicate workmanship, large fragments of narrow bands of bronze, ornamented in relief, intended as ornaments of the head, or, perhaps, stitched upon a garment, and three buttons much corroded, which were found buried in a gray dust, the remains, as M. de Bonstetten conjectured, of some kind of stuff or cloth garment.

Under the second layer of sand were found the stones of a third sepulchre, which contained bronze armlets, much broken, a bracelet of elastic wire, and a ring of bronze; also a large ring of amber, too large for the finger, but too small to have been worn on the arm or wrist, and a great number of small, thin plates of bronze, resembling the scales of a fish, lying together in a brown substance, which damp had reduced to a sort of paste, and which was probably the remains of cloth, on which they had been stitched, to form a light coat of mail.

Tomb VI.—This tumulus was higher than any of the rest. It contained, at two feet from the top, a broken urn (clay), full of ashes; a foo lower was a bed of cement, formed of stones and sand, which increased in thickness towards the centre of the tomb. In it were found, placed so that the lines joining their centres would have formed a rectangle, four circles of iron, twenty-three inches diameter, with nails which had evidently fastened them to wood. One of these was broken, but the other three were entire. Near each of these iron circles was an iron round plate, one inch broad, and four in diameter, which had been fastened upon wood with nails, and had a rim or flange on its outer circumference of about three inches. From these remains—the position of the four iron circles, and the fragments of wood still adhering to them, the number of nails, fragments of rings and of iron plates found surrounding them—M. de Bonstetten concluded that this tumulus had contained a chariot, with four wheels, which had been buried with the corpse or ashes of its owner. Between the wheels of this chariot he found also a human thigh-bone, and an iron sword, fifteen inches long, in a sheath of bronze.

Having dug through the thick crust of cement which formed the floor of the first chamber, he came upon an immense mass of stones, of all shapes and sizes, piled upon each other. At a depth of twelve feet from the top of the tumulus were found large flags, on which were a prodigious quantity of remains of leather, wood, iron, and bronze, and circles of iron, or wheels, similar to those found in the upper chamber. Here

M. de Bonstetten found large fragments of leather harness, ornamented with copper nails arranged in squares and triangles; a piece of wood, ornamented in the same way; several rosettes or buttons of bronze fixed to thongs of leather; an iron horse-bit; a horse's breastplate in bronze; and a plate of bronze in the form of a crescent. Further on were found large remains of an ornamental grating or trellis-work in bronze, which had evidently been fastened upon wood with nails, and was strengthened round the edge with bars of iron; more than twenty cones of wood, which was found to be hazle, covered with thin bronze, were also discovered; these M. de Bonstetten supposes to have been the spokes of the wheels, and the bronze trellis-work to have been the ornaments of the body of a chariot.

Fragments of a human skull, with the jaw-bone, were also found, together with two sword handles; a chain of gold in filigree work; a bead or runner of solid gold, about half an inch in diameter, the surface of which was highly ornamented in relief.

All these objects were found under large stones placed upon the flags at regular intervals, leading to the conclusion that the chariot had been taken to pieces, and its several parts, with the other articles, laid out upon the flags.

In this tumulus was also found a piece of flint, cut like the flint of a gun-lock, which M. de Bonstetten supposes to have been an amulet; also a triangular, irregular, fragment of stone, three feet wide by two high, which was found built into the side walls of the chamber, and seemed like a fragment of some larger stone, the surface of which had evidently been cut by human art. The position of this fragment in the wall was purely accidental; two lines crossing at right angles traversed the surface of the stone, and within the angles thus formed were several circular holes of different sizes, and of about half an inch deep. M. de Bonstetten seems disposed to believe that this stone had some connexion with the ancient paganism of the country, and that its having been broken and used as the material for ordinary building is an evidence that at the period when this tumulus was erected, Christianity had already undermined the ancient superstitions.

Tomb VII. contained nothing but an iron ring or bracelet. It had an enclosure of stones on the south side only, and was much smaller than the preceding.

Tomb VIII.—After penetrating a covering of mortar mixed with clay, at a depth of five feet lower, there was found a large vessel of thin bronze, without ornament, three feet high. The diameter of the mouth was three feet, that of the base one foot four inches. It stood in a second bottom of wood, with a large rim outside, much decayed. The earth in which this vessel was embedded was so hard, and adhered to it so strongly, that the vessel was much broken in the attempt to get it out; it was filled with gray dust and fragments of cloth, which adhered to its sides. Near the vessel was found a small plain gold ring, apparently part of an ear-ring; also a collar or neck-lace formed of hollow balls of thin gold, which had been on a string; each ball something more than an inch in diameter, but all of them much battered and bruised; also

the remains of a crown or diadem of thin gold, with some fragments of a human skull. This diadem was ornamented by a stamp impressed on the inside, rendering the ornament concave inside, and raised in relief outside; the ornament consisted of concentric circles, composed alternately of small squares, circles, and triangles, with lines between. M. de Bonstetten supposes the form of this diadem to be that of a cap or bonnet, resembling the crowns to be seen on the statues of the Merovingien kings on the portico of the church of St. Denis. The outer edge was turned back on itself, forming a border of about half an inch, ornamented with fine crossing lines. Remains of a thin plate of bronze were found adhering to the inside in several places, evidently an internal lining for strength. Near this was discovered a brooch of hollow bronze, and two large rings, arm-rings apparently, of wood. Two chariot wheels, of which the iron shoeing only remained, were placed upright on each side of the bronze vessel already described; large fragments of the timber of which they were composed were found all around. At a foot lower were found the flags forming the roof of a lower sepulchral chamber. In this were a wooden armlet, a buckle, a bronze bracelet, of somewhat elaborate construction, and fastened with a hook and eye; the umbo of a shield, fastened by thongs of leather to circles of bronze, exactly the same as the umbo found in Tomb III. The leather crumbled into dust on exposure to the air.

Tomb IX.—On the top of this tumulus was a circular sunken space, about a foot deep, and seven in diameter. The interior of the tumulus consisted of a circular wall of stones, about from three to four feet high; the centre was filled with earth and lime, forming a cement so hard that it was broken with great difficulty. The Baron found here only charcoal, and two pieces of iron, which seemed the remains of a hook.

From this circumstance he concludes that a tumulus of this construction was intended only for the reception of the bodies of serfs, or the lower orders; whilst the tombs of kings or nobles were constructed altogether of stones and flags, the quantity of stones piled up upon the cairn being proportional to the rank of the deceased.

Tomb X.—A large beech tree grew on the top of this mound, which rendered it necessary to open it at the side. After removing a large upright triangular stone of flint, large horizontal flags were discovered, on which lay two great armlets, of the same kind as those formerly described, both of wood, but broken and decayed; two bronze rings or bracelets for the wrist, and one, also in bronze, of the spiral form, being a bronze wire twisted several times in a spiral round the arm; a fragment of a bronze plate, with engraved ornamentation, a wooden ring, and a plate of bronze, bearing in relief a Greek cross. The existence of this ornament, worn probably on the breast or round the neck, seems to prove that this, and the other tombs of similar contents and construction, are to be assigned to the Christian period.

It remains now to make some general remarks on these ancient sepulchres.

There can be very little doubt that the steel sword, with its bronze scabbard; the gold chain of filigree work, and the gold bead, which

seems to have belonged to it, were of Roman manufacture. Many similar articles are to be found in the museums of Italy. The chariot of four wheels, ornamented with bronze trellis-work, is also most probably Roman, and M. de Bonstetten shows that it was a Roman custom to bury or burn shields, armour, chariots and harness, with the bodies of the illustrious dead: so Virgil—

> "Hinc alii spolia occisis derepta Latinis
> Conjiciunt igni, galeas, ensesque decoros,
> Frenaque, ferventesque rotas."—*Æn.*, lib. xi.

On the other hand, the "brassards," as M. de Bonstetten terms them, i. e. armlets, or arm protectors, of wood and bronze, the bronze collar, the diadem of gold, the necklace of hollow golden balls, and the rings of amber, are evidently not Roman: nor do these tombs seem to have contained anything decidedly and unquestionably Celtic.

The Baron de Bonstetten is, therefore, I think, fully justified in the conclusion that these tumuli are not of a high antiquity: the Greek cross found in Tomb X. shows them to have been subsequent to Christianity; their contents indicate a period of transition from the old civilization of the Roman Empire, to the rude and more barbarous manners of the feudal ages. He infers then that the Helveto or Gallo-Romans, are the only people to whom we can attribute the tumuli of Anet.

But a still more important conclusion he has omitted to draw from an examination of the contents of these sepulchres. It is evident that they at once refute the attractive theory of the Danish and some German antiquaries, of a Stone, a Bronze, and an Iron period. In these tombs we find wood, iron, and bronze together. We find even protective armour for the body, of all these materials: and M. de Bonstetten mentions in one instance a flint, which he supposes to have been an amulet, but which was more probably one of those flint, spear, or arrow-heads so commonly found in Ireland. It is evident, therefore, that there is great danger of our being led to distort or falsify historical facts, if we suppose the existence of a chronological period defined by the use of stone, another by the use of bronze, and a third by the use of iron. On this subject, however, I would refer you to the able remarks made in this room by the late lamented John Mitchell Kemble, little more than a year ago, which have been printed in our Proceedings, and which I caused also to be printed in a separate form. In that able paper, the last production, alas! of its accomplished author, you will find also some valuable remarks on the subject of ornamentation as a characteristic of race. The ornamentation of the articles found in the tumuli of Anet is all evidently of the same character, and strongly confirms the conclusion arrived at by M. de Bonstetten of their belonging to the Helveto or Gallo-Roman race. But I have already occupied so much time, that I must forbear making any further remarks on this subject, and I shall, therefore, content myself with observing only that the Greek or Pelasgic people of Italy have left behind them bronze articles, with the same ornaments of alternate rows, composed of serrated lines, of circles, of lozenges, and of triangles, which form almost the exclusive style of ornament on the bronze remains found in the tombs of Anet, and that the same combi-

nation of the serrated zig-zag with the circle, triangle, and other geometrical figures, seems to have been characteristic of the Teutonic or Germanic tribes.

It is to be regretted that M. de Bonstetten has not more minutely described the pottery found by him in these tombs. He mentions it only in general terms; and does not say whether it exhibited any or what kind of ornamentation; nor does he tell us whether the fragments disinterred by him were the ruins of sepulchral urns, or articles for culinary or domestic use. It is most probable, therefore, that they were of the latter class, for it is scarcely to be supposed that if they had been of the nature of our clay sepulchral urns, of which so many specimens are preserved in your Museum, so accomplished an antiquary would have passed them over without notice.

The following heel-ball rubbings, made by Captain W. Persse Newenham, R. N., were presented by that gentleman to the Academy:—

Nos. 1, 2, 3, and 4, from brasses in St. Mary's Redcliff Church, Bristol.

Nos. 5 and 6, from brasses in the Temple Church, Bristol.

No. 7, from a brass in Swainswick Church, Bath.

No. 8, from a brass in the Abbey Church, Bath.

Nos. 9 and 10, from Turkish tombs brought from the Crimea.

Nos. 11 and 12, from sculptured stones found in a by-street in Alexandria.

Also, copies of inscriptions from a temple built by Psamitik II. (the Psammis of Herodotus), who reigned six years (from 597 or 596 to 591 or 590, B. C.). The king is represented making offerings to different deities.

MONDAY, MAY 24, 1858.

JAMES HENTHORN TODD, D. D., President, in the Chair.

ON the recommendation of the Council, it was—

RESOLVED, That the sum of £50 be placed at the disposal of the Committee of Antiquities, for the purpose of purchasing articles for the Museum.

His Excellency the Lord Lieutenant having arrived,—

The PRESIDENT delivered the following Address:—

MY LORDS AND GENTLEMEN,—The Council have imposed upon me the grateful task of announcing to you their recent award of the Cunningham Medals, and of explaining to you the grounds upon which they have adjudged them to the four gentlemen to whom I am commissioned to deliver them at this meeting; but I must, in the first instance, return thanks to his Excellency the Lord Lieutenant, who has most kindly consented to give additional honour to the distinction conferred upon those gentlemen by his presence on this occasion.

Before I proceed to the principal subject to which I have alluded, perhaps you will allow me, for his Excellency's information, as well as for yours, to give a short account of the history of the Cunningham Medals, and the different plans that have been, at different times, adopted of awarding them.

Timothy Cunningham, of Gray's Inn, London, left to the Academy, by his will, the sum of £1000. This bequest was notified to the Council August 1, 1789, and to the Academy, October 31, 1789; and in these facts, I am sorry to say, is contained almost all I know of our benefactor. The Academy made every effort to obtain a bust or a picture of him, but no such memorial was in existence.

His will left full powers to the Academy to dispose of his bequest according to such rules as the Council might, from time to time, enact, for the encouragement of learning in Ireland, by offering Prizes for Essays on certain subjects, or giving rewards to distinguished authors; and accordingly, different plans have, at different times, been adopted.

The first plan was that of giving Prizes for the best Essay on a subject proposed by the Academy.

This was soon afterwards altered, and "The Cunningham Gold Medal" was instituted instead of a pecuniary prize.

These Medals were for some time given for papers published in the Transactions of the Academy, but this plan was objected to as narrowing too much the field of competition, and diminishing in proportion the honour of the reward.

Accordingly, in the year 1848, the plan now in operation was instituted. It is as follows:—

1. All works or Essays, in the departments of Science, Polite Literature, or Antiquities, which shall be published in Ireland, whether in the "Transactions of the Academy" or not, or which shall relate to Irish subjects, may be considered as competing for the Medal.

2. The Council shall award Medals every third year, and shall then take into consideration all papers or works coming under this description, which have been published within the six years preceding.

3. Money premiums shall, from time to time, be given for Essays or Reports on stated subjects.

This last regulation has never as yet been acted upon, the fund at the disposal of the Council having been found too small to enable them to carry out both objects; this is the more to be regretted, as it is evident that the Medals given in accordance with the first and second rules do not produce or encourage new researches, but only reward those authors who had laboured independently, and whose works would have been published, whether any such Medals had been given or not.

But besides this, our Medals are, in my opinion, open to a still greater objection, owing to the fact that they are of gold, and that they are all struck from the same die. A gold medal is necessarily unique: it is locked up in a strong box during the lifetime of its owner, and at his death it is, in many cases, disposed of for the value of the gold, by his executors or his heir. A gold medal, therefore, does not spread the fame, either of the individual who receives it, or of the Academy by whom it

is given. But the Gold Medal of the Academy is objectionable on another ground: in that it contains nothing to indicate either the person to whom it was awarded, or the reason why it was given to him. The Medals are all from the same die, whether they are given for the advancement of science, or for classical learning, or for the promotion of archæological knowledge,—and if one of them were stolen or lost, there is nothing to indicate to whom it once belonged.

I am, therefore, very much disposed to prefer the plan suggested many years ago, I believe in 1839, by Dr. Aquilla Smith. The main features of this plan are, that the Medal should be of copper, bearing on one side a permanent device, and on the other a portrait of the individual to whom it is given, with an inscription containing his name, and the reason why the medal was awarded. A certain number of copies of each Medal should be sent by the Academy to royal and public cabinets at home and abroad, and the remainder sold to Members and to the public. A single copy in silver to be given to the person who receives the medal, but no gold impression to be taken.

The advantages of this system are, that it spreads at once the fame both of the Academy and of the individuals distinguished by the Medals. Collectors will look eagerly for them; a series of them will be preserved in every public cabinet, and in all the principal private collections; and the money now spent uselessly in the purchase of gold will be expended in the encouragement of art, inasmuch as every Medal given must have a new and peculiar die sunk for it.

To return, however, from this digression to the proper business of this meeting.

The Medals now about to be given ought, strictly speaking, to have been given last year; but the death of our Treasurer, the late Dr. Ball, and some private matters connected with our finances, induced the Council to postpone the delivery of them until now; and I am glad that these accidents are attended with at least one good result, that we are now honoured by the presence of the distinguished nobleman who so worthily represents her most sacred Majesty in this country.

In consequence of the interval that has elapsed since the last distribution of these Prizes, the Council have resolved to give four on the present occasion, two in the department of Science, one in that of Polite Literature, and one in Antiquities.

On the recommendation of the Committee of Science, the Medals have been awarded to Edward J. Cooper, Esq., M. P., of Markree Castle, for his "Catalogue of Ecliptic Stars;" and to the Rev. George Salmon, for his researches on the "Geometry of Plane Curves."

On the recommendation of the Committee of Polite Literature, a Medal is adjudged to the Rev. Dr. Wall, for his important work on the "Ancient Orthography of the Jews, and the Present State of the Text of the Hebrew Bible."

On the recommendation of the Committee of Antiquities, the Rev. Dr. Reeves is to receive a Medal for his new edition of Adamnan's "Life of St. Columba."

It will be necessary for me to give you some little account of the works to which we have thus awarded our highest mark of approbation.

I. Much importance has of late years been attached by astronomers to the formation of catalogues and charts of stars in the vicinity of the ecliptic, the region of the planetary movements. The fixed points, whose positions are thus determined and mapped, not only serve as points of reference for the places of the moving bodies of our system, but they afford also most important facilities for the discovery of new planets. They enable us to determine the variation in the position of a moving body, by a simple micrometrical measurement, or even by ocular triangulation, and so render much more easy the detection of those regular variations of place which enable us to pronounce the moving body to be a planet.

Induced by these considerations, and stimulated by zeal for the advancement of his favourite science, our fellow-Academician, Mr. Cooper, undertook the laborious and formidable task of determining the position of all the stars in the neighbourhood of the ecliptic, to the twelfth magnitude inclusive. His Catalogue contains no fewer than 60,066 stars, of which by far the greater part have been determined for the first time. This gigantic undertaking was commenced in 1848, and has occupied nearly eight years. In that time upwards of 72,000 observations were made, including the two co-ordinates of right ascension and declination of the observed body; in other words, 9000 observations yearly. The Catalogue has been published by the aid of the Parliamentary grant of the Royal Society, and extends to four volumes; but Mr. Cooper has announced his intention of publishing a fifth, or supplementary volume, to complete the work.

I must, however, call your attention to a singularly interesting and remarkable circumstance, which was discovered during the progress of this undertaking. A large number of stars (as many, I believe, as seventy-seven) which had been previously observed, and their positions noted, were found to have disappeared. Of these, fifty had been catalogued by Mr. Cooper in the earlier years of the progress of his work, but, when sought for of late, are found wanting. The remainder are stars that were noted in the catalogues of foreign astronomers.

This remarkable fact of the disappearance of stars recently observed, has been fully confirmed by the labours of M. Chacornac, who has been engaged, simultaneously with Mr. Cooper, in forming a catalogue of ecliptic stars, and who has already published eighteen charts of their positions.

It is, of course, quite possible that some cases of supposed disappearance may be apparent only, arising from the errors of former observers, and some, perhaps, also by the discovery of small planets, belonging to the group between Mars and Jupiter, whose nature was not recognised at the time of observation, and which were mistaken for stars. But it is quite certain that by far the greater number are real disappearances, and can only be accounted for by an actual variability in the stellar systems, whether periodical or otherwise. The number of known *variable* stars—

stars whose brightness varies periodically,—has been greatly augmented since the attention of astronomers has been directed to stars of inferior magnitude; and it is not improbable that the stars which have disappeared belong to this class, and that they will consequently be found to *reappear* at some future time. But we cannot without great presumption conclude that all are of this class, and that all the stars now seemingly extinguished will reappear at distant intervals;—in other words, we cannot presume to assert that there are no permanent changes in the stellar system not compensated by opposite fluctuations; and if this be so, the observations published by Mr. Cooper, and others of a similar kind made by other astronomers, acquire an importance far beyond that belonging to their immediate object; opening up, in fact, a new field of astronomical inquiry, and new motives to diligence and accuracy in the arduous labour of mapping the stars.

I have said nothing of the manner in which Mr. Cooper's work has been performed, or of the excellence of the observations themselves. This is a point upon which none but practical astronomers can form a judgment. But we have the strongest external evidence, in the way of presumptive proof, that the observations are of the highest value for their accuracy and excellence; not only from the known scientific zeal and devotion of the accomplished director and proprietor of the Markree Observatory, the perfection of the costly instruments which his enlightened liberality has provided, but also from the high astronomical character and ability of Mr. Graham, his first assistant, under whose superintendence the observations were made. I may add also, that the instrument employed was the great Markree Equatorial, the eye-piece of which was furnished with a micrometer of a peculiar construction, devised by Mr. Graham; and that the same magnifying power was used throughout the whole series of observations.

II. The chief merit of Mr. Salmon's "Treatise on the Higher Plane Curves" is the clear and full exposition of all modern improvements in the methods of analytical research which it contains. The author does not profess to have made any new discoveries, or to suggest new methods of investigation, but he has done both; and this new matter is introduced with so little parade, or, I should rather say, generally without any notice at all, that it requires considerable knowledge of the subject to distinguish the discoveries of Aronhold, or Plücker, of Poncelet, or Joachimsthal, from the new and highly interesting propositions introduced whilst giving an account of the investigations of those authors, and connected with their researches, but due altogether to Mr. Salmon.

The method of investigating the properties of conic sections by reference to two tangents and the line joining their points of contact, and the analogous method applied to cubics of the third class; the application of the theory of determinants to the discovery of the properties of curves, particularly to finding the reciprocals of curves of the third and fourth degrees; the investigation of the focal properties of cubical biquadratic curves, and many other new properties of conics,—may be mentioned as original, the result of Mr. Salmon's genius and research. But,

however valuable and interesting these additions to what previous writers had discovered, the great practical value of the work is, that it arranges in a clear and connected system all the important geometrical discoveries hitherto published, so that, to use the author's own words, "each new student, who wishes to devote himself to original investigation in any branch of mathematics, may have his energies brought to bear upon the undiscovered part of the science." Such a student, with the aid of Mr. Salmon's book, without the labour of searching the scattered papers in scientific journals, or transactions of societies, will at once see what has been already done, and will escape the danger of wasting his abilities by rediscovering what others had discovered long before.

It would be premature to speak of Mr. Salmon's investigations in the geometry of three dimensions, as they have not as yet been fully given to the public; but we have already had a foretaste of what may be expected from him in this higher region of mathematical research, as he has already read to the Academy a valuable paper on the "Reciprocal of a Surface of the Second Degree," and he has contributed to different periodical journals most important investigations relative to the surface of the third degree: all of which, with many additions, we may look forward to in a collected form, in a third volume of his Geometry, devoted to the properties of surfaces.

III. It is now more than 200 years since Louis Cappel, who died in 1658, published his celebrated "Arcanum Punctationis Revelatum," in which he maintained that the Hebrew vowel-points and accents were no part of the inspired text of the Old Testament, but were to be regarded in the light of an uninspired commentary, added to the text at different times, and brought by degrees to perfection by the Masoretic doctors. Cappel was a Protestant minister, and Professor of Hebrew at Saumur, in France; and such was the opposition made to his opinions by his brethren, that he was forced to send his work to Holland, where the first edition appeared without his name, under the editorial care of the celebrated Erpenius. He was represented as in league with the Jesuits to undermine the authority of the Bible; his congregation repudiated him; he was deprived of his Professorship; and the magistrates of the town were called on to banish him from his home, as if he had been an offender against society.

It is well for Dr. Wall that he lives in better times. He has gone further than Louis Cappel ever dreamt of going; he has adopted all Louis Cappel's doctrines as to the modern origin of the vowel-points; and, instead of driving him from the University, or handing him over to the police, this learned Society meets together to-night, in presence of her Majesty's honoured representative, to confer upon him our highest literary distinction. Thus it is that learning and enlightened liberality ever go hand in hand. It was ignorance, rather than bigotry, that ignited the zeal of Cappel's persecutors. It is the advancement of learning that enables us now to do honour to the memory of Cappel, and to recognise in Dr. Wall one who has made a great further advance in the science of Biblical criticism. We see now that the question of the true inspiration of the Bible is not really affected by the discovery of Cappel, nor even

by that of Dr. Wall,—that, on the contrary, the removal of an error must always clear the way to the discovery and elucidation of the truth.

It is not easy to give a clear idea of the nature of Dr. Wall's theory to those who are unacquainted with the Oriental languages; but I shall venture, trusting to your indulgence, to make the attempt.

He maintains that when men first attempted to record their thoughts by writing, hieroglyphic pictures were naturally the first mode of doing so that occurred to them.

He asserts that the great defects and necessary obscurity of this method of writing, being inadequate to the fulfilment of the Divine purpose of giving to mankind a *written* revelation, not subject to the uncertainty of tradition, the Almighty was pleased to reveal to Moses the *principle* of alphabetic writing; and the Tables of the Law, written by the finger of God, were the first example of words expressed in writing by an alphabetic representation of their elementary sounds.

In this primitive revelation of alphabetic writing, it is to be borne in mind, that it was the *principle* only that was revealed. With that economy of miracle which characterizes God's dealings with man, the Almighty revealed to Moses, as Dr. Wall maintains, only this principle,—that, instead of pictorial objects to represent things, and arbitrary pictorial symbols to represent abstract ideas, the *sounds* of language might be analyzed into their elements, and writing made a representation, not of thoughts or objects, but of *sounds*.

According to this theory the alphabetic principle was not revealed in its perfection, but in its elementary idea; and men were left to work out that idea, and to perfect their alphabetic systems for themselves. I cannot stop to attempt any account of Dr. Wall's learned dissertations on the progress and defects of alphabets, and on the very curious subject of the ideagraphic system of writing still in use among the Chinese. I must hasten to the essential part of his theory, in its application to the Hebrew Bible.

He maintains that the Book of Job was first written in hieroglyphics, and was translated by Moses into alphabetic writing. He supports this opinion by most ingenious arguments, and shows that this hypothesis explains in a remarkable way the obscurity of style complained of in that sacred book.

He maintains that the letters of the Hebrew alphabet were originally the representatives of syllabic sounds, not of consonants or vowels; that the letter *b*, for instance, represented *ba, be, bi, bo, bu,* indifferently, according as the context required; there was nothing in the alphabetical character (ב) itself to determine which of these vowel sounds was to be connected with it.

Hence the ancient Orientals had no vowels among their alphabetic characters, and it was not until they became dead, or partially dead, languages, that the necessity of something more than a syllabic alphabet was felt. When the Jews returned from the Babylonish Captivity, where a new generation had been born, and had consequently forgotten, in a great degree, the language of their forefathers, a difficulty was found in the reading of their sacred writings.

At this period, therefore, *began* that more ancient vocalization which Dr. Wall has discovered in the Masoretic text of the Hebrew Bible. Cappel made the far easier discovery, that the points and accents could not be an original part of the orthography of the language; they bear on the very face of them evidences of gradual and of modern growth. We have the very Jews themselves confessing the fact. We find the Talmudic doctors ignorant of them, and making no mention of them, in places where they must have been mentioned, if the system in its full perfection, as extant now, were known to those writers. But Dr. Wall maintains, and he has supported his theory by most ingenious arguments, that there exist in the Hebrew text traces of a vocalization much more ancient than the points, aiming at supplying the defects of a syllabic alphabet by the insertion of vowel-letters, not actually vowels—for they are used also as consonants—but of a class of letters peculiar to the Shemitic languages, which grammarians, by a sort of anticipation of Dr. Wall's theory, have called *matres lectionis*. This older vocalization he believes to have been completed about the second century of our era; and consequently, like the points, to be no more than an uninspired commentary, of great value indeed, but still an uninspired commentary on the text. He believes this commentary to contain many errors, and to be susceptible of improvement, and he has thus opened to Biblical critics a new field of investigation for the emendation and correction of the text.

I am afraid that I cannot venture to enter more in detail into the explanation of Dr. Wall's theory; but I cannot help referring you to his comparison of the present Biblical Hebrew with the ancient Phœnician inscriptions, chap. vi. of his last volume, which is certainly one of the most curious and ingenious arguments he has adduced in favour of his theory of the ancient use of the *matres lectionis*, as vowel-letters.

I would also notice his very ingenious explanation of the feminine forms in the verb, which he accounts for by supposing that the ancient Hebrew pronoun had no gender; *he*, *she*, and *it*, having been denoted by the same sound, so that it was necessary to denote the sex of the speaker or agent by giving gender to the verb. And he shows that this observation enables us to clear up many apparent inconsistencies in our present text, and to explain many anomalies and mistakes in the Masoretic vocalization.

IV. Dr. Reeves, for his valuable edition of Adamnan's "Life of St. Columba," has been awarded a Medal in the department of Antiquities.

To estimate the value of the original work, it is necessary to remark that its author, St. Adamnan, flourished in the middle of the seventh century, and that the MS. from which Dr. Reeves has printed was written by a scribe, who is, in all probability, to be identified with the Dorbene who was Abbot of Hy for five months only, and whose death is recorded by our Annals on October 28, 713: and as Adamnan died in 704, it is not impossible that this valuable MS. (now at Schaffhausen, and formerly belonging to the Irish Monastery of Reichenau), may have been written before the death of Adamnan, and, perhaps, under his inspection.

This MS. is professedly the text from which Colgan's edition of the

life was printed; but there are so many arbitrary alterations, and such gross typographical errors in that edition—omissions frequently of whole sentences—that to Dr. Reeves belongs the honour of having, for the first time, given a correct and scholarlike edition of the text of this ancient and authentic work, retaining the curious orthography of the MS., which Colgan modernized; for in Colgan's time the importance of retaining these seeming inaccuracies of spelling was not understood; but we now know them, very much from Dr. Reeves's labours, to be of the greatest interest as being characteristic of the Latin MSS. written by Irish scribes, several of which exist in Continental libraries, and which are only now beginning to attract the attention of philologers. Dr. Reeves has given in his Preface a valuable table of these peculiarities, classifying them under two heads—interchange of vowels, and interchange of consonants—and has compared them also with similar peculiarities of orthography in the "Book of Armagh."

In the copious notes with which this edition of Adamnan is enriched, Dr. Reeves has collected a vast body of historical and antiquarian information, throwing great light on the constitution, manners, and customs of the Scotic or Irish Churches of the seventh and eighth centuries. He has also identified, for the first time, the names of a great number of places mentioned by Adamnan, which had previously been unknown, and were indeed frequently misprinted, and, in some cases, altogether omitted by former editors. It will be seen at once what a very important evidence of the authenticity of the work may be derived from this circumstance; as it would have been impossible for any person not living at the period, and on the spot, to have introduced so large a number of true topographical names, the greater part of which are now identified with existing (although obscure) places in the Scottish islands, to say nothing of the names of individuals and families which also may be identified, and their dates fixed, by references to our native Irish genealogies and Annals.

In the Appendix of Additional Notes, which occupies nearly half the volume, Dr. Reeves has given a number of most valuable dissertations on subjects requiring a more full illustration. One of these may be briefly noticed, although it is by no means the most important in antiquarian and historical value; but its subject may be more easily explained, and it refutes a curious and wide-spread error, which it is now, perhaps, hopeless to correct,—I allude to the name of the island Iona, the seat of St. Columba's most celebrated monastery. I have seen etymologies of that word by Scottish antiquaries, making it out to be a compound of I-ċonɑ, or "island of waves," and I remember exciting the wrath of an antiquarian friend in Scotland when I ventured, some years ago, to express my doubts of that etymology. It has also been, with at least equal absurdity, derived from the Hebrew *Iona*, a dove, and explained as an allusion to the name of its patron saint, Columba. The Gaelic etymology, *I-shona*, or "the happy island," has also been suggested; and all these puerilities are widely circulated down to the present day, in the tourist's guide-books, and in other works of higher pre-

tensions: but Dr. Reeves has shown that there is in reality no such word as *Iona*, and that the island never was so called in any ancient or authentic document. The fact is that the *n* is a mistake for a *u*, a circumstance that was unknown even to Ussher, and which is now, for the first time, established beyond the possibility of a doubt by Dr. Reeves. The proper name of the island, as it is found in all the ancient sculptured monuments there still extant, and in all authentic records, is I, or Hy—and I-[or Hy-]Columkille, the I, or island, of Columcille—and Dr. Reeves has further shown that Ioua is an adjective—the adjective formed from the proper name I, and that Adamnan has always used it in connexion with *insula*, "Ioua insula"—the island of I.

The change of *u* to *n* appears to have taken place in the fifteenth or beginning of the sixteenth century, and the error was favoured by the very slight distinction between the *u* and *n* in the black-letter writing of that period. The *n* occurs in the "Breviary of Aberdeen," printed in 1509–10; and it is found upon one tomb, and upon one only, in the island, which records the death of a Prioress of Hy, who died in 1549. It is remarkable that a similar error of *num* for *mun* occurs in the text of the *Te Deum*, which originated at the same period, the beginning of the sixteenth century; and it is curious that the present Churches of Rome and England agree in adopting the erroneous reading of *numerari* instead of *munerari*, so that the mistake has had a still wider circulation than that of Iona for Ioua.

I shall only just allude to another note which throws light upon the popular corruptions of ancient names, and gives some curious instances of the transformations of the name of Adamnan. By an aspiration of the *d* in this word the first syllable *Ad-* is pronounced, in many parts of Ireland and Scotland, like *Au, Eu, O, Ou*,—the *m* is also aspirated, and pronounced like *w*, or its sound altogether dropped. Hence in Sligo the saint is termed *Awnan* or *Aunan;* in Raphoe he is St. *Eunan;* in the county of Londonderry he is *Onan;* and we find the same form in the topographical name *Sy-onan* (Sessio Adamnani) in the county of Meath. In the parish of Aboyne, in Aberdeenshire, the final *t* of the word *saint* is added as the initial of his name; and Adamnan appears under the disguise of *Theunan;* and in other parts of Scotland we have *Teunan* and *Thennan;* and with a still further change, *Skewlan;* we find also the forms *Eonan* and *Fidamnan.*

These errors have led to serious confusions of history, and have misled some very high authorities. Thus, even Sir James Ware distinguishes between St. Adamnan and St. Eunan, making the latter the first Bishop of Raphoe—although there is no evidence from any ancient record of the existence of such a personage—nor was St. Adamnan ever a bishop. But, what is still more singular, the imaginary St. Eunan's day has been kept on the 7th of September, as the patron saint and Bishop of Raphoe, whilst the real St. Adamnan's day is the 23rd; and Dr. Reeves shows that one highly respectable writer divides the saint into three, giving St. Eunan at September 7th, St. Adamnan and St. Thennan at September 23.

Errors such as these may seem to some trivial, but it is impossible to overrate the importance of correcting them; they are corruptions at the very fountain-head of history; they lead to a confusion that propagates itself and generates other more serious errors. Important, however, as these corrections are, they are far from being any measure of the value and interest of Dr. Reeves's notes; I regret that time will not permit me to go into further particulars; but I must stop to call the attention of antiquaries to the note in which Dr. Reeves has given a list of the various articles which tradition represented as having been in the possession or in the use of St. Columba: the great Altar Cross, said to have been sent him by Pope Gregory the Great; the Cathach, which may be seen in our Museum; the Cochall or cowl of the saint; the Cuilebadh, or Cuilefaidh, probably his tunic; his Delg or brooch; his great Bachall, or pastoral staff; the Bachall he gave to St. Centigern when they exchanged croziers; the Gospels of St. Martin of Tours; the two Evangelistaria, called the "Book of Durrow," and the "Book of Kells," now in the Library of Trinity College, Dublin; the Misach, now in the possession of St. Columba's College; and many other similar relics,—bells, consecrated stones, and croziers, which were supposed to have been connected with his history. Some of these, as we know, still exist; and the great value of such an enumeration of them as Dr. Reeves has given, is, that it may possibly lead to the discovery, or identification of others of them, if they should still peradventure be found on the Continent, or in the possession of some obscure or private person.

Dr. Reeves is the author of several other publications of great interest to the Irish antiquary and historian. The able description of the Bell of St. Patrick and its shrine; the Visitation of Archbishop Colton, of the diocese of Derry; the "Ecclesiastical Antiquities of Down and Connor;" and we may shortly, I hope, expect from him the "Book of Armagh," with a valuable dissertation on its contents.

Having given you this short and very imperfect account of the grounds upon which the Council have awarded the Cunningham Medals on the present occasion, nothing now remains for me but the very grateful duty of presenting the Medals to the gentlemen who have so well deserved this high distinction. I regret, however, to say, that two of those gentlemen are unavoidably absent,—Mr. Cooper having been detained in London by his Parliamentary duties, and Dr. Wall being prevented from being present by his advanced age, and the inclemency of the weather. Mr. Cooper, however, has deputed his distinguished assistant, Mr. Graham, to represent him on this occasion; and I have requested Dr. Butcher, the Regius Professor of Divinity in the University, to receive the Medal for Dr. Wall, and to convey to him my regret that I could not have the pleasure of delivering it into his own hand.

The President then, having called forward Mr. Graham, said:—

"Mr. Graham, although every one here must lament the unavoidable absence of Mr. Cooper, there will, I think, be equal unanimity in feeling that no more worthy substitute for him could have been found than your-

self. To your exertions is due much of the merit of the work to which this Medal is awarded, and it is with great pleasure I deliver it into your hands. Mr. Cooper, in conjunction with another eminent Member of the Academy, has won for Ireland the proud distinction, that on her distant shores the zeal of two private individuals, out of their own private means, has done more for the advancement of practical astronomy than in other countries of Europe has been effected with the aid of Government patronage and public funds."

Mr. Graham then thanked the President for the allusion he had made to his own share in the work, for which this Medal had been awarded, and added :—

"I have been requested by Mr. Cooper to express his great regret that the very short adjournment of the House of Commons for Whitsuntide has prevented his attendance here this evening, to offer his personal thanks for the high honour conferred upon him.

"That regret is increased on account of the two facts that you, Mr. President, are connected with the county in which the labour has been performed that has elicited your approval, and that this meeting is honoured by the presence of the representative of her most Gracious Majesty.

"I am also desired to add, that Mr. Cooper has never considered himself more than a quarrier of stones or a hewer of wood for the scientific temple, but that he cannot deny that he has been anxious for, and received far beyond his deserts, encouragement in his pursuits from the master-builders of this eminent Academy."

The President then called upon Mr. Salmon, and said :—

"Mr. Salmon, I have to apologize to Mr. Cooper, and more especially to yourself, for the very imperfect account I have given to the Academy of your labours. But you know that for many years my studies have been directed to other subjects, and that I have given no portion of my time to practical astronomy, or to the higher branches of mathematics, in which you have so eminently distinguished yourself. Nevertheless, I retain enough of my former knowledge to appreciate very fully the merit of your works ; although I confess that, without the kind assistance I have received from two of our brother Fellows, I could not have given to the Academy even that very inadequate account of your and of Mr. Cooper's researches, for which I feel that I owe you this apology. Accept, however, this Medal as a mark of the high approval of the Academy ; and believe me, that it is no small gratification to myself personally to be the official medium of presenting it to you."

The President then called upon Dr. Butcher to receive the Medal awarded to Dr. Wall, and said :—

"Dr. Butcher, you, who are so well aware of the intimate friendship (and friendship is too cold a word), which exists between our venerable Vice-Provost and myself, will easily believe that the gratifica-

tion with which I ask you, on the part of the Academy, to deliver to him this Medal, is only alloyed by his own absence. It would have been a real pleasure to me, and I think I may say to every Member of the Academy, to have seen him receive it in person. It is not often that a man who has reached the scriptural limit of human life is called upon before a Society like this, to receive a Medal for his literary exertions; but it is still more rare, that a man, after having reached that advanced age, should have produced a work of great originality and acuteness,—a work of which it is not too much to say, that it opens up new fields of thought and of research to all students of Biblical criticism."

Dr. Butcher returned thanks on behalf of Dr. Wall, and promised to convey to him the President's message.

The President then called upon Dr. Reeves, and said:—

"I have no small pleasure, Dr. Reeves, in presenting to you this well merited reward of your labours. Accept it as a testimony from this Academy to the great value of your writings, not only from their intrinsic merit, and the additions they have made to our historical and antiquarian knowledge, but from the tone and style in which they are composed, which render them models to be imitated by all who would labour with profit to themselves and others in the same field of learning."

Dr. Reeves returned thanks.

A vote of thanks to the President for his Address was proposed by his Excellency the Lord Lieutenant, seconded by Sir William Rowan Hamilton, and passed unanimously.

The Academy then adjourned.

MONDAY, JUNE 14, 1858.

JAMES HENTHORN TODD, D. D., President, in the Chair.

HENRY J. BROWNRIGG, Esq., and the Ven. Frederick Goold, Archdeacon of Raphoe, were elected Members of the Academy.

WILLIAM DRENNAN, Esq., read the following paper—

ON AN ANCIENT INSCRIPTION SUPPOSED TO BE IN THE ETRUSCAN LANGUAGE.

DONALDSON, in his "Varronianus," pp. 126, 127, gives an inscription which he conceives to be Etruscan, in which the Pelasgian element preponderates; and he proceeds, in a note, to offer suggestions for explaining it upon that supposition. In consulting his work for etymological purposes, it struck me very forcibly that the words of this inscription,

with a slight change in the division of the letters, were Hellenic rather than either Pelasgian (which I believe to have been a comparatively barbarous dialect) or Etruscan. I proceeded to read them on that hypothesis, and they certainly seemed to me to afford a very probable and adequate solution of the enigma. I, therefore, requested permission, and obtained it, to mention my conjecture to the Academy, and I was in hopes that it might have excited some interest, both from 'this interesting fragment,' as Donaldson terms it, not having been attempted to be explained up to 1844, the date of the "Varronianus;" and also from the new view, as it seemed to me, which it tended to open up respecting the very great antiquity of the Hellenic or Epic form of the Greek language. For the inscription is on a vase, which was dug out of a tomb at Cervetri, the ancient Cære or Agylla; and the tombs there are supposed by Italian *literati* and architects, according to Mrs. Hamilton Gray, in her "Sepulchres of Ancient Etruria," to be *above* 3000 years old.

They are found to contain articles of such magnificence and taste as induce the belief that centuries must be conceived to have rolled away ere a people could have attained such a height of civilization. Indeed, this view would pretty well settle the claims of the Latin language, or even of most of its elements (contrary to the received opinion of scholars), to be considered as older than the Greek. It is curious that Donaldson appears to labour under a suspicion that some of these inscriptions called Pelasgian or Etruscan are "almost Greek," "nearly akin to Greek," and "little else than archaic Greek," and, yet, that he did not attempt to explain this particular one as Greek.

His explanation, indeed, is merely of the words *singly*, and he says that the interpretation of the whole must be mere guess-work. After such an assertion from a scholar of his reputation, I proceed to offer an interpretation with considerable diffidence, and chiefly in the hope that some member of the Academy, better qualified than I have any pretensions to be, may enter on what may prove a most interesting inquiry. I have not seen a *fac-simile* of this inscription, which, unfortunately, is not mentioned in Mrs. Gray's work; but, judging by the specimens of those which she has given, it must have run without intervals between the letters or words, from right to left.

I propose to read it thus, as Greek, for greater convenience, in the more modern form of letters and direction:—

MI NIKE ΘΥΜΑ MI ΜΑΘΥ ΜΑΡΑΜ ΛΙΣΙΑ ΙΘΙ ΠΥΡΕΝΑΙ
ΕΘΕΕΡΑ ΙΣΙΕ ΕΠΑΝΑ MI ΝΕΘΥ ΝΑΣΤΑΝ ΗΕΛΕΦΝ.

Or, as I interpret it, in a more common form:—

Μι Νικη· θυμα μοι, μαθυ, μηρον, λυσει ιθι πορηναι·
Ετερᾳ, εσσι ηπανα, μοι νεθυ, ναστον, αλειφα.

"I am Victory; go provide for me incense, wine, flesh, for expiation.
Or you are needy; for me, water, barley-cake, oil."

I remark on the words singly.

Mi.—I agree with Donaldson, = εσμι, or in old inscriptions εμι = ειμι.

Niké.—I find in an epigram of Simonides that *Nikō* was the name of a woman in his day. It applies particularly happily in this case, as in the same tomb were found the gold ornaments of a *female*, supposed to be a *warrior queen.*

Thuma requires no remark, except that strong perfumes were found in these Etrurian tombs.

Mi.—This *mi*, and those following, I look upon as *moi*, or Lat. *mihi*, contracted *mī*. Donaldson acknowledges a difference of quantity from the first *mi.*

Mathu.—Doric form of μεθυ.

Maram seems doubtful. I have supposed it to mean μηρον, or thigh.

Lisia is conjectural. I supposed it might mean λισσω, *I entreat;* but λυσει, for sacrifice or expiation, seems as probable.

Ithi porenai.—Go provide. Neither *o* nor *ω* occurs in these inscriptions: its place is supplied by *υ* generally; occasionally by *a.* The form of *porenai* seems poetic, like φορηναι in Homer for φορειν. It may be read *purenai* for *pureuein*, or *burn;* but a word applicable to all the nouns seems preferable.

Etera (ο-δῳ understood), *otherwise.* The ε possibly of the inscription doubled by mistake.

Isie of the inscription I suppose to be εις, or εσσι, its Doric form.

Epana.—An old form of the word, not now occurring as an adjective; σπανιος and πενης, other forms; but ηπανια occurs, though rare.

Nethu.—An old word for water. It were hard to say how it became obsolete in Greek. It remains in νησσα, νηττα, *a duck* (or water-fowl), and several other words, and Donaldson says is the origin of the water-god Neptunus; in older form *Nethuns.* This root remains in German, *nass* (wet), and Dutch and Flemish *nat* (meaning either water or wet).

Naston.—Barley-cake. Perhaps it might be read in the genitive νασστου, τι or ολιγον understood.

Aleipha is rather an Ionic than a Doric or Epic form; the *h* merely marks a difference of pronunciation. See Thiersch, Gr. Grammar, p. 45, that the rough breathing has been dropped from many Greek words in later times.

To conclude—I do not pretend to defend every word of the above interpretation; it must be remembered that *bad spelling* is not uncommon in such early inscriptions, and allowances made accordingly. It is sufficient for me if on the whole it presents a probable meaning, and if it should furnish the slightest clue to other inscriptions I shall be amply rewarded for any little pains which this one may have cost me.

Donaldson furnished me with the three words,—the first *mi*, *mathu*, and *nethu.* The lines seem to be *verse;* but I have not attempted here to scan them. I would give Donaldson's explanation, if it did not require to be explained.

Mr. Wilde made the following communication—

ON THE ANCIENT AND MODERN RACES OF OXEN IN IRELAND.

I feel quite certain that any subject connected, no matter how remotely, with the great cattle interest of Ireland—a question always of the highest social concern, and never more so than at the present moment—will be listened to with patience by an assembly so constituted as the Royal Irish Academy. Neither the geologist nor palæontologist have sufficiently explored the earth's surface in this country to enable me to state, from any printed documents to which I have had access, the amount, nature, and distribution of the ancient Fauna of Ireland; but although the book of nature has not been investigated to the extent to which, no doubt, it is capable, our historic records—decidedly the oldest and, I think I may add, the most authentic in any living language in Europe—afford ample materials for drawing up some account of the ancient animals of this country. It has been stated by Professor Owen, chiefly upon the authority of the Earl of Enniskillen, that the remains of bovine animals have been found in the sub-turbary shell-marl in various localities in Ireland, and there is a belief current among naturalists that such remains have been found associated with those of *Cervus megaceros Hibernicus*—our great fossil elk.

It is quite possible that the remains of oxen have been found in clay formations and fresh-water drifts in Ireland; but I have been so long accustomed, in investigating another branch of science, to receive with caution the accounts of collectors, that I should like to have something more explicit and topographical written upon the subject than that of—"various localities." There is, however, every reason to believe that the ox existed contemporaneously with the first inhabitation of the country, and from thence to the present day it has largely contributed to the wealth of this kindom. In the very earliest times man must have been to a large extent a flesh and a fish-eating animal; and in Ireland the primitive inhabitants not only fed upon the flesh of oxen, but were clothed in their skins, formed weapons (pins and fasteners) out of their bones, used their sinews and intestines for strings, and employed different parts of these animals in ministering to clothing and decorative arts. And now, after a lapse of two thousand years at least, we find the Irishman, notwithstanding the fearful losses of the famine period—one of the most direful calamities that ever befell a people—still able to elevate his country in the social scale, to increase his own personal wealth, and to assist in supporting the sister kingdom—by his cattle.

From the earliest period to which our Annals refer we find notices of horned cattle. Thus, we read in the Book of Lecan, that in the reign of Findoll, long anterior to the Christian era, every calf born at a particular period had a white spot on its forehead. A multitude of places are called after cattle—such as Inis Bofin, the island of the white cow; Lough Bofin, the lake of the white cow; Drum-shanbo, the ridge of

the old cow; Dun-bo, the fort of the cow; Agha-bo, the cow-field or plain; Bally-bo, cow-town; Daimh-inis, Ox Island, now Devenish, in Lough Erne; Bo-dhun, or Bawn, a cow fortress or enclosure; Dun-na-mbo, a great cattle fort of stone, in Erris; Cluain-da-damh, the pasturage of the two oxen, in the county of Galway. Other places are called after calves, and some after bulls—as Cluan-dá-tarbh, the enclosure of the two bulls, now Clontarf, near the city of Dublin; and Eden-na-Tarve, in the county of Down. The glen of the heifer, Glen-Samhaisce, in Dalaradia, is one of the oldest local names in Ireland. Legends without number upon the subject of "cow lore," as we might call it, float among the peasantry in every part of Ireland; and stories relating to horned cattle, bulls, cows, and calves, are intimately interwoven with Irish fairy mythology, and become interesting to the archæologist from their topographical references. Many of our popular superstitions, and much of our folk-lore, more particularly concerning the merry month of May, abound in reference to cows and oxen. Cattle raids and forays afforded fruitful themes for the early metrical romance writers and compilers of what is termed Ossianic poetry, the most remarkable production of which is the Táin bó Cuailgne, or great cattle raid of Louth—the "Niebelungen Lied" of Irish history. From all these sources I might cull numerous anecdotes to amuse, if such were the object of this communication. Even the celebrated abduction of Dervorgil partakes, when we come to examine it by the light of modern investigation, more of the nature of a black-mail foray, for abducting cows and bullocks from the plains of Brefny and the slopes of Shemore, than a romance or love passage between an Irish chieftainess, aged 44, and Dermot Mac Murrough, then in his sixty-second year, and, if we can rely upon contemporaneous historians, not remarkable for his amiability of character. Cattle formed not only, in early times, the chief wealth and produce of the country, but were also employed as a means of barter. Thus we read of ransoms being paid with oxen, and as many as 140 milch cows being given for a manuscript. Quantities of the butter and cheese of remote periods have been dug out of our bogs (upon which subject I have already made a communication to the Academy), and many specimens of bog-butter may now be seen in our Museum. In the Leabhar na g-Ceart, or "Book of the Rights and Privileges of the Kings of Erin," cattle are frequently mentioned as being derived from those localities, such, for example, as Rathcroghan and Moylurg in Roscommon, parts of Limerick and Tipperary, the plains of Meath and Westmeath, &c., &c., which are to this day celebrated for producing the best stock in Ireland. As an example of the amount of cattle existing in Ireland in the fifth century, I may cite the following among the tributes paid to the King of Cashel alone, from distinct and separate localities, most of which can be identified at the present day:—"Cows at the time of calving; cows that enrich the farmer's dairy; cows frisking and skipping; cows not like those of ravens, lean or dying; brown oxen; strong oxen; oxen to supply the ploughing," &c., amounting in all to about nine thousand head of cattle. From our collected "Annals" by the Four Masters,

we may learn what was the abundance of cattle at all periods in Ireland, from the numbers said to have been carried off by the chieftains or petty kings in their unceasing wars upon each other, as well as by the destruction of our herds and flocks by invading armies. That oxen ranged wild in some part of the country in very early times, I have long since shown, from the curious zoological poem concerning Cailte Mac Ronan, the foster-brother of Fin M'Coul, who, being required by King Cormack to ransom that chieftain, by producing upon the green of Tara a pair of each animal in Ireland, brought two wild oxen from the district of Burren, in Clare. But at a very early period the Irish domesticated their oxen, and yoked them in the plough.

"In our Brehon Laws, H. 2, 15, p. 40, col. *b*," writes Dr. O'Donovan to me, "the measurement of a cow is given:" in girth "xx dopn—twenty hands, or 6 feet 8 inches; from which it would appear to me that the size was smaller than that of our present cow. You will find from the fragments of those Laws, given in Vallancey's Collectanea, vol. iii., that the milch cow was valued at twenty-four screpalls; a three-year old heifer, twelve screpalls; a *calpach*, or two-year old, six or eight screpalls; a *dart*, four *screpalls;* a *dartaid*, two *screpalls*."

Our annals and histories also abound with records of epizootics from a period anterior to the Christian era, down to the recent great pestilence of pleuro-pneumonia which ravaged the flocks of this country, in common with those of the rest of Europe. Their history is exceedingly interesting, as constituting symptoms of those great epidemic constitutions which come upon particular parts at almost regular periods, but which only attract attention when they occur in our own times. As, however, I have recently published an extended history of these epizootics in a Parliamentary Report ("The Census of Ireland for 1851," Part v., vol. i.), I need not do more than allude to the subject here.

The relics of our ancient oxen are not only abundant and interesting to the naturalist, but are exceedingly curious in an historical point of view, as they afford undeniable evidence that, so far back as the eighth or tenth century at the latest, we had in Ireland a breed of cattle which, for beauty of head and shortness of horn, might vie with some of the best modern improved races, so much admired by stockmasters, and which are now being re-introduced from England. I here beg to observe that this communication is not intended as a purely zoological or anatomical paper. I am not going to discuss the mooted question of species and variety; and I am well aware of the great difficulties attending the classification of domestic animals, which have not only been derived accidentally from two or three varieties, but among which great and successful efforts have been made by man to alter their physical characters for his own purposes by what is called breeding—a subject of very great importance in the present day. But breeders and cattle-fanciers, as well as naturalists, have adopted a particular nomenclature, well adapted for expressing their meaning; when, therefore, in the following description I speak of breeds or races of cattle, I am not to be understood as meaning anything more than the varieties of a variety.

According to the most authentic authorities, Cuvier, Herman von Meyer, and Owen, four great types of oxen existed in Europe in early times—first, the *Bos priscus*, or Urus, the great Auroch which the Roman armies found in the primeval forests of Germany and Belgium, and of which a few specimens still remain in the imperial preserves of Lithuania—the chief modern representative of which is the bison. It was a creature with long horns rising above the head, a narrow forehead, high frontal crest, projecting orbits, and a warm shaggy coat. The stuffed specimens I have examined in the museums of Vienna and Frankfort were of a reddish brown-colour, and of great size. The second is the *Bos primigenus* of Boganus, which was also found by the Romans among the fastnesses and entangled forests of uncultivated Europe—with long slightly curved horns, set on at right angles with the head, but turning forwards at the extremities, and spreading to a breadth of nearly five feet from tip to tip; and of which beast it is conjectured the present race of horned cattle in Europe spring. Some degenerate descendants still exist in Sicily; but the Cape buffalo affords the best specimens of the long-horned species. A third extinct ox, described and named *Bos trochocerus* by Meyer, had a very narrow head, and long cylindrical horn-cores rising high above the level of the back of the occiput, and then curving forwards and inwards. All these three have been found in diluvial deposits—the last, however, only in Germany. The fourth, which is almost peculiar to Ireland, has been denominated *Bos longifrons* (the long-fronted or small fossil ox), somewhat of a misnomer, it must be confessed, became, properly speaking, it should be denominated *Bos latifrons*, from the exceeding breadth of forehead and face, in which particular it differs in an especial manner from either of the three former. It is the type of the present short-horn, and the first specimen recorded came from this country long before the present century. "A frontlet and horn-core of this species," says Professor Owen, in his beautiful work upon British Fossil Mammals and Birds, "formed part of the original collection of John Hunter, in the manuscript catalogue of which collection it was recorded as having been obtained from a bog in Ireland." I had entered it in the catalogue of the Museum of the College of Surgeons in 1830, under the name of *Bos brachyceros*, on account of its peculiarly short horns; and, after the imposition of that name upon a living African species, to *Bos longifrons*, under which the remains of this interesting species or variety were described in my "Report on British Fossil Mammalia." In 1839 Dr. Ball, our late Treasurer, brought the subject of the remains of oxen found in bogs in Ireland before the Academy; but the few lines which I find upon the subject in the "Proceedings" has in no wise elucidated the matter or assisted my researches. The animal he described was evidently the small fossil ox of Hunter. He also in 1844 noticed the circumstance in the third volume of the "Transactions of the Geological Society of Dublin," but does not say where or how the specimens were found.

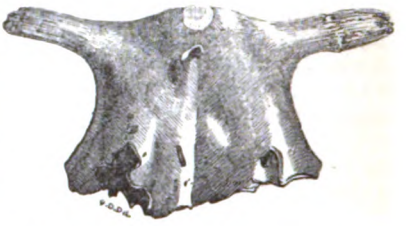
It will be in the recollection of some of the senior members of the

Academy that in the year 1840 I presented to the Museum, and described in the "Proceedings," a large quantity of animal remains which had been discovered in the great crannoge of Lagore, near Dunshaughlin, county of Meath—the first of those curious marsh or lake-fortresses which have been discovered during the last twenty years. The most remarkable, as well as the most numerous, specimens amongst that vast collection, amounting to hundreds of cart-loads, were the remains of horned cattle. With these were found the largest, the most varied, and I think I am justified in saying, the most valuable, collection of antiquities, viewed from an ethnological point of view, which has ever been found in Ireland, of which a large number now adorn our Museum, and serve to fix the range of date of that crannoge and its osseous contents, viz., from A. D. 848 to 933. Since then many other crannoges have been brought to light during the progress of the arterial drainage in different parts of the country, as set forth in the "Catalogue of the Antiquities of Vegetable Material." From these localities, as well as in deep cuttings also made for the same purpose, and in peat bogs, particularly in the counties of Roscommon, Westmeath, Tyrone, Longford, and Fermanagh; from Loughgur, in the county of Limerick; and in the artificial embankments, as well as in some of the subterranean passages of ancient raths—other specimens of bovine remains have been deposited in the Museum by the Board of Works, and by private donors. Several of the specimens which I described in 1840 were subsequently figured in Mr. and Mrs. Hall's beautiful work on Ireland. I have selected twenty heads of ancient oxen belonging to the Academy's and my own collections, and arranged them in four rows, each row characteristic of a peculiar race or breed, viz., the straight-horned, the curved or middle-horned, the short-horned, and the hornless, or maol, all of which existed in Ireland in the early period to which I have already alluded. Can we now identify any of those old heads with those belonging to our native races of the present century? Before that question is discussed it is necessary to say something on the subject of the native cattle of Ireland, ere they became replaced or altered by the old Ayrshires or Durhams, or the more recent improved breeds introduced by Bakewell, Colling, and others.

According to my own observations, we possessed four native breeds about twenty-five years ago. First, the old Irish cow, of small stature, long in the back, and with moderate-sized, wide-spreading, slightly elevated, and projecting horns: they could scarcely be called long-horned, and they certainly were not short-horned. This breed was of all colours, but principally black and red. They were famous milkers, easily fed, extraordinarily gentle, requiring little care, and were, in truth, the poor man's cow,—the "ould Irish stock," the true *Drimin dhu Dheelish;* but they did not easily fatten, and when beyond a certain age seldom put up flesh. They abounded in all parts of the plain country. Second, the Kerry, which is somewhat more of a middle horn. In its native state it is usually much smaller than the former; in colour it is either red,

brindled, or black; it is exceedingly hardy; its milk is abundant and rich, and it possesses the additional advantage of rapidly fattening upon very moderate fare when brought from its native mountains into the plains and fertile country. This race have small heads, and rather short horns, turning upwards. They are very docile, although Fynes Moryson, writing in the times of Elizabeth, and Thomas Dineley, in those of Charles II., describe them as exceedingly ungentle, and "as wicked and rebellious as the people." Several possess many of the finest points belonging to the modern short-horns, and are in some respects superior as a stock, owing to their fattening as well as their milking qualities. Their beef is also most excellent. As was recently stated by his Excellency Lord Eglinton, "they are the thoroughbreds of cattle." Their chief localities are at present the mountains of the Kerry and Cork; but it is more than probable that in former times the race existed in all the regions of Ireland. It was said that during hard winters the people of Kerry thatched their cattle by means of mats tied on their backs. Droves of small Kerries are driven by jobbers over the whole country every year, and may sometimes be seen perambulating the streets of Dublin. Third, the Irish long-horns, similar to, but not identical with, the Lancashire and Craven; for while many of the race had wide-spreading horns, only slightly curved, the great majority of the Irish turned so completely inwards that they either crossed in front of or behind the mouth, or pressed so much inwards towards the cheek as to become a source of great irritation to the animal, and to require amputation. They were generally a red or brindled colour; had large bones, grew to a great size, particularly as bullocks, and their drooping horns, sloping gracefully under the chin, gave them a particularly calm expression of face. They were covered with a plentiful supply of hair, which protected them from the inclemency of the weather. This, together with the peculiarity of their constitutions, rendered them an exceedingly hardy race of cattle, never requiring winter fodder, except when the ground was covered with snow. They were not much used as milkers, but were the principal cattle sent to the Dublin market or exported to England thirty years ago. Their hides were of great value, being, when tanned, at least half an inch thick, and I have reason to believe that it was these hides which gained for the Irish leather so much celebrity both at home and abroad in former times. This breed principally abounded on the plains of Roscommon, and might justly be termed the Connaught ox. Fortunes were made in former times, chiefly out of these cattle, which would scarcely be credited at the present day. They grew, as I already stated, to a great size; but they took four or five years to come to perfection. Compared with some of the short-horned races, they possessed, I might almost say, an immunity from disease; they were very docile, and made good ploughers and cart oxen. I have heard it stated that this breed was imported from England about seventy years ago; but among the great collection of bones found at Dunshaughlin I discovered specimens of this race, although smaller than my old com-

panions in the west, thus proving that they existed here in what may be termed our middle ages. The skull and horn-core of one of those which I figured in Hall's "Ireland" many years ago is here represented. There is also a portion of the frontal bone and horn-core of this long-horned breed, found in a bog in the county of Limerick, now in the Museum of Trinity College. Were one to strip the skull of one of these animals of its horn-cores, it would, from the narrow forehead and projecting crest, resemble in a most remarkable manner the cranium of the maol, or hornless breed. I regret to say that the race is nearly extinct; the only possessor of any that I now know is Lord De Freyne, who has still a stock at Frenchpark, and lately exhibited a pair at the Royal Dublin Society's Cattle Show. They have been replaced upon the plains of Ratheroghan and Moylurg by the modern imported and much prized short-horn—a beast with a thin silky skin, short fine hair, and which comes to perfection, and consequently gives a return to the breeder or feeder, in one-half the time in which the old long-horns did. But it cannot be denied that it is of a comparatively delicate constitution, and must, from the physical circumstances which I have mentioned, be more liable to disease than its hardy, slow-growing, thick-skinned, easily fed predecessor.



I know it will be considered a heresy, and probably presumptuous of me, to offer any opinion upon this subject; but I would propound this question to the grazier, and also to the political economist:—Taking the slow growth, but great size, strong hide, little care required with, and comparative immunity from disease of this long-horned stock on the one side; and, upon the other, the great original first cost, the rapid growth to saleable perfection, and also the quick, but perhaps unwholesome, and certainly unnaturally induced powers of reproduction, together with the great susceptibility of fattening, the thin hide, the winter care, both of housing and provender it required, and the very great susceptibility of disease, both sporadic and epidemic,—and then strike the balance, and I am not sure that it would not turn in favour of our native stock. Certain I am that the beef would be more wholesome. Fashion, however, may have had its influence in this matter. But we need not wonder at £250 being given for a yearling calf, when twenty guineas was but very lately considered a moderate price for a Cochin cock during the epidemic of the 'fowl fever,' which raged so extensively in Great Britain and Ireland.

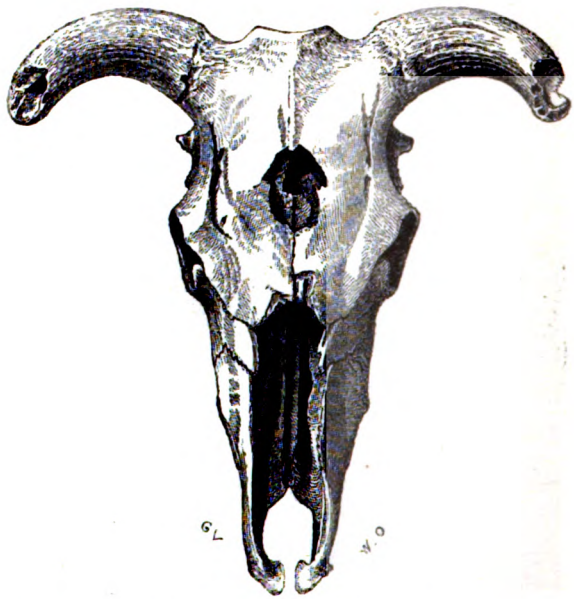
The fourth is the Maol or Moyle, the polled, or hornless breed, similar to the Angus of the neighbouring kingdom, called Myleen in Connaught, Mael in Munster, and Mwool in Ulster. In size they were inferior to the foregoing, although larger than the Kerry, or even the old

crooked horned Irish, but were comparatively few in number. In colour they were either dun, black, or white, but very rarely mottled. They were not bad milkers, were remarkably docile, and were consequently much used for draught and ploughing. Of the four examples of the crania of neat cattle which I have now placed before you, the most beautiful is the straight-horned,—broad in the face, flat on the forehead, nearly level between the horns, with but slight projecting orbits, short, thick slugs or horn-cores, rising but little above the occipital crest, and turning slightly inwards like some of the best short-horned bulls of

the present day. It is eighteen inches long in the face, and nineteen from tip to tip of horn-core. This was found at Dunshaughlin, and is evidently a domesticated descendant of the ancient wild *Bos longifrons*. It is a cranium of surpassing beauty, and resembles in the most remarkable manner the ox-heads carved upon the friezes of Grecian temples,—somewhat conical in the face, with short, straight horns, very broad at the base, and not more than eight or ten inches long, having force, dignity, and mildness expressed in even the dead bone. Were we to wreathe this head with a garland of flowers, we would have before us a perfect example of those taurine embellishments sculptured upon the metopes of the Parthenon during the best days of Athenian architecture. This animal would appear to have been the creature used in sacrifice by the early Greeks, and also by the Hebrews, and other sacrificing nations. We have no specimen of this native race

now existing in Ireland. The four other heads placed beside it are evidently those of cows of the same breed, but slightly differing one from another, probably as the result of domestication. Most of the heads found in crannoges have been broken in the centre of the forehead by some blunt instrument, and a few were evidently perforated by bronze celts, such as those now in the Museum.

The second breed (for I fear calling it a variety, lest I might offend the naturalists) would appear to be the most numerous, and is the curved horned. This magnificent head of a bull of this race (in second row)

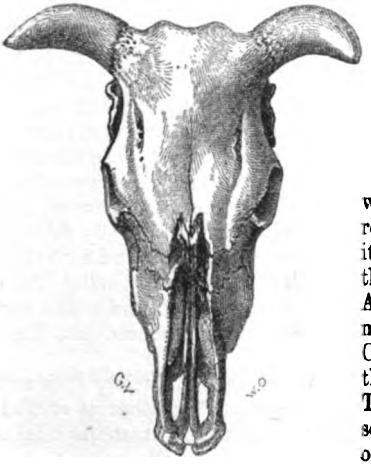


is, in point of size, one of the finest specimens of ancient oxen found in the British Isles: it is 23½ inches long and 8 inches across the forehead, which has been broken in by some blunt instrument, probably in slaughtering. The horn-cores are not so large at the base, but more than twice as long as those of the straight-horned race; they are curved considerably inwards, so that the tips of the horns, when perfect, must have approached much nearer than their bases; each horn-core was, when perfect, about eleven inches long, measured upon its upper curvature. This head, together with most of the others of its class, came from Loughgur, county of Limerick. The horns did not spread so wide or rise so high as those of the modern Kerry.

The third set of heads here arranged were undeniably short-horns, and of a very peculiar class: they are characterized by long, narrow

faces, and exceedingly small short-horn cores, curving abruptly inwards, somewhat like the Alderneys of the present day. I have not found a head of what might be considered a bull of this race, but one of the best of the cow's heads presents the following measurement:—Seventeen inches in length of face, six across the forehead, and eleven from tip to tip of horn-core. This beautiful race was abundant in former times; but I am not aware of its having had a representative in Ireland for the last hundred years at least. An intermixture of this race with the broad-faced straight-horned would give, in my opinion, a breed with which even the most fastidious of our cattle-fanciers could not find fault.

These two cuts afford good illustrations of this race:—



The last is the Maol, or hornless, which differs so little from its living representative of the present day that it is unnecessary to describe it. From the five specimens placed before the Academy, it is evident that it was much smaller than the modern breed. One head differs from another only in the amount of the occipital projection. The average length of the face is about seventeen inches, and eight across the orbits.

As the nomenclature of the naturalist will not assist me in the classification of those different breeds, I must call them by their Irish terms of *Dron-adharcach*, the straight-horned; *Crom-adharcach*, the stooped or curved horned (hence the words 'crommie' and 'crumpled horn' applied to those cattle both in England and Ireland); *Gearr-adharcach*, the short-horned; and *Maol*, the hornless. Thus far, you see, I have only been able to identify two of our ancient stock in modern times with the ancient remains. But now comes the question with which I set out,—From whence came the original short-horns; were they indigenous in England, or introduced prior to the days of Colling, and other great breeders of that class? That they existed in Holland, in great numbers, long before they became fashionable in England, can be proved from Dutch pictures antecedent to the days of Cuyp or Paul Potter. But, centuries prior to the date of these Flemish paintings or English cattle-breeders, we possessed in Ireland quantities of these much coveted and highly prized breeds of long and short-horned cattle, while no other country in Europe has published any account of such animals existing in times contemporaneous

with those I have described. It is true that some specimens of the *Bos longifrons* have been discovered in fresh-water drifts in England; and Owen conjectures that it was the domesticated species in the British Isles anterior to the Roman invasion. But, acknowledging this, it still leaves Ireland the principal habitat of that race, and, so far as our investigations have as yet gone, the sole habitant of the ancient short-horns.

Let me add the following useful observations of my friend Mr. Barnes, of Moynalty, to whom the Royal Agricultural Improvement Society of Ireland awarded a medal for his essay on the best breeds of horned cattle adapted to this country:—"For feeding on a large scale in our rich low pastures, the best breed for Ireland is the short-horned and the cross from the short-horned; where food is abundant, and care and attention can be bestowed, they are suited to the small as well as the large farmer. . . . . For hilly countries and inclement climates there is no breed of cattle comparable to the West Highland; and where that breed was established I would recommend, where practicable, that it should be crossed with the short-horn; but not with the intention that in such situations the West Highland should be increased by this cross breed: the produce of the cross should be sent forward to the rich pastures to feed. In the other hilly districts, where our native breeds are general, the West Highland bull should be introduced to improve them. By following this system we would establish breeds of cattle in Ireland suited to all situations in the island,—breeds which the most convincing trials have proved must answer all our purposes, and never can disappoint our expectations. The West Highlands are now being introduced into Connemara."

It is greatly to be regretted that the Royal Dublin Society does not possess a perfect collection of the heads of neat cattle, either as stuffed specimens or simple osteological examples, from which amateurs might learn how to distinguish those breeds which are annually exhibited at their great and yearly improving agricultural Cattle Shows,—the best evidence of the increasing prosperity of the country, even though it be a return in a large extent to its original, and, as I believe, its normal condition—that of a great grazing and cattle-feeding country, to which both its soil and climate so amply conduce. I have often spoken to members of the Dublin Society on this subject, and I feel that this allusion to it now will be received in the kindly spirit in which it is intended by those who have the management of the new Museum, and by the able Curator, my friend Dr. Carte.

In a strictly antiquarian sense, the propriety of retaining in our Museum unmanufactured animal remains might be questioned; but, regarding the Academy's collection in an ethnological point of view, it has been considered advisable to keep some of these zoological specimens as illustrations of the associations by which man was connected or surrounded in early times, the more particularly as most of them have been found along with some remains of the former inhabitants of this country. Should, however, the Academy think well of presenting the Royal Dublin

Society with a portion of its collection, I shall be happy to increase that donation with specimens from my own collection.

In conclusion, allow me to read an extract from a letter written by Dr. Johnson, in the year 1777, to our distinguished countryman, Charles O'Conor, of Belanagare:—"If you could give a history, though imperfect, of the Irish nation from the introduction of Christianity to the date of the invasion from England, you would amplify knowledge with new views and new objects. Set about it, therefore, if you can; do what you can easily do without anxious exactness. Lay the foundation, and leave the superstructure to posterity." If I have in the foregoing communication elicited inquiry, or laid a foundation for others to build upon, I shall have accomplished the task which I proposed to myself, and, I hope, interested a meeting composed of gentlemen who have always evinced an anxious desire to forward the best objects of Ireland.

Denis Crofton, Esq., read a paper on a Collation of the MS. of the Bhagavad Gitâ, in the Library of Trinity College, Dublin.

Dr. Apjohn read a communication from Lieutenant Renny, R.E., on the Constants of Barometric Formula.

Rev. J. H. Jellett made some remarks on Mr. Renny's paper.

W. R. Wilde, Esq., presented a bronze celt, on the part of Dr. O'Meara, of Carlow; and also, from William Smith O'Brien, Esq., a wooden stake and part of a cow's horn found under a great depth of bog on the summit of a mountain near Cahirmoyle. The stake was supposed by Mr. O'Brien, as explained in his note, to have formed a "portion of an ancient fence, which has been covered for many centuries with bog. Eleven or twelve feet of turf have been cut from the mass of bog under which it was found. Mr. O'Brien conceives that it is an interesting relic, as it proves clearly that at a very distant period of time the inhabitants of this country possessed sharp-edged tools, which were capable of clearing timber as perfectly as it could now be cut by the best modern hatchet. It also proves that land which at present is of no value except for turf was formerly used for pasturage, and enclosed for that purpose, though it lies in the vicinity of some of the richest land in Ireland. From this circumstance Mr. O'Brien infers that in these early times the county of Limerick was highly peopled; since, if the population were scanty, they would not have taken the trouble to enclose land which, from its position, never could have been of good quality. Mr. O'Brien also at the same time placed at the disposal of the Academy a horn which was found in the same locality, under the same layer of turf. Mr. O'Brien possesses other specimens of these stakes, and he has been told that cart-loads have, at different times, been found by the peasantry when cutting the turf in the same locality."

The thanks of the Academy were voted to the respective donors.

The Academy then adjourned.

MONDAY, JUNE 28, 1858.

JAMES HENTHORN TODD, D. D., President, in the Chair.

DR. LYONS, on the part of the Commission appointed by the Council on March 1st, presented and made some remarks on—

THE REPORT ON THE CASE OF M. GROUX.

THE case of M. Groux, on which we have been instructed to report by the President and Council of the Royal Irish Academy, is an example of bifid sternum, or congenital fissure of that bone, a condition noticed by Meckel, Breschet, Serres, and Geoffrey St. Hilaire. By the two last investigators it has been specially instanced in support of the doctrine of osseous development being conducted in conformity with the laws of "bilateral symmetry," and central conjunction. This bifid sternum, like the bifid spine and the remaining examples of the symmetric category of Serres, depends on the arrest of growth.

When M. Groux's arms are not extended, and the pectoral muscles are relaxed, this depression is an inch in width when measured at the termination of the third rib. The integuments pass into and across this groove, and present no alteration of structure or adhesion; they can be pinched up and drawn outwards in a fold without any indication of the existence of a dense fascia or expansion beneath; into this groove the hollow at the lower portion of the neck is continued, uninterrupted by any bounding osseous line or inter-clavicular ligament; the sternal ends of the clavicles are small; the sternal portions of the sterno-mastoid muscles are not deficient, nor are their sternal tendons, which are inserted into the edges of the bone immediately beneath each clavicle. The groove is closed transversely, and at the lower part by the ensiform cartilage, which is flat, broad, very firm, and overlapped on each side by the sternal ridges, with which it is connected by a strong but elastic medium. This is rendered very evident when M. Groux raises or throws back his arms, or when, having fixed the latter, he puts the pectoral muscles, which are well developed, into strong action: the fissure then becomes expanded to a width of nearly three inches. When, on the contrary, the shoulders are brought forward, the fissure becomes nearly closed, and the clavicles touch and even overlap each other.

Before proceeding to describe the most remarkable feature in this case, namely, the existence of a visibly pulsating tumour in the upper and middle parts of this fissure, we have to observe that there is no evidence, either from symptoms or physical signs, of the existence of any diseased condition of the heart, the great vessels, or the lungs. There is no visible pulsation in the veins of the neck. But a question might arise, namely, whether the organs of circulation might not themselves present some form of congenital malformation or malposition. On this point we have come to the conclusion that evidence of any of these conditions which might be expected in such a case—namely, defect of me-

sial union—does not exist. There is nothing to lead us to suspect that any malformation by defect exists in the heart.

When the subject is in a state of quiescence, the following phenomena can be observed on inspection and examination of the sternal fissure:—

1st. The existence of a pulsating tumour, of an elongated oval shape, of about two inches in length; it crosses the mesial line obliquely, so as to show about two-thirds of its volume to the left.

2nd. The pulsation of this tumour, though plainly visible at a distance, is by no means forcible. It has not the strength of the systole of a healthy heart, nor yet the force of the beat of an aneurism; and it does not convey the sensation of proceeding from a cavity with thick or solid walls.

3rd. The collapse of this tumour is much more sudden than its protrusion. It appears to be second in point of time.

4th. This collapse or disappearance of the tumour is, however, effected with a progressive movement from above downwards. This is rendered obvious by the observer placing three fingers lightly on the pulsating mass. Their successive elevation shows the course of the movements as above stated.

5th. This pulsation was ascertained to be not synchronous with the beat of the apex of the heart, but to precede it by a slight though appreciable interval of time.

6th. The diastolic movement seems to take place in a direction from the left and behind, forwards and to the right.

7th. On applying the finger lightly over this tumour, the pulsation is observed to be single.

8th. On more deep and forcible pressure backwards and slightly to the left side, a double stroke is felt.

9th. On deep pressure backwards in the upper part of the fissure, a distinctly double pulsation can be perceived.

10th. This second pulsation, we submit, is that of the arch of the aorta, of the innominata, or of both.

11th. This pulsation (that of the arch of the aorta) follows, by the shortest appreciable interval, upon that of the heart's apex.

12th. It is also consecutive, but by a more prolonged and sensible interval, to the pulsation of the oval-shaped tumour.

13th. The order of succession of the phenomena here described is well displayed and confirmed by the application of the sphygmoscope.

14th. The heart was examined with the stethoscope in the usual situation, and presented the ordinary first and second sounds, quite devoid of any abnormal character in tone or rhythm.

15th. Auscultation over the seat of the aorta gave the two sounds peculiarly well defined, the second in particular being remarkably clear in this situation.

16th. In no part of the cardiac region, or in the line of the great vessels, was any murmur or other abnormal sign discoverable.

17th. Occasionally the second sound lost its usual definite and single character, and assumed a complex character, approximating to reduplication, and containing at least two elements of sound. This was observed towards the close of the examination, when M. Groux was somewhat fatigued.

The pulsations of the oval tumour were examined with great care, and with the following results:—

At our first examination, when we used an ordinary stethoscope, we were not able to discover any *special* single sound, attending the diastole of the tumour. The ordinary double sounds of the heart were heard, without any departure from their normal character, except that the first sound had a slightly muffled character.

But on our second examination we came to the following conclusions:—

When an observation was made with the flexible stethoscope of M. Groux, the bell being simply placed in apposition with the tumour, and pressure being, as far as possible, avoided, a single sound was evident. This single sound was replaced by a double sound on making even a slight degree of pressure, but its distinctly single character could be reproduced at pleasure by removing the pressure.

Under these circumstances, taking the three points or centres of sound in the fissure, from above downwards, or from below upwards, they might be enumerated as follows:—

Double sound, Single sound, Double sound,	corresponding to	Aorta. Left auricle. Right ventricle.

The succession in point of time is, as before stated, as follows:—

Tumour.
Ventricle.
Aorta.

There is a peculiarity belonging to this sound (of the oval tumour) which, without offering any explanation of it, we think it right to record:—

The first impression it gives is that of a single, complete, and instantaneous sound, somewhat analogous to that observed in aneurisms with a single beat. But, on more careful and delicate analysis of its characters it is found not to be instantaneous, but to rise progressively, though still in the shortest possible interval of time, from a minimum to a maximum, conveying the idea that its cause is a vermicular rather than an instantaneous or perfectly sudden action. This character is found most evident in the very uppermost part of the tumour.

It was observed that the character of this sound (sound of tumour) was not constant: it seemed to have certain periods of a maximum intensity, and again of a minimum; there was a certain relation not easily determinable to the inspiratory or expiratory efforts. A peculiar whiff was occasionally observable, but under what precise conditions did not admit of being defined.

We have studied the enlarged condition of the oval tumour produced by M. Groux, after deep inspiration, followed by suspension of further respiratory effort. It has appeared to us, under this condition, to reach at least three times its ordinary volume: and this circumstance, were there no other, furnishes a strong argument in favour of the opinion that the tumour in question is the right auricle. In the distended state the pulsation becomes feeble, irregular, and fluttering, and apparently more rapid.

18th. By certain respiratory efforts M. Groux can arrest the radical pulse in both wrists.

19th. There is a peculiar condition of the heart's action induced in M. Groux by certain respiratory efforts, which is worthy of notice, though not bearing upon the main question upon which we have been appointed to report. It is the production of a strong pulsation at the left side, and referrible to the body of the heart. To induce this, M. Groux makes use of the following succession of actions. He takes a very deep inspiration, and then, by a long regulated expiratory effort, expels the air from his lungs as far as it appears possible to carry this process. Towards the close of this expiratory effort the pulsation of the heart is felt with great force, and with a kind of struggling motion, in the third, fourth, and fifth intercostal spaces, between the left border of the sternum and a line passing vertically through the left nipple. During this time the stethoscope, placed on the anterior part of the right side of the chest, seemed to indicate a period of apnœa, while a loud muscular murmur, apparently referrible to the action of the intercostals, was heard.

If it be assumed that in this case there is no abnormal condition of the heart or great vessels, we may inquire what is the actual nature of the pulsating tumour.

The possible causes of a pulsation in the sternal region may be enumerated as follows:—

I. The pulsation of the base of the heart itself, and principally of that of the right ventricle.

II. The pulsation of the pulmonary artery.

III. The pulsation of the aorta.

IV. The action of the right auricle.

Against the first hypothesis there is to be urged:—

a. The want of synchronism between this pulsation (that of oval tumour) and the impulse in the left infra-mammary region.

b. The singleness of the pulsation.

c. The direction of the action of the tumour, which is from above downwards.

The following considerations lead us to reject the second supposition:—

1. That this pulsation precedes the stroke of the heart.
2. That it is single, and from above downwards.

3. That a double pulsation or action may be felt on deep pressure over the tumour.

4. That when M. Groux suspends his respiration, the tumour acquires a volume far beyond what could be supposed to be attainable by the pulmonary artery, even at its origin.

By a similar process of investigation we conclude that it is not produced by the diastole of the aorta. This conclusion is strengthened by the observation that, on making pressure in the inter-clavicular space, the pulsations of the aorta can be felt giving the usual phenomena,—the sphygmoscope also showing the want of synchronism between the beat of the tumour and that of the aorta, the fissure preceding the latter by a distinct interval.

We hence conclude that this remarkable pulsation can be only that of the right auricle. Its general character and appearances coincide remarkably with those which belong to the auricular actions as seen in vivisections; and all its phenomena are explicable on this hypothesis. For the sake of clearness we shall here recapitulate the reasons which lead us to conclude that the oval body is the right auricle.

1st. Its situation, which is neither that of the base of the ventricles nor the arch of the aorta.

2nd. The progressive, or, as it were, vermicular action of the pulsation.

3rd. Its singleness of sound.

4th. The sensation which it conveys of being a cavity with thin walls.

5th. Its remarkable enlargement when respiration is suspended.

6th. Its precedence of the ventricular impulse.

ROBERT HARRISON.
ROBERT LAW.
WILLIAM STOKES.
ROBERT D. LYONS.

Dr. Law said, that, as a member of a profession peculiarly interested in the advancement of the science of Physiology, he felt that he ought to express his obligations to the Academy for the readiness with which it had acceded to the suggestion of appointing a Commission to inquire into the case of M. Groux, which presented so favourable an opportunity of investigating some of the most important phenomena of the circulation and the heart's action. In the conduct of the Academy on this occasion Dr. Law recognised an admission that Physiology had its place amongst those sciences that it was intended to promote, and that it was not its fault that communications upon so important and interesting a science were so rare in the Academy, but rather reflected on those members from whom such communications might have been expected. Dr. Law observed that Physiology was the basis of medicine as a science; that we acquired our knowledge of it by observation and experiment on living animals. Observation taught us the phenomena which bodies

present immediately to our senses, while experiment discovered to us their mode of existence under circumstances contrived by art,—not the result of natural necessity, but the act of one desirous of extending his knowledge. While we observe, we, as it were, watch Nature; when we experiment, we question her. Dr. Law remarked that nature or accident sometimes provided us with experiments on man, whose results were infinitely more satisfactory and more to be relied on than those deduced from the experiments, even the most artfully contrived, when made on inferior animals; that in the latter case the results were only applicable to human physiology when the animals experimented upon stood in very close zoological relation to man; and, therefore, the analogy could never be so complete as when nature or accident made man the subject of experiment. And, again, the sufferings of the animal the subject of experiment often so modified and affected the phenomena, that they could not be regarded as such as Nature would exhibit under less painful influences. M. Groux' case was one of those in which nature afforded us a facility of both seeing and hearing the actions of the heart more plainly than could be done under ordinary circumstances, when the walls of the chest were normally developed. A similar case to that of M. Groux occurred in a female in France, and who suffered as little inconvenience from it as M. Groux seemed to do. There was in her case, as in M. Groux', a deficiency in the sternum, which allowed the heart's action to be seen. She was beyond the age of thirty when she was the subject of observation. She was then in good health, actively engaged in laborious occupations, and had borne children. Dr. Law instanced, as an example of accident in the human subject supplying a most favourable opportunity of extending our physiological knowledge, the case of St. Martin, with whose history every physician was familiar. This man received a gun-shot wound which penetrated the chest and abdomen, wounding both the left lung and the stomach. He ultimately recovered, with a fistulous opening of the stomach, which communicated externally. Luckily for science, he became the servant of a physician, Dr. Beaumont, who knew how to avail himself of this precious opportunity of investigating the actions of the stomach, and of observing the relative digestibility of different substances which constitute our ordinary food, which he did by withdrawing them at various intervals of time, and seeing the time each required for its complete digestion. Dr. Beaumont's observations made on St. Martin furnish us with the fullest information we possess on the process of digestion. Dr. Law urged, as an additional ground of preference for those natural and accidental experiments on the human subject, the reluctance of the British physician to experiment on inferior animals, except when impelled by imperious necessity,—a plea for which necessity, he felt, was only justifiable when these experiments held out a fair prospect of being directly instrumental to the attainment of a knowledge beneficial to mankind, and which could not be attained in any less objectionable way. The British physician participated in the sentiment of the distinguished Haller, who, when he would justify his experiments on animals, observes:—"Multa ipse peri-

cula feci, invisâ certe mihi crudelitate usus quam tamen utilitas humani generis et necessitas perinde excusant." Dr. Law, as a member of the Commission, hardly felt himself justified in entering into a discussion on the Report, which would necessarily involve technicalities scarcely suited to such a meeting, but would content himself by observing, that its chief topics were amongst some of the most interesting of physiology, and which had been proposed as subjects for investigation by the British Association, viz., "the sounds and motions of the heart." As Dr. Law had been a member of the Commission appointed by the British Association, it afforded him great satisfaction to find in the phenomena exhibited in M. Groux' case a confirmation of those results which had been deduced from the experiments then made, and had constituted the material of the Report. While Dr. Law subscribed to the Report on M. Groux' case, he had no difficulty in understanding why others should not do so. Discrepancies in observations when the senses of sight and hearing are simultaneously engaged, or even separately employed, seem not confined to physiology or medicine: astronomical observations exhibit similar discrepancies. Dr. Law felt that the interest evinced by the Academy towards the Report, and towards the few observations made upon it, would encourage future communications of the same nature.

Dr. Benson said he wished to make a few remarks in connexion with the subject of the Report, of which an abstract had just been read. He was not a member of the Committee, but he had been appointed, with Professors Jacob and Power, by the Council of the Surgical Society of Ireland to examine into the case of M. Groux, and report upon it. This Report he and his colleagues had made at a meeting of the Society, held in the College of Surgeons, on the 13th of March, and which was printed in the "Dublin Medical Press" of the 31st March. He (Dr. Benson) was very well pleased with the result of his investigations. They did not, indeed, bring to light anything very novel, nor establish any new facts; but they did what was better—they confirmed the opinions generally entertained respecting the actions and sounds of the heart. The opinions to which he alluded were those published by a Committee of the British Association after its first Meeting in Dublin, and founded upon experiments then made. He agreed with the authors of the Report, just now read, that the large, prominent, pulsating tumour in the fissure of M. Groux' sternum is the right auricle. It swells out suddenly as the concurrent effect of three causes:—1st, the influx of blood from the cavæ; 2nd, the reflux of blood from the right ventricle, or, at all events, the wave pushed back by the tricuspid valves; and, 3rd, the distention of the pulmonary artery behind it. He thought it very strange that distinguished men in London had differed so much as to the name to be given to this tumour,—one calling it the aorta, others the right ventricle,—while it seemed most obvious that the aorta could be felt (not seen) pulsating higher up, and the ventricle could be felt (not seen) pulsating lower down, all in the same fissure. M. Groux told him (Dr. Benson) that all the medical men who examined him in

Dublin agreed that the central prominent part above mentioned was the left auricle, which quite coincided with his (M.Groux') own conviction. Dr. Lyons mentioned that Dr. Corrigan, a distinguished member of his Committee, had not signed the Report, not agreeing with the other members upon a point connected with the pulsation in that auricle. He (Dr. Benson) was inclined to think Dr. Corrigan's opinion was the correct one; but he would request Dr. Lyons to state that opinion again, as he was not sure that he had collected it accurately from the very short abstract of the Report read.

[Dr. Lyons explained.]

Dr. Benson resumed, and said that the opinions of the gentlemen who examined the case with him were very much divided. Two sounds were certainly heard when the stethoscope was pressed firmly back upon what he believed to be the origin of the pulmonary artery. All subscribed to that. But when the instrument was placed lightly on the auricle, sometimes one sound was heard, sometimes two, and sometimes none. One heard a splashing sound, another a rubbing, and so on. There was no agreement as to the number or character of the sounds; and, for his own part, he rather thought there was no sound, strictly speaking, produced in the auricle. The sounds which he sometimes heard might have depended on the friction of the skin against the instrument, or by the ripple caused by pressure, or they may have been conducted by the auricle from neighbouring parts.

He added, it was a curious fact that the sounds of the heart were better heard in most other individuals than in M. Groux: the sternum formed a kind of sounding-board, which rendered the sounds more audible in others; but the advantage in M. Groux's case was that they were more defined and localized.

Dr. Henry Kennedy said he had arrived at the conclusion that the tumour seen in the centre of the fissure could be none other than the right auricle, or a portion of it. He founded his opinion mainly on the anatomy of the heart itself; for no other cavity of the organ would admit of the same great and rapid dilatation which was seen when M. Groux pleased to render it prominent; but, besides what the sight took cognizance of, there was also sensible, to a gentle pressure, a very peculiar vermicular motion; and the auricle would exactly be, from its structure, the kind of cavity which would generate such a movement. From these arguments he felt satisfied that the central tumour was caused by the right auricle, and the phenomena present appeared to him to admit of no other explanation. He begged to state further his impression that in M. Groux's case the right heart was, most probably, above the natural size. Any one who had seen him exhibit could easily understand how this would be brought about. It was well known, too, that the pearl-divers were all short-lived, and this was due directly to affections of the right heart. In the present instance his opinion was founded on the very great distances which existed between the three centres of pulsation.

It was proposed by W. R. Wilde, Esq., and seconded by Geo. Petrie, LL. D., and passed unanimously,—

That the Report of the Commission be received by the Academy; and that the thanks of the Academy be given to the members of the Commission.

Sir W. R. Hamilton, LL. D., read a paper on a "New Method of Transformation of certain Diverging Series, with an Application to a Series connected with a celebrated definite Integral, which has important Physical Significations."

The Rev. Professor Haughton made the following communication respecting—

NICOTINE CONSIDERED AS AN ANTIDOTE TO STRYCHNIA.

Having recalled to the recollection of the Academy the experiments he had communicated 29th November, 1856, on the poisoning of frogs by nicotine and strychnia, and the mutual counteraction of those poisons: Professor Haughton said he believed the subject to be an important one, as the action of the antidote depended on its physiological, and not on its chemical properties. After reading that paper, he had, in conjunction with Dr. H. Head, performed some experiments on dogs with those poisons, in January, 1857, but as they had not succeeded in recovering the animals from strychnia poisoning—in consequence of the nicotine acting as a powerful emetic, thus saving the animal's life, merely by emptying its stomach, as any other less dangerous emetic would have done—he had not published the results.

Quite recently, however, Mr. Haughton's experiments had proved to be the means of saving a human life, as was shown by the following case, published in the "Medical Times and Gazette" of the 12th inst.

"*Attempted Suicide with Strychnia; Treatment with Nicotine; Recovery.*—By Thomas O'Reilly, M. D., M. R. C. S., Eng.—On Thursday, September 10, 1857, at 1 o'clock P.M., I was urgently requested by Dr. Byrne to accompany him to see a Mr. Johnson in this city (St. Louis, Missouri, U. S.), who, he was informed, had taken poison. On arrival at his residence we learned the following history to account for his condition:—

"After a three years' cruise as a musician on board an United States frigate, he was paid off in New York, and for the amount purchased drafts on St. Louis, which on his arrival here were found to be worthless. This, together with recent domestic sorrows, so overwhelmed him, that he determined on self-destruction. To accomplish this end, he called on a respectable druggist, and demanded a large dose of poison for a dog. The druggist gave him six grains of strychnia, which he carried into an adjoining beer-house, and, playfully remarking to the bar-tender that he was going on his last spree, mixed the strychnia with beer, and drank it off. Soon repenting this rash act, he mentioned to those present that he had taken poison, and wished they would give

him an emetic. One was procured, which vomited him freely, but notwithstanding, violent symptoms set in, and we were called on to see him.

"On entering his room, we found him stretched on his back, his countenance expressive of the most painful suffering and distress, his frame shaken by frequent convulsive spasms, his limbs rigidly extended, and his head slightly bent backwards. His face was of a livid red, and covered with a profuse sweat; his eyes were sunken, and moved with a rapid motion; his mouth was covered with saliva, which he ejected by spasmodic jerks, strongly reminding me of a case of hydrophobia which I had seen some time before. His respiration was quick and difficult, and attended with great pain in the precordial region; skin warm, and covered with a profuse clammy sweat, and he had copious watery discharges from his bowels. His intellect was clear and collected, and his feelings were so morbidly acute that the slightest touch appeared to aggravate his sufferings, and to bring on a spasm. On this account we could not correctly ascertain the state of his pulse.

"Ignorant of any antidote likely to relieve him, and pressed by the urgency of the case, Dr. Byrne, acting on the suggestion of Mr. Haughton's paper (read before a meeting of the Royal Irish Academy, Nov. 29, 1856), took a cigar from a gentleman present, and infused it in half a pint of water.

"One hour and fifteen minutes after he had taken the poison, we gave him the first dose of the tobacco infusion, which he swallowed with difficulty. We continued it in table-spoonful doses at intervals of five minutes, until he had taken half the quantity infused, before we had noticed a favourable change. Then the muscles became relaxed, the spasms less severe, and the intervals between them longer; and so conscious was the patient of relief, that he constantly called for the tobacco juice when he found the paroxysm approaching. This encouraged us to persevere with the infusion, prolonging the intervals between each dose, as the frequency of the spasms abated; until, finally, after twelve hours, they disappeared, leaving him in a state of fearful nervous prostration, from which he recovered in a few days, under a careful tonic treatment.

"In the quantity of infusion administered, we used one ounce and two drachms of dry tobacco leaves, including the cigar—a quantity which no healthy condition of system could stand; but the urgency of this case demanded it, and the result justified it, and at the same time afforded us another illustration of the counteracting influence of poisons, and tended in some way to establish the correctness of the conclusions at which the Rev. Mr. Haughton had arrived by his experiments.

"From a single instance like this, I should be far from recommending nicotine as an antidote; but I trust that the publication of the case may attract the attention of others, who will test the subject with due care, and give the result of their experience to the world.

"*St. Louis, Missouri, United States.*"

Mr. Haughton then made the following statement to the Academy:—The success of the antidote suggested by me for strychnia poisoning in

this case induces me to publish some of my experiments of January, 1857, in the hope that the subject may be taken up by some person more competent than myself to do it justice.

No. I.—*Strychnia and Nicotine.*

SMALL CURLY DOG.

	Minutes.
1. Administered one grain of strychnia in a small piece of meat,	0
2. Slight spasm and twitching of extensors,	15
3. Gave 0·6 grain of nicotine in bread,	17
4. Hind-legs rigid, but dog lively,	19
5. Fell in tetanic spasms, characteristic of strychnia,	21
6. Gave five drops = three grains nicotine, into mouth,	22
Death nearly instantaneous, rigidity of muscles quite gone.	
7. Quite dead, bladder voided,	26
Pupils greatly dilated.	

Post-mortem.

1. Lungs pale and collapsed.
2. Heart greatly engorged.
3. Blood coagulates naturally.
4. Stomach natural.

The meat was scarcely acted upon, although the dog had fasted for twenty-four hours; to all appearance, the greater part ($\frac{9}{10}$ths) of the strychnia remained not acted upon by the juices of the stomach in the cavity of the small piece of meat in which it had been originally placed. It is evident that this dog died of an over-dose of the nicotine, administered as an antidote.

No. II.—*Strychnia alone.*

SMALL BLACK TERRIER.

	Minutes.
1. Administered 1 gr. strychnia, in meat,	0
2. Slight twitching of extensors,	13
3. Dog staggered on attempting to move,	60
4. Slight rigidity of extensors, and partial loss of power of volition,	62
5. Panting and restless,	65
6. Fell over in tetanic convulsions,	71
Violent convulsions over whole body, with marked opisthotonos, particularly in the neck; quick breathing and panting in the intervals of the convulsions; continued in this state for one minute, and recovered.	
7. Fell over again, as before,	154
8. Voided bladder, and died,	177
Muscles not rigid after death.	

Dr. Head and I examined the liver, kidneys, blood, and a small quantity of urine remaining in the bladder, for strychnia, with very doubtful success; in fact, although I am of opinion that we found strychnia in the liver, I should be very sorry to assert it positively, as we found the colour tests very doubtful in the presence of cholesterine, which behaves somewhat like salecine.

No. III.—*Nicotine and Strychnia.*

LARGE WHITE DOG.

	Minutes.
1. Gave 0·6 gr. nicotine, in bread,	0
2. Slight loss of power in hind-legs,	11
3. Gave, additional, 0·4 gr. nicotine,	13
4. Vomited,	23
5. Gave 1 gr. nicotine, in solution,	33
6. Began to turn round, with spasm and twitching of hind-legs,	45
7. Gave 2 grs. strychnia,	55
8. Fell in tetanic convulsion,	89
9. Dead (not very rigid),	101

In this case the animal died of the strychnia administered as an antidote to the nicotine, proving that in this case 2 grs. of strychnia more than counteracted 2 grs. of nicotine.

No. IV.—*Nicotine alone.*

SMALL WHITE DOG.

	Minutes.
1. Gave 0·6 gr. nicotine, in bread, He immediately began to turn round and round; this was followed by loss of power in the limbs, and great dilatation of the pupils.	0
2. Likely to recover,	71
3. Gave 1·8 gr. nicotine,	72
4. Quite dead,	74

Immediately on swallowing the last dose of nicotine, he turned round as before, exhibited convulsive twitchings in his hind-legs, uttered a peculiar squeak, and then barked; this was followed by immediate death.

No. V.—*Muriate of Strychnia.*

LARGE WHITE TERRIER BITCH (VICIOUS).

	Minutes.
1. Gave 1 gr. muriate of strychnia, in butter,	0
2. Dead, with tetanic convulsion,	40

No. VI.—*Muriate of Strychnia and Nicotine (simultaneous).*

SMALL CURLY BLACK DOG.

	Minutes.
1. Gave 1 gr. muriate of strychnia, 1·5 gr. nicotine, in gelatine capsule, in butter, ...	0
2. Vomited dose, ...	10

Recovered, and did not seem injured.

No. VII.—*Strychnia only.*

SKYE TERRIER.

	Minutes.
1. Gave 1¼ gr. muriate of strychnia, in butter, . . .	0
2. Twitching and slight rigidity of extensors, ...	20
3. First tetanic convulsion, ...	30
4. Dead; bladder voided, ...	63

I do not make any remarks on the preceding, although they suggest several points of much interest; I prefer simply adding them to the stock of facts already accumulated on the subject.

Dr. Edward Bewley suggested the possibility that other sedative poisons might act as antidotes also, their action on the nervous system being antagonistic to that of strychnia; and he gave his reasons for making the suggestion by relating an accidental experiment which the late Dr. Boxwell, of Abbeyleix, and he made, some thirty years ago, when strychnia was first introduced into this country. They wished to put a speedy end to the existence of a mangy cur; and, as Dr. Bewley had just read Magendie's "Report upon Strychnia," in which he says that "the sixteenth of a grain will kill the *largest* dog," he determined to make sure work of his *very little* animal, and accordingly administered what was supposed to be half a grain, or more. Either Magendie had made a false statement, or the drug was adulterated; for, at the end of ten minutes, the dog was not dead. He was bent backwards in a bow, and seemed to suffer so much from tetanic convulsions that it was resolved to put him out of pain at once. Dr. Bewley mixed at least half a drachm of medicinal prussic acid of the shops with a little milk, in a saucer, and managed to thrust it under the patient's snout. He lapped the milk with avidity, and in less than a minute discharged his stomach, got upon his legs, ran away, and recovered!

Dr. John Aldridge remarked that Mr. Haughton's proposal involved the introduction of a new principle in toxicological science, hitherto overlooked, namely, the employment of a physiological, not a mere chemical, antidote; the object being, not as heretofore, simply to render the poison inert, but to neutralize the poisoning.

W. R. Wilde, Esq., presented the following donations to the Library and Museum:—

On the part of the Marquis of Kildare, a copy of his recently published work, "The Earls of Kildare and their Ancestors;" Dublin, 1858.

On the part of Dr. Bewley, a copy of "The Vital Statistics of the United States," by James Wynne, M.D.; New York, 1857.

From John Purser, Esq., a copy of "Doomsday Book."

From the Rev. C. P. Meehan, C. C., a shale celt, found near a cromlech in the townland of Corcahan, parish of Kilmore, and county of Monaghan (No. 513).

From the Rev. Edward Clarke, of Lifford, a stone effigy of a bishop, 9 inches high (No. 31), and also a perforated oval stone of greenstone porphyry (No. 128), similar in shape to those oval tool-stones described in the Catalogue of the Stone Materials in the Museum, at p. 94. Both these objects were said to have been procured in the county of Donegal; but their history is unknown, as they were purchased from an itinerant collector.

On the part of Dr. Kelly, of Mullingar, a cubical stone, $2\frac{3}{4}$ inches in diameter, and marked No. 129 in continuation of the printed Catalogue. It is indented on two of its sides, like No. 121 among the sink-stones in the Museum, described at page 98 of the Catalogue. It was found in an ancient rath in the county of Westmeath. Also, a fine flint spear-head (No. 1276), of a white colour, 4 inches long, but wanting about an inch of the top. It was found resting on the gravel, ten peats deep, in the bog of Curraghmore, near Mullingar, county of Westmeath.

On the part of Charles Haliday, Esq., two slender gold armlets, weighing 14 dwts. 12 grs., a portion of the great "Clare Find," of which the Academy is already in possession of the finest specimens. See "Minute-book of Committee of Antiquities."

From Arthur A. Nugent, Esq., and Mr. Richard Murray, of Mullingar, two imperfect human crania, and the long bones of two skeletons, together with a rude urn, found in a tumulus in the townland of Barrettstown, parish of Dysart, near Lough Ennel, now called Belvedere Lake, in the neighbourhood of Mullingar, county of Westmeath. Mr. Wilde stated that these remains had been exhibited to the Ethnological Section of the British Association, at the Dublin Meeting in 1857, and that, having recently visited the locality where they were discovered, he had drawn up the following abstract:—

"The parish of Dysart borders Lough Ennel on the western side, and contains several ancient raths, as well as some curious subterranean chambers and passages, formed of uncemented masonry, and of great antiquity. It is likewise memorable in history from containing the great rath or fortress of *Dun na Sgeath*, or Fort of the Shields, the seat of Malachy II. The tumulus in which these remains were found presented a small oval nipple upon the rise of some sloping ground in place called Carawn, the property of Mr. Nugent, to whom the Academy is already indebted for several donations. The surrounding mould and some cart-loads of small stones having been removed from the surface of the heap, two large flags, laid horizontally,

were exposed, each about 3 feet 6 inches in length, 2 feet 6 inches in breadth, and 4 inches thick; one of these is said to have shown marks of fire, and on it were found some remnants of charcoal. Underneath these were found two small chambers, lying east and west, divided by an upright flag, and floored with stones similar to those on top. The largest of these chambers, which was of a pentagonal form, was but 2 feet 3 inches deep, and about 3 feet 6 inches in its greatest diagonal. Both chambers, but particularly the western, were nearly filled with 'an umber-coloured, fine flour-like mould, evidently the deposition of ages, from the surrounding mound, which forced its way through the chinks of the kistvaen.' Each contained a human skeleton, a sufficient number of the bones composing which were collected to lead to the belief that when interred they were quite perfect; but in what position the bodies were placed, or whether they were denuded of the flesh before interment, were questions which the furnished accounts do not enable us to determine. It is greatly to be regretted that when excavations are about to be made into ancient tumuli, the assistance of persons already conversant with such matters is not sought, and sketches are not made of the precise position of the remains when first discovered. Fortunately, Dr. Kelly, of Mullingar, visited the spot very shortly after the discovery, and furnished 'The Westmeath Guardian' of the 6th and 20th of August, 1857, with all the particulars attending the excavation.

"The eastern chamber contained portions of the skeleton of a middle-aged man, with fragments of a skull of a globular form, with a high frontal development, and light thin bone plates, similar to that found in a stone-chamber at Dunamase, now in the Academy's collection, and which I described in the Proceedings, vol. iv., p. 35, in 1848, and to which I then assigned the name of *Tuatha da Danaan*, in contradistinction to the long-headed, low-foreheaded *Firbolg* race found in the tumulus in the Phœnix Park. The teeth throughout the whole dental series, both above and below, have their crowns so much worn down as not only to obliterate the tubercles, but to hollow out the bony portion so deep as to leave in some teeth nothing but a hollow surface, with a thin shell of enamel all round it. This peculiarity in the very earliest of the Irish skulls I have long since called attention to, and believe it to be produced by the trituration of hard grain food, such as parched corn. Coexisting with such formation, we find a stout jaw-bone, with a well-developed prominent chin process. None of the teeth in either of these skeletons, nor, indeed, in any ancient Irish crania which I have examined, exhibit any signs of decay. The only other object found in this chamber was a large boar's tusk.

"All the bones which we have received of both skeletons,—consisting of those of the head already described, the long bones of the legs and arms of one, and those of the arms of another skeleton,—are exceedingly light and friable, and evidently do not contain as much animal matter as those found in the Phœnix Park tumulus.

"The western chamber contained a skeleton in somewhat better preservation, and with it the remains of the skull of one of the long-headed

or Firbolg race, evidently belonging to a younger individual, who was probably about 5 feet 10 inches high. The lower jaw is lighter and narrower, with the chin not so prominent or well developed as in the globular headed race.

"In this chamber, between the leg bones, was placed the cinerary urn herewith presented to the Academy. It is of the very rudest form, and of reddish unglazed pottery, more pyramidal than globular in its form, $4\frac{1}{4}$ inches high, $5\frac{1}{4}$ inches wide at the top, and standing on a base $2\frac{1}{2}$ inches across. It is much thicker than the better class of vessels of this class in our collection, and its ornamentation is of the very rudest description, consisting of a few scratches and indentations. It is now numbered 46 in the addition to the collection of such vessels already enumerated in the printed Catalogue. It did not contain any incinerated bones, but was said to be found filled with the fine clay which occupied a great portion of the kist.

"The fact of these two heads being found together is exceedingly interesting, as it shows not only that the two races existed contemporaneously, but that they were there and then, at least, in such amicable relation as to have a common tomb, yet separated by a partition, as if to mark the distinction which even in death remained between them. The urn, which probably originally contained the incinerated bones of a human sacrifice, may have been common to both. Outside, and in close contiguity with the western chamber, were found some fragments of human bones, and portions of the upper and lower jaw of an individual who had probably not exceeded twelve years of age."

A vote of thanks was then passed to the various donors for the foregoing presentations to the Library and Museum.

Dr. Petrie presented, on the part of Sir Richard Griffith, Bart., an antique seal, which had been found by the workmen of the Board of Works, when sinking for the foundations of the new buildings in the neighbourhood of the Four Courts.

After some explanatory observations from Dr. Petrie on this seal, which he said belonged to the thirteenth century, a vote of thanks was passed to Sir R. Griffith, and the meeting separated at a quarter past 11 o'clock.

MONDAY, NOVEMBER 8, 1858.

JAMES HENTHORN TODD, D. D., President, in the Chair.

THE REV. WILLIAM REEVES read the following paper—

THE monastery of Reichenau (Augia Dives), situated on an island in the lower part of the Lake of Constance, was in early times much resorted to by the Irish. Walafridus Strabo, its Abbot from 842 to 849, has left us an account of the martyrdom of the monks of Hy by the Danes in 825, more full than anything on record at home. The oldest copy extant of Adamnan's "Life of S. Columba" was preserved there till

the last century. Dr. Ferdinand Keller, in a letter from Zurich, in 1850, states that the convent of Reichenau contained before its suppression, in 1799, as he was informed by a monk of that house, besides the "Life of St. Columba," several Irish manuscripts. The monks, not willing to deliver these valuable relics into the hands of the Government of Baden, saved them, as they called it,—that is, divided them among the members of the congregation. Some of these having entered into other Benedictine convents, bequeathed their treasures, when about to die, to their friends. A portion of the collection, however, seems to have become the property of the State; and from the original, described as a Reichenau manuscript (No. 221, Karlsruhe), Francis Joseph Mone-Archive-Director at Carlsruhe, has published a most curious Hiberno, Latin composition, in the third volume of his "Hymni Medii Aevi,"* pp. 181, 182. He observes, in a note, that it is of the eighth century, written in a Franconian hand, and that the author was an Irishman. But, as might be expected from a stranger to Irish hagiology, he is altogether in error as to the subject of the poem.

It consists of twenty lines, in five stanzas, possessing alliteration as well as rhyme, which latter, according to Irish custom, prevails on one syllable through each stanza. The style is extremely barbarous, and characterized by the phonetic spelling which is observable in Hiberno-Latin writings; as, *murmoris* for *murmuris*, *benibula* for *benevola*, *puro* for *pura*; and the termination the present subjunctive of the first conjugation, *at*, for *et*.

O rex, o rector regminis,
o cultor cœli carminis,
o persecutor murmoris,
o deus alti agminis.
.i. filio .i. pater
Aid o sanctus mech prich benibula
posco puro precamina,
ut refrigerat flumina
mei capitis calida.

Curat caput cum renibus
.i. cerebro
meis, atque cum talibus,
cum oculis et genibus,
cum auribus et naribus.

.i. nervibus
Cum inclitis euntibus,
cum fistulis sonantibus,
cum lingua atque dentibus,
cum lacrimarum fontibus.

Sanctus Aid altus adjuvat,
meum caput ut liberat,
ut hoc totum perseverat
sanum atque vigilat.

This poem is evidently in the nature of a charm for headach, and all the parts which are recited in it belong to the head, even those denoted by *renibus*, *talibus*, and *genibus*. The *renes* and *tales* appear to be intended for the brain, or its parts; for over *talibus* (probably a barbarism for *talis*) is the gloss *cerebre*, which Mone pronounces "does not answer at all," though written by the original scribe. Possibly, like the *nates* and *testes* of ancient anatomy, they are technical names for some parts of the cerebral structure. *Genibus* is a barbarism for *genis*, to prop up a sinking metre. *Inclitis euntibus* is unintelligible. Over *inclitis* is the gloss *nervibus*; but Mone goes astray when he proposes *ancylis*, as if from ἀγκύλη. Whatever it be, the order of the recital gives

* "Friburgi Brisgoviæ," 1853–1855.

no help to the interpretation, for the parts are thrown together without connexion, and order is sacrificed to rhyme.

A somewhat similar composition, commencing *Galea salutis esto capiti*, forms part of a very curious Hiberno-Latin poem preserved in the Leabhar Breacc,* which is enriched with interlinear glosses giving the Irish equivalents for all the Latin terms. The argument which is prefixed states that "Gillus† hanc loricam fecit ad demones expellendos eos, qui adversaverunt illi;" and it adds, "Laidcend mac Buithbannaig venit ab eo in insolam Hiberniam, transtulit et portavit super altare sancti Patricii salvos nos facere, amen." This same hymn, without the glosses, has been published by Mone, in the first volume of his above-named work.‡ He found it in a manuscript of the close of the eighth century preserved at Darmstadt§; and he states that another copy, written about the end of the fifteenth century, exists at Vienna.‖ As printed by Mone, it contains ninety-two lines, is entitled *Hymnum Luricæ*, and has the subscription *Explicit Hymnus quem Lathacan Scotigena fecit;* the *Lathacan* of the continental copy being evidently a variety of the domestic form *Laidcenn.* This ecclesiastic¶ was a pupil of St. Lactan, at Clonfert-Molua, now Clonfertmulloe, or Kyle, in the Queen's County, and died on the 12th of January (at which day he is commemorated in the Irish Calendars), in the year 661.** From the designation *Sapiens*, which is applied to him by the Annals of Ulster, he seems to have been in repute for learning in his day; and it is an interesting fact that his name appears in another continental manuscript, namely, an abstract of the *Moralia* of St. Gregory, also preserved at Vienna, written by *Ladkenus Hiberniensis.*††

A manuscript in the library of St. Gall (No. 1395) has on the recto of one leaf a sacred effigy, and, on the back, four clauses, principally in ancient Irish, being charms or invocations for the relief of certain maladies. They were first printed by Keller,‡‡ and afterwards, more accurately, by Zeuss.§§ The third, which was ar chenn galar, "for [the relief of] headach," runs thus, partly Latin and partly Irish:—"Caput Christi oculus isaie, frons nassium noe labia lingua salomonis collum temathei mens beniamin pectus pauli unctus iohannis fides abrache sanctus sanctus sanctus dominus deus sabaoth—Cauir anirin cachdia imbu-

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* Library of Royal Irish Academy, fol. 111 *a b.*

† The "Annals of Ulster" record the death of a Gildas at 569; but the present is a later writer.

‡ "Hymni Med. Aevi," No. 270, vol. i., p. 367.

§ No. 2106.

‖ Denis, "Catal. Codd. Theol. Vindob." i., 3, p. 2932.

¶ Colgan has a meagre notice of him at this day (Act. SS., p. 57), but without any mention of his writings.

** A. D. 661. Laidhgnen mac baith bandaich quieuit.—*Tighernach*, A. C. 660, Laidgenn *sapiens* mac baic bannaig *defunctus est.*—*Ann. Ulst.* So *Ann. Inisfall.* A. D. 651; *Four Masters*, A. D. 660.

†† Denis, "Catal. Bibl. Vindob.," p. 2980, cit. Mone, vol. i., p. 369.

‡‡ "Bilder und Schriftzüge in den irischen manuscripten," &c. p. 92 (Zurich, 1851). A tracing of them had previously been brought to Ireland by Samuel Ferguson, Esq.

§§ "Gram. Celt." vol. ii., p. 926.

chenn archenngalar iarnagabáil dobir darale itbair ⁊ dabir imduda are ⁊ fortchulatha ⁊ cani dupater forthri lare ⁊ dobir cros ditrailiu forochtar dochinn ⁊ dogni atóirandra dam u. fortchiunn.

"Say this thing every day for thy head against headach; after taking it, place thy spittle upon thy palm, and put it on thy temples, and on thy pole, and say thy *Pater* thereupon, and draw a cross with thy spittle on the top of thy head, and draw the form of a U on thy head."

We now come to inquire, concerning the Reichenau verses, who is the saint through whose intercession relief is sought for the head. Mone supposed him to be Aidus or Maidoc, the patron saint of Ferns. But he was son of Sedna. The Poem says—

> "Aido mech Prich benibula
> Posco puro precamina."

The scribe glosses *mech* by *filio*, and *Prich* by *pater*. The word *filio* might lead us to suppose that the scribe took Aido for the ablative of Aidus. But it rather seems to be the old Irish genitive, which ended in *o*, in such forms as Aedh, and as we actually find it in Adamnan's Latin "Life of St. Columba."* The other words are genitives also, and are the same as mec bric, the form in which they occur in domestic authorities. We find, in the Calendars, at November 10, the commemoration of "Aedh mac Bric, Bishop of Cillair in Meath, and of Sliabh-liag in Tir-Boghaine in Cinel Conaill." Of this saint there are lively traditions in Ireland, and his Life, copied from the Book of Kilkenny, is given by Colgan† at the 28th of February, which date is in opposition to the express statement in the life, "quarto idus Novembris migravit ad cælum;" but a happy prolepsis, for, had the editor deferred the memoir till the legitimate day, it would not have seen the light. This Aedh, Aidus, or Hugh, was born in the early part of the sixth century, and was a contemporary of Sts. Columba, Brendan, and Cainnech. His death is placed by our Annalists at 589. This date tallies perfectly with his pedigree, which represents him as "Aedh son of Brec, son of Cormac, son of Crimthann, son of Fiacha, son of Niall of the Nine Hostages." Niall died in the year 405, and thus five generations are allowed to fill up the 184 years which intervened between his and St. Aedh's death. From Fiacha, son of Niall, Aedh's great-great-grandfather, descended the Cinel Fiachach, who occupied and gave name to a district in the south of Westmeath, and adjoining part of King's County, afterwards known as *Kinelea*, but which is now represented by the barony of Moycashel, on the borders of Westmeath and King's County. Of these, St. Aedh was the tutelar saint, and the parish of Rahugh, in the barony just named, derives its name from him, its church having been founded by him within the precincts of a fort (castellum), which was granted to him by the local Chief; whence, as the Life tells us, the place was called *Rath-Aeda*,

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* Lib. i., cc. 10, 13, 48, pp. 37, 41, 82. Publ. Irish Archæol. Soc.
† Act. SS., pp. 418–423.

that is, *Castellum Aidi*, "Aedh's Fort." Mention is made of this church in the Four Masters at 771, 783, 1382, and, at 857, it is expressly called *Rath-Aodha-mic-Bric*. Another church was Cill-air in Moy-assuil, now the barony of Rathconrath, also in Westmeath, where was shown within the churchyard, in Colgan's time,* the stone on which the saint was believed to have been born. The remains of an oratory founded by him are also shown on the top of Slieve-League, a high mountain, 1964 feet above the sea, in the barony of Banagh, in the south-west of Donegal, where he is traditionally called *Bishop Hugh Breaky*, and near which is his holy well, where stations were annually held on his festival until a couple of generations past. He also founded a church called *Eanach Midhbreuin*, in his mother's native territory of Muscry Their, now the baronies of Ormond, in the county of Tipperary.

His life is a curious legendary tale, from which I shall content myself with citing one passage, as it serves as the key to the sentiments contained in his foreign hymn:—

"Homo quidam qui patiebatur magnum dolorem in capite, venit ad sanctum Aedum dicens; O sancte Dei affligor valde dolore capitis, et ora pro me. Cui ait Pontifex; Nullo modo poterit a te dolor iste exire, nisi in me superveniet: sed præmium magnum habebis, si patienter sustinueris. Ille respondit, Domine, dolor supra vires. S. Aedus ait; Dolor capitis tui, o homo, veniat in caput meum. Et illicò dolor descendit in caput Pontificis, et homo ille sanus exivit gratias agens. Suscepit igitur sanctus Christi famulus dolorem alterius in se ipsum, ut per Christum proximum adjuvaret, et ut pro Christo martyrium toleraret. Et multi postea *invocato nomine S. Aidi à dolore capitis sanantur*, sicut in hac re probatum est."†

I was so struck with the coincidence between these remote vestiges of ancient times, that I wrote to Mone, in the middle of the year before last, asking for information on some matters of interest. In his reply, dated July 24, he writes:—"The literary exertions of the Irish for language, history, and sciences, existing in their manuscripts, are partly known, and Zeuss has appreciated them in his 'Grammatica Celtica.' But there is still a great deal of interesting fragments, written in Irish and Latin, which deserve a careful attention. You were pleased with the ancient Latin hymn on S. Aidus: I have since found an *Irish hymn* on him,‡ of the eighth century also, in fifty-two verses, which commences with these words:—

Aeb oll fri anbub nane
Aeb fonn fri fuilceb fele
Inbeil belgnaibi archóemem
Oibingnaib noepenn nebe.

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* Colgan, Acta Sanctorum., p. 422, *b.* n. 5.

† Vit. c. xvi.; Colg., Act. SS., p. 420 *a*, "patronum capite dolentium."—*Marg.*, *ibid.*

‡ It is possible, however, that the "Aedh" of this hymn may be another of the numerous saints of the name who occur in the Irish Calendar. The question cannot be decided until the whole poem is examined.

"It is difficult to a German to understand the ancient Irish language, because we have not an old Irish dictionary; and I know not if the Vocabulary of Cormac is yet published or not. If you desire to have a copy of this Irish hymn, I shall send it to you, and you will oblige me very much if you please to return to me a literal translation."

I submitted the verse to Dr. O'Donovan, from whom I received the following translation:—

> "Aidus magnus in protrahendo jejunium
> Aidus hilaris in gaudiis solemnitatis;
> Ingenium peracutum, pulcherrimum;
> De mirabilibus Hiberniæ campestris."

Or, as he paraphrased it:—

> "Aedh was ascetic during the fasts,
> But joyous and merry during the festivals;
> His genius was sharp as a pin; his face the fairest of men,—
> In short, he was one of the wonders of the plain of Erin."

I wrote back to Mone, enclosing the above translation, but the remainder of the poem has not yet arrived.

The little composition which forms the leading subject of the paper which you have now done me the favour to listen to, possesses no literary merits, but it is a well-defined trace of that early religious emigration which commenced in the sixth century, and waxed more and more vigorous till it attained its height in the ninth, taking with it not only the language and literature of the Scoti, but also their legendary associations, which they clung to in foreign climes; and not only so, but left them on record in manuscripts which have weathered a thousand years, and are now beginning, through German industry, to be reflected on the mother country, where they find their counterparts, after a separation of so many centuries.

John Robert Kinahan, M.D. T.C.D., read the following paper—

ON A PROPOSED SCHEME FOR A UNIFORM MODE OF NAMING TYPE-DIVISIONS.

The present system of names for types and type-divisions labours under the disadvantages of uncertainty of value in terms, and cumbersomeness of detail. Scarcely any two authors employ the same group-name in the same signification. One term is often found to be used for divisions of very unequal value, not merely as to absolute perfection or extent, but also as regards the mutual dependence and sequence of the divisions, and their relation to other types. The terms used, also, are too numerous, every division, no matter what its extent, being represented by a distinct name, and these names being merely of arbitrary signification, and in no ways expressing the relation of the groups to one another.

This, probably, has arisen from the transference to a natural system of the machinery of a system which was, for the most part, artificial, and in which, as a matter of course, it was of extreme moment that the divisions should be of equal extent.

Whilst this transfer was going on, and whilst the minds of even the advocates of a natural system were, so to speak, in a transition state, systematists found it extremely hard to divest themselves of the idea of a necessity for an equality in the groups, in the number of their subdivisions and types; and hence hastily applied the same terms to very unequal groups. For instance, in a natural system we may have two great groups of equal value in their relation to the same general archetype; whilst they may be most unequal as regards the number and general value of the more particular types contained beneath themselves.

I give an example. Suppose that by the terms "class," "order," "family," we express the following relations:—

Class.—A number of types agreeing in their general plan, but differing in the details of that general plan.

Order.—A number of types, which, agreeing among themselves in many particular details, yet differ in other particular but minor points; and which agree in general detail with those orders comprised with them under the same class.

Family.—A number of groups of types, which, agreeing in the general plan of the order, yet differ among themselves in certain still more particular characters.

Now every one who has examined in detail the types of a natural system knows that, owing to the mode in which the archetypes and types have been developed in time, as at present known, none of our groups of major extent comprises the entire of the types which might be imagined to make it up. Under one class, for instance, we will find four or five groups answering to our idea of order; and under these orders, probably, as many families; whilst under another class, we meet with, perhaps, but one group of ordinal value, the characters which distinguish its subdivisions being of such minor importance as not to justify us in considering them of higher grade than those divisions which we called families in the class first alluded to. Systematists, however, in too many instances, through forgetfulness of this fact, have, in such cases as I have last described, applied to these minor groups the same term as they applied to the more important groups in the former case, and hence a system of looseness in the application of terms has arisen, which leads to much confusion and embarrassment, especially among students in the science.

The employment of a distinct arbitrary term for each division has the further disadvantage of incumbering our class-books with a series of names, which, after all, have no fixed value, inasmuch as it is necessary, in the first place, to learn the exact sense in which the author uses them, before we can thoroughly understand their exact value in his writings.

Now it appears that the present nomenclature of type-divisions would be much simplified if writers of systems generally, taking a hint from what has been already accomplished in the practical working of systems in which groups of supposed equal value always have the same termination to their name, would, in the first place, abandon the use of the terms, *class*, *family*, *order*, *tribe*, *legion*, *cohort*, *kingdom*, *sub-king-*

dom, and a host of others, and adopt a scheme somewhat of this kind :— Let the *species*, as the most particular idea of a group of characters common to many, be called either *ultimate* type or species—though this latter term has now received such a wide range from the hands of some that there is danger of our particular knowledge of it being altogether lost. Let the most general type, that is to say, that under which all the other and more particular groups are comprised, be called *Archetype;* the group next in succession to the archetype being called *Primary Type;* the next, *Secondary Type;* and so on: the genus or group next to the ultimate type or species being called *Penultimate Type*, unless it were preferred to retain the name *Genus*, as this term is generally used correctly, and its position properly understood.

There would be no inconvenience in the number of terms required, because, at present, even in the most elaborate systems, there are but five grades of characteristic groups recognised beneath the archetype, viz. :—Class = Primary Type ; Order = Secondary Type ; Family = Tertiary Type ; Genus = Penultimate Type, and Species or Ultimate Type. Sub-classes, sub-orders, sub-families, and sub-genera, would be represented as Primary Sub-Type, Secondary Sub-Type, and so on; whilst those modifications of species which are commonly called Varieties and Races would be represented as Ultimate Accidental Sub-Type, and Ultimate Cultivated Sub-Type. The subjoined Table will explain this more fully:—

PROPOSED NAMES.	EXAMPLE.	PRESENT NAMES.
	(1)	
Archetype.	Vertebrata.	Sub-kingdom.
Primary type.	Mammalia.	Class.
,, sub-type.	Gyrencephala.	Sub-class.
Secondary type.	Artiodactyla.	Order.
,, sub-type.	Omnivora.	Sub-order.
Tertiary type.	Suidæ.	Family.
,, sub-type.	Suinæ.	Sub-family.
Penultimate type.	Sus.	Genus.
,, sub-type.	,,	Sub-genus.
Ultimate type.	Scrofa.	Species.
,, cultivated sub-type.	,, var. domesticus.	Variety.
	(2)	
Archetype.	Vertebrata.	Sub-kingdom.
Primary type.	Mammalia.	Class.
,, sub-type.	Gyrencephala.	Sub-class.
Secondary type.	Proboscidea.	Order.
Tertiary type.	Elephantidæ.	Family.
,, sub-type.	Elephantinæ.	Sub-family.
Penultimate type.	Euelephas.	Genus.
Ultimate type.	,, Indicus.	Species.
,, accidental sub-type.	,, var. Zeylandicus.	Variety.

The advantages that would accrue from the use of this or some similar system are, first, the simplicity of the terms used; next, the fact that these terms declare, at once, the relative value, in the author's

ideas, of the several groups to which they are applied, and thus enable the reader to at once compare separate systems, and discover their differences; thirdly, the facility with which they enable a writer to state the difference between different systems of classification. To give an instance:—

According to some systematists, the sub-kingdom (*Archetype*) Vertebrata is divided into the classes (*Primary Types*), Mammalia, Aves, Reptilia, Batrachia, Pisces. According to others, this sub-kingdom (*Archetype*) is divided as follows:—Classes (*Primary Types*), Mammalia, Birds, Hæmacrymes. Of these, the class Hæmacrymes is again divided into the sub-classes — Reptilia, Pisces; the Reptilia being again divided into the orders (*Secondary Types*) Batrachia, Ophidia, &c. Now it is manifest that if, instead of stating that Batrachia was, according to some, a class of Vertebrata, and, according to others, only an order of the Reptilia, which was a sub-class of Hæmacrymes, a Vertebrate class, that we made the statement,—Batrachia, according to some, a Vertebrate primary type; according to others, a secondary Vertebrate type,—the exact relations between the values assigned by the two systematists would be at once understood; and this, I conceive, would be one great advantage of the proposed nomenclature, that, no matter how our ideas about the value of the groups themselves might vary, that of the value of the names would necessarily remain the same; all that would occur in case of a change in our ideas of the value of groups, being the transference of the group to a higher or lower division, as the case might be. It must not be thought that I claim any originality for this idea: the principle of it has been long recognised, as already stated, and the general idea of the necessity for a *definite* value to our divisional names will be found floating through all the later books of classification, a thing which, however, it appears, will be impossible as long as we use terms which by long-continued custom have come to be mere arbitrary names, without any definite connexion or mutual dependence on each other; and therefore, it would appear to be desirable to suppress them altogether, and substitute in their place others, the relationship between which is manifest, understood, and universally acknowledged.

Dr. E. Perceval Wright said that, without entering into the details of the paper just read by Dr. Kinahan, he still thought that one of the most important objects which a universal nomenclature had in view would be altogether nullified if any of the terms used would suggest ideas foreign to the nomenclature; that hence he would suggest that the word 'archetype' having been used by Professor Owen to represent an idea now familiar to all zoologists, it would not be advisable to have it appearing at the head of a new nomenclature with a very different idea attached to it. He would not occupy the Academy by entering into the merits or demerits of Dr. Kinahan's paper. If a satisfactory universal nomenclature was ever invented, it would be a very great boon, indeed, to the systematist, nor would it be without great benefit to the comparative anatomist also.

Dr. Kinahan said the term 'archetype' being objected to by some as already pre-occupied and used in a double sense, perhaps, if he might coin a word, that of 'holotype' might be advantageously used in its place.

THE VEN. THE ARCHDEACON OF ARDFERT read a—

REPORT OF AN OGHAM MONUMENT LATELY DISCOVERED ON THE SITE OF THE FIRST BATTLE RECORDED AS HAVING BEEN FOUGHT BY THE MILESIANS IN IRELAND.

IT seems to me desirable to place before Irish antiquarians in general, and more especially those interested in Ogham investigations, some details respecting an Ogham monument lately brought under notice in a locality marked by very definite description in the legendary annals of Ireland. I need not enlarge upon the great question pending between Ogham authorities, as to whether these inscriptions are to be assigned to a date anterior or subsequent to the Christian era; to whichever side the preponderance of opinion may incline, I believe that it must be said "*adhuc sub judice lis est*;" and it will be conceded that a main part of the difficulty in arriving at any unquestionable conclusion arises from the fact, that while a considerable number of those monuments have, from time to time, been discovered, there is scarcely a thread of historic clue to guide the inquirer as to their meaning or chronologic relations. It is in this dearth of historic information that I am induced to invite attention to the discovery of an Ogham monument hitherto unnoticed, which, though lying in a locality intimately known to the late lamented Richard Hitchcock, escaped even the research of that enthusiastic investigator of Ogham remains, and which has now been brought to light in the very position in which a very circumstantial historic legend might lead the supporters of one of the theories respecting Ogham to expect that such a monument would be found. Being so found, I venture to hope, that under the examination of competent investigators, it may prove doubly interesting; first, as having light thrown upon its age and meaning by the legend referred to; and again, as possibly returning the obligation, by affording, in its mute but unquestionable record, a testimony which may tend to establish, among historic verities, statements which many, pretending to decide with all the authority of right reason, have, by a judgment more hasty than dispassionate, summarily dismissed to "the wild and pathless region of romance." (*Vide* Wood's "Ireland," p. 60.)

All who do not throw aside the remnants of Irish history which have come down to us as "bardic myths," consent to the tradition that the first landing of the Milesians in Ireland took place on the south-west coast of Kerry, in Munster; and it may here be observed, that this landing is supposed to have been effected in the very locality upon which a world-wide attention is now fixed, as the European point from which it has been ascertained that the flashing of intelligence between the New and Old World continents is an accomplishable fact. It was here that, as is calculated, about thirty centuries since, a tribe of the Scythi, after a sojourn in Spain, are recorded as having first made good a landing in

Iar, in that "Isle of the West" indicated as their ultimate settlement; and the locality still retains in its nomenclature traces or memorials of the supposed events.

Dar Iri (the Oak Island of Ir) is still, in the mouth of the peasant, the familiar name of the "Island of Valentia," derived, as is believed, from that son of Milesius, held, also, to have had his burial in the adjacent Skellig Rock, once dedicated to the Pagan Jove," but, under Christianity, consecrated, as all similar separated rocks were, by dedication to St. Michael, and thence known as Skellig-Mihil, or Skellig of St. Michael.

The actual landing is recorded as having taken place at Inbher Sceine, or the Kenmare Estuary, and the first encounter between the possessors of the soil and the invaders is placed "three days' journey inwards," in the very locality of which I write, namely, in the large and deep valley terminating on its western face the Sliab-Mis range of mountain which skirts the southern shore of Tralee Bay; and in this valley, on the very field of battle, lies the Ogham monument which furnishes my subject.

Before I glance at the signs and tokens which still identify this field of battle, I think I should extract the clear and precise narrative which Keating gives us, as derived from still more ancient chronicles; for that he ever saw the place itself, I hold to be in a high degree improbable.

Dr. Wood, the great impugner of Keating's authorities, though acknowledging him to be a "faithful narrator and assiduous compiler," tells us that in the reign of King Charles I., Dr. Keating travelled through different parts of Ireland, with a view to gleaning materials for his history of this country from bards and priests. Whether in his travels he took in Munster and Kerry, I know not, but in the age referred to I think it almost certain that the valley was an inaccessible fastness, covered in great part with wood, and without road or track to invite a passenger or tourist to turn aside and inspect it. It is only within a late period that the traces of conflict to which I am about to refer have been discovered; and there is no kind of probability that Keating could have been aware of the Ogham witness which lay hidden in this valley to give the testimony, which, *quantum valeat*, remains for consideration. Having premised this, I proceed with Keating's narrative:—

"Three days after Heber and his followers were got on shore, they were attacked by *Eire*, the wife of *Mac Greine*, one of the princes of the country, at Sliabh-Mis, or the Mountain of Mis.

"This lady was attended by a strong body of men, and a desperate battel followed, in which many were destroyed on both sides. In this action *Fais*, the wife of '*Un Mac Vighe*,' was slain in a valley at the foot of the mountain, which, from her obtained the name of *Glen-Fais*, which signifies the Valley of Fais. The death of Fais is thus observed by an old poet:—

"'The valley where the lovely Fais fell,
From her, as ancient Irish records tell,
Obtained the name Glen-Fais.'

"Scota, the relict of King Milesius, was likewise slain in this engagement, and was buried in another valley, on the north side of Sliabh-Mis, adjoining the sea. This valley, which was the place of her enterment, was called *Glen-Scothian*, or the Valley of Scota, as an old poet testifies.

"This was the first Battel that was fought between the Milesians and the Tuatha-de-Danans, for the Empire of this Island, as we are informed by the same author.

"The persons that fell on the side of the Milesians in this action were, the Princess *Scota*, and the Lady *Fais;* they likewise lost two of their principal Druids, whose names were, *Uar* and *Eithir*, and there was no more than three hundred of the Gadelian soldiers missing after the fight, notwithstanding they defeated the Tuatha-de-Danans, and slew a thousand of them. *Eire*, the wife of *Mac Greine*, one of the princes of the country, with as many of her flying troops as she could keep together, retired to Tailton. The Milesians continued on the field of battel burying their dead, and *celebrating the funeral rites of the two Druids, with great solemnity*. An old poet makes honourable mention of this battel, and confirms some of the particulars."

Thus far Keating—in confirmation of whom I can say, that *Glen-Fais* and *Glen-Scothian* are localities as well known at the present day, by these designations, as any in the country. They both run south and north into the *Sliabh-Mis* range, with an interval of about eight miles between; and in Glen-Fais—much the more considerable of the two—are found the following memorials:—The Ogham Pillar, now prostrate; a companion *Gallaun*, or pillar-stone, standing about eleven feet high above the earth; and on the side of the valley between them are an unascertained number of rows of cists, or graves, which were brought to light in the following manner:—

Many years ago, when, for the first time, a presentment road was being formed through Glen-Fais, the workmen came upon a row of cists, or stone-formed graves, two or three feet below the surface, across which the line of road cut laterally; and there being no ruined church, or other sign of grave-yard near, the workmen proceeded without hesitation, and in the bank or fence at the west side of the road they left exposed cross-sections of these graves, to the number of ten or twelve. They were formed of the common clay-slate flags of the country. They all contained human remains, which, up to a late period, any passer-by could take out easily; but the road-bank is now faced with stone, and the apertures covered.

A few years ago, passing along this road in company with the then parish priest, the Rev. George O'Sullivan, he directed my attention to those semi-graves, adding, that he had heard that the adjacent fields, both above and below the road, were "full of them."

I had not at that time at all connected Keating's narrative with this valley, in which I had but lately become possessor of a small estate, but I determined to ascertain whether the popular impression as to a number of graves was well founded, and in some time after, accompanied by a scientific friend, I set some of my labourers to work in trenching the

field at the road-side, and, after some labour, we lighted on one of the rows of graves. I say one of them, for it would appear that these dead, whenever buried, had been placed in regular layers, each grave being some feet distant from the other, with an interval between each row. The first grave we opened contained some human bones, but the principal parts of the skeleton had decayed and disappeared. We proceeded to a second, and a third, in which last we found the complete skeleton, in an arranged and connected form, as it had been buried originally; and having thus satisfied ourselves of the fact that a great interment of human beings, regularly laid "each in his narrow cell," had at some indefinitely distant period taken place in this spot, we desisted from further examination, which could only have gratified idle curiosity. There was no trace of any article of bronze, iron, or ornament of any kind in the graves we examined. They lie about midway between the two Gallauns, or Pillar-stones, already alluded to. One, which is standing, is without inscription, or any mark whatever; the other, being the Ogham stone under consideration, lies in a half-fallen position, about a third of a mile further down the glen, to the north. It had long lain unnoticed, under brambles and rubbish, but when cleared of these, it shows as a Gallaun, of about ten feet in length, half prostrated by accident or design, and having the Ogham inscription well cut on the natural edge of the stone, as its *fleasgh*, or guide-line.

Upon this discovery of the graves being noticed in the local newspapers, the Rev. John Casey, an aged priest, and excellent antiquarian, immediately connected them with the Milesian conflict, as recorded by Keating. Upon the ground of some researches in the Roman Catacombs at which I had assisted a few years ago, and in which I had *seen* the skeleton of a body, buried within the Christian era, disappear into dust even as we looked upon it, within a few minutes after its first exposure to the atmosphere, I ventured to hint a doubt as to the possible durability of bone, during a period of three thousand years, without having undergone embalming, or any other preserving process; but I was immediately met by confutations from more than one quarter, based upon antiquarian discoveries and physiological reasoning, assuring me that there was no impossibility in the case, and that human bone was capable, under certain conditions, of an indefinitely long duration. I had to oppose to such arguments but the single fact alluded to, and have, therefore, since submitted to the conviction that the assertion of these being remains of the first Milesians involves no physical impossibility.

Immediately on the discovery of the Ogham stone in this same locality, it was submitted to the notice of the aged, but enthusiastic antiquarian referred to, whose advanced years and impaired sight did not deter him from a journey of some thirty miles from Killarney, to inspect the stone with his own eyes. I also at once sent a carefully made transcript to Dr. Graves, and another to Mr. Windele of Cork, one of our most painstaking Southern antiquarians, and who has done much to work out the Ogham question to solution.

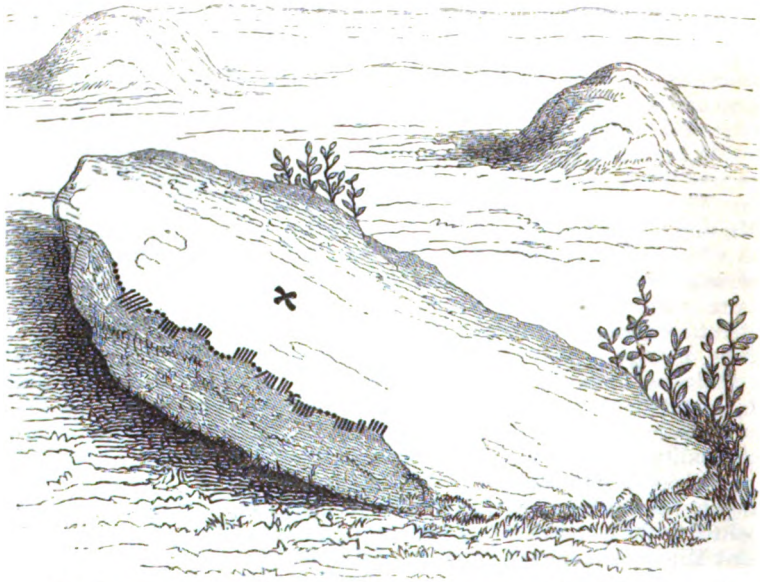
The Rev. Mr. Casey has, with no hesitation, read off the inscription,

according to the version of which that on the annexed diagram is a copy, and his rendering, as translated by himself, is to the following effect:—

"Here is Martial Sun officer Druid *Ni.* here illustrious *alas Ni.*"

Ni Mr. Casey explains to be *Nighe*, oghamically written, and he identifies him with the *Vighe* of Keating's History, the father-in-law of the Lady Fais; and further seems to identify him as one of the Druids slain in the battle, whom Keating severally names *Uar* and *Either*.

Dr. Graves has not favoured me with his reading; indeed, when I sent him a copy of the inscription, I was unaware that I was intruding these "Nugæ Oghamicæ" upon one whose time was engaged in a serious public employment; and he has since, probably with a wise caution, declined to give his rendering until he can both see and feel the inscription himself; a process in which, as I may now call him a naturalized denizen of the Kingdom of Kerry, I hope to be allowed to act as his conductor at no distant period.



Mr. Windele, without professing to give any reading of his own, has favoured me with a version from some learned Oghamist of his acquaintance, who, without being aware of Mr. Casey's interpretation, had also, "without hesitation," read it off to a sense which would have a very interesting reference to the traditionary account of the Milesian conflict. However, as this reading was based on a conjectural emendation of the characters, which they will not bear, at his request I do not offer it to the consideration of the meeting, nor my own objections thereto.

In reference to either or both the renderings to which I allude, although they severally rest on different grounds of interpretation and reading of the symbols, still, if either were sustainable by the *literæ sculptæ* of the stone, this monument would be, as Mr. Windele calls it, "one of an interest far beyond anything of the kind hitherto presented for consideration,"—and if I might allow the wish to be father to the conclusion, I would gladly accept either version as establishing in our Glen a piece of Ogham evidence of remarkable value for settling a remarkable controversy; but in the mere fidelity of an observer, pretending to no Ogham knowledge save such as a spelling out of Mac Curtin's Alphabet (confirmed, as it now stands, by the high analytic investigations of Dr. Graves) could afford me,—I am compelled, as a true deliverer of what I have *seen*, to state that both these interpreters, to arrive at their several senses of this inscription, are forced to take liberties with their text which are scarcely warrantable; they seem to me each obliged, in order to sustain their conclusions, in more than one instance to read letters as flattering painters draw pictures, for what "they ought to be, not what they are." Sometimes a well-defined, connected, and clear-cut group is broken up so as to make two letters, where the stone gives but one. Again, a letter is assumed to be above or below the *fleasgh*, which is clearly upon it; and again I find some of the marks read for letters, for which I can find no warrant anywhere in Mac Curtin's chapter on Ogham; and in reference to these emendations I adopt, altogether, Mr. Windele's sound canon of interpretation, where he writes to me as follows:—"I confess I dislike arbitrary dealing with the letters where we find a group of scores well defined, and so unconnected with any others at either side,—so isolated as to warrant the conviction that it has been carefully and well expressed, or where its direction, whether vertical or oblique, is expressed with similar care, I am disposed to be very jealous of any intermeddling with it, and am disposed to protest against any arbitrary forcing or dislocation."

The Ogham characters of this inscription, as I copy them, are eighteen in number. The sixteenth group is cut where a natural inequality in the stone renders it doubtful whether the points are to be read as *two* vowels or *one*; if the former, the number of characters will be nineteen. All the other characters are perfectly clear and legible, so far as Ogham can be said to be legible.

On the flat surface of the stone is cut a small and rude cross, as in the drawing I offer; but it seems to me impossible to look on this mark without feeling convinced that it is not of the same age, nor cut with the same care as the Ogham characters; it seems of ruder, later, and hastier workmanship altogether.

It will be observed that while the first vowel *o* is expressed by *lines*, all the rest are given by points, or dots. I can suggest no reason for this, except that the *fleasgh* line becoming rather blunt, or broad, it was found easier, and less liable to weather-wear, to work by dots than lines upon it.

Referring to the diagram No. 1, I am obliged to object to Mr. Casey's reading as follows:—I cannot understand how the fifth and sixth groups

can be read *uar;* the fifth group is completely identical with the third, which has already been read as *cu;* while No. 6 is expressly said by Mac Curtin to stand "for all diphthongs and triphthongs beginning with the vowel *e*," though in his Grammar it stands for *ea* only. In the sixteenth group he reads the vowel *o*, whereas it must be either *u* if a single character, or *oa* if double, for this is the spot before alluded to, where the irregularity of the stone renders it doubtful whether the group be two letters or one.

The seventeenth group, which he reads for *n*, as if below the line, is, from its position in reference to the last letter, an unmistakeable *r;* but I submit that this correction may not be fatal to Mr. Casey's reading, inasmuch as if read *o a ri*, it might still be interpreted in a consistent sense.

I should here mention, that on the flat surface of the stone, under the line of Ogham, are some cuttings which look like defaced or imperfectly formed characters; but it seems quite impossible to determine for what they were intended.

Upon the reading No. 2, I am precluded from making any remark, by learning that the author desires to re-consider it before committing it to public notice.

In conclusion, I take the opportunity of entering a protest on behalf of these ancient monuments against the misplaced and misplacing zeal in which Ogham stones are sometimes abstracted from their natural *habitat* in the fort or lone burial-ground, where they have been found and brought to notice, into the pleasure-grounds of the virtuoso, or the halls of archæologic societies, where they seem as much out of place and keeping as would any wild denizen of the mountains if introduced to the learned Society I have now the honour to address. I believe the interest of proprietors in these remarkable monuments is now sufficiently awakened to insure their preservation from being converted into door-lintels or gate-posts by the peasantry, as has often been done before now in times of archæologic neglect or ignorance. But there is a barbarism of preservation as well as of destruction, and we must only refer to the better taste and consideration of Ogham coveters, that in removing an Ogham stone from the place where it was erected, they may destroy much of its interest as an antiquity, and *all its value* as a piece of evidence. It is unnecessary for me to remark, that in reference to the stone now under consideration, should it prove to have any connection with the historic legend which attaches to Glen-Fais, it would be perfectly worthless as a witness, and scarcely worth attention as an antiquity, in any other locality than that in which it has lain, waiting to be questioned as to its silent but significant testimony, from some indefinitely remote period to the present time, when it is hoped that some of our learned Ogham interpreters may be able to reduce its record to intelligible language.

The following donations were presented to the Academy:—

Lithographs representing antiquities in his collection were presented by H. Westropp, Esq., of Rookhurst, county of Cork.

A wooden bow, 37½ inches long, found in a moat surrounding a square rath, near Dundrum, county of Tipperary, at the depth of two feet under the surface, in a bed of leaves about four feet thick, associated with a quantity of small timber, was presented by Arthur B. Wynne, Esq., on the part of Mr. Thomas White, who discovered it.

The Geological Map of Ireland, with the latest additions, was presented by Sir Richard Griffith, Bart.

Two photographs of the church of St. Doulough's, county of Dublin, were presented by William Allen, Esq.

The thanks of the Academy were voted to the donors.

TUESDAY, NOVEMBER 30, 1858. (STATED MEETING.)

JAMES H. TODD, D.D., President, in the Chair.

IT was moved by Robert Macdonnell, M.D., and seconded by Rev. Samuel Haughton:—

"That it be recommended to the Council to propose to the Academy:—

"That in future, if any Commission be nominated by the Academy to draw up any report, or for such purpose, the Secretary of such Commission shall submit the report to each Member of the Commission, and give each the option of signing it, if it meets with his approval."

The following Amendment thereto was moved by J. E. Pigot, Esq., and seconded by Rev. J. H. Jellett:—

"That the discussion upon the Resolution proposed by Robert Macdonnell, M.D., be adjourned to the next meeting of the Academy."

Upon a division, the Amendment was negatived. The original Resolution was then proposed and carried.

FRANCIS M. JENNINGS, ESQ., communicated the following remarks on—

CERTAIN BROOCHES AND ORNAMENTS FROM MOROCCO, PRESENTED BY HIM TO THE ROYAL IRISH ACADEMY.

IN April, 1856, when I was travelling in Morocco, I observed a great similarity in the form of the brooches worn by the Bedouin Arabs of that country, as well as the settled inhabitants of the towns and villages, to those anciently used in Ireland, and now occasionally discovered in excavations. I purchased the following articles as illustrations of the resemblance, that our ethnologists and archæologists might be able to compare the genuine modern African specimens with the ancient Irish.

No. 1* consists of two silver brooches, connected by a silver chain. The tongues of the brooches are pointed upwards when worn, the chain

* The numbers refer to a Plate published in the "Ulster Journal of Archæology," No. 24.

falling gracefully across the breast. It is worn in this way by the natives generally, and also by the Bedouin women when in full dress, which I had an opportunity of observing in the tent of a tribe, about ten miles from Tangier. A mother sat lamenting near the corpse of a young child, and wore a shawl, fastened in the way described, across her shoulders.

No. 4 is a silver brooch, very common in the country, and worn by all the women. I have seen it on the Bedouins, the poorer class of women of the villages, and the wealthier classes of the cities.

Nos. 5 and 6 are different patterns, made of brass, and coloured with red paint. Two of similar patterns are sometimes united, and worn in the same manner as the silver of No. 1. Those in brass are worn only by the very poorest; but this circumstance indicates how generally the ornaments of this type are distributed through the country.

No. 3 is a silver ear-ring, which I purchased from some acrobats from Soos, the southern province of Morocco. The ears are kept open by a piece of wood when not occupied by the ear-ring.

No. 2 is a copper ring, taken off the upper arm, immediately above the elbow, of a brother of the Sheikh of Wednoon, when at Mogador. He said he had worn it for many years, and immediately presented it to me on my asking permission to examine it. His arm was marked where it was in contact, and the colour of his skin changed where it had rubbed. I have no doubt he was correct in saying that he seldom took it off.

A necklace of amber and silver, from Mogador, and some other objects, not lithographed, together with those described, are in the Museum of the Royal Irish Academy, and are worthy the examination of those interested in antiquarian pursuits.

I learned at Mogador, that at Wednoon, far in the interior, ornaments similar in form were made of gold, but was unable to obtain any in Morocco. It would be interesting to procure specimens of the different-sized brooches, and the other ornaments worn by the inhabitants of Morocco and the neigbouring provinces, as most probably they have not altered the fashion of their adornments for ages. The similarity of form in the accompanying illustrations must, at least, be considered as another evidence of the trade anciently existing between the Phœnicians, their colonies, and this country.

Nos. 7 and 8 are silver brooches; they were dug up in Ireland—the former near Galway, the latter near Tralee—and are lithographed, to show the great resemblance existing between the brooches of ancient Ireland and Morocco of the present time.

Mr. Urquhart, in his "Pillars of Hercules," notices the fact of the existence in Northern Africa of brooches similar to those used formerly by the Scotch; but that gentleman has neither published drawings of the brooches in his work, nor has he, so far as I am informed, brought home any specimens of these ornaments, which must be considered objects of great interest by all students of ethnology and archæology.

The following notice, by FRANCIS M. JENNINGS, Esq., of a Meteor, was also read by the Secretary :—

On Thursday, November 25, at 43 minutes after 11 P.M., I observed, whilst standing in the vicinity of Cork, a sudden increase of light. At first I could not tell from whence it came; but my eye was almost instantly attracted by an object moving with immense rapidity, from one or two points south of west, to one or two points north of east. The light was bright and intense, and seen through and between the dense masses of cloud that were driven across the sky, by a wind nearly due south, prevented my observing its exact path; the moon and stars being only visible for a few seconds between the clouds, which appeared to belong most nearly to those of the cumulo-stratous class. It was probably owing to the dense vapour through which it was seen, that the colour of the meteor appeared to be blue and reddish, in addition to that of a brilliant white, its chief characteristic.

I cannot say whether it left any luminous track behind it; the clouds and the light of the moon would have rendered any slight luminosity imperceptible. It was not visible for more than two seconds.

In four and a half minutes afterwards, there was a noise resembling a loud clap of thunder, which lasted but for a few seconds, and I did not hear any reverberations. Presuming that the noise was connected with the meteor, this would give a distance, at the time when the sound proceeded from it, of a little over 50 miles, reckoning the speed of sound at 1100 feet in a second.

The following donations were presented to the Academy :—

By W. Henry Hartigan, Esq., a basin, made of hammered brass or bronze, discovered in a morass in the rectory of Aughrim, by St. George Jones Martin, Esq.

By R. W. Reynell, Esq., a bronze pot, found at Killynon, Killucan.

By Robert D. Bolton Massy, Esq., an Irish half-crown of Elizabeth.

By W. A. Reynell, Esq., a small collection of Roman and British coins.

By the Earl of Leitrim, a large flat piece of timber, supposed to be part of a canoe, found in a crannoge in the county of Leitrim.

The thanks of the Academy were voted to the donors.

MONDAY, DECEMBER 13, 1858.

JAMES HENTHORN TODD, D.D., President, in the Chair.

THE Secretary of the Academy announced that the Council had at their meeting, held on December 6, taken into consideration the Resolution passed at the last meeting of the Academy, and had come to the following Resolution respecting it, viz. :—

"That inasmuch as it is a part of the ordinary duty of the Secretary of any Commission to submit the Report of such Commission to the Members thereof, for their signatures, the Council think it unnecessary to propose the By-Law recommended by the Academy at their last meeting."

An election having taken place to supply the vacancy in the Committee of Antiquities, occasioned by the resignation of William R. Wilde, Esq., the Scrutineers reported that Eugene Curry, Esq., had been elected a Member of that Committee; and that the Rev. Samuel Butcher, D.D., had been elected Secretary of Foreign Correspondence.

The Academy then adjourned.

MONDAY, JANUARY 10, 1859.

JAMES HENTHORN TODD, D. D., President, in the Chair.

His Grace the Duke of Manchester, Alphonse Gages, Esq., and James Graham Hildige, Esq., were elected Members of the Academy.

MICHAEL DONOVAN, M. R. D. S., Hon. Member of the Philadelphia College of Pharmacy, &c., read the following paper:—

DESCRIPTION OF A HORIZONTAL SUNDIAL, WHICH, WHEN REMOVED FROM ONE SITUATION TO ANOTHER, RESUMES THE POSITION NECESSARY FOR INDICATING SOLAR TIME; AFFORDS MEANS OF READING ITS INDICATIONS WITH PRECISION; EFFACES PENUMBRA, AND REMEDIES CERTAIN LOCAL CAUSES OF IRREGULARITY.

A SUNDIAL possessing the properties indicated by the title of this communication renders a little more complication necessary than has been hitherto resorted to in the construction of those generally simple instruments. The complication is to no great amount; and, when the advantages are considered, it will perhaps appear that it was not introduced in vain. If accurately made, the instrument will do its duty with great exactness, will obviate certain local sources of error incidental to all movable dials, and with less trouble in the management than the description of the mode of using it might lead a person to suppose. Most of the advantages of the dial are peculiar to itself, the means of obtaining them never having been applied to any other, although contributing much to its convenience, utility, and adequacy. The following brief account will sufficiently explain the construction:—

The principle of the mariner's compass affords the obvious means of obtaining the horizontal and meridional position of the dial. The dial-plate, of sufficient area to afford an open graduation, must be made of a very light, yet refractory material: such a substance is talc, a mineral unalterable under any circumstances of heat or moisture, even when as thin as paper. A circular very thin lamina of this mineral, about six inches in diameter, is to be covered on both surfaces with the thinnest white paper, on one of which the usual hour-lines with their subdivisions are to be drawn. This plate is to be mounted on a bar-magnet as a diameter, about the thickness of a silver threepence, and about and half an inch in breadth, and in length a quarter of an inch longer than the diameter of the plate: its ends, therefore, project one-eighth of an inch beyond the circumference. A mark on the south end projection acts as the index to a graduated arc of 30 degrees, drawn on a part of the circumference at the vacant south-east of the dial-plate. This is the declination arc. The index is made to correspond with such degree of the arc as represents the angle of magnetic declination of that period. According as the magnetic declination of any period is known to have varied, a corresponding variation must be made in the angle, by turning the dial-plate on the common axis of itself and the magnetic bar, until the index and

the proper degree of the declination arc correspond. The change of declination will cause a change of time on the dial of about eighteen seconds each year at noon. The declination at present is, I believe, 25° 41′ west.

The style is a human hair, which, passing up through a hole in the centre, whence the hour-lines are drawn, forms with the plate an angle equal to the latitude of the place, and is sustained at that elevation by a light arch of brass fixed to a thin brass bar which passes diametrically under the dial-plate, in the direction of its meridian line, to give steadiness to the whole. Adequate tension of the hair, a hygrometric substance, is secured by a small weight underneath, or by a weak spring. The perfect horizontality of the dial-plate is attained by bits of paper pasted to the under surface where required. The total weight of all the parts just described should not exceed one ounce; so that the dial will be under the control of the magnetic bar, and will return, when disturbed, to its right position with the greatest accuracy—a condition without which the instrument were of little use. The steel pivot on which the dial turns is fixed to the dial-plate itself, and is supported on an agate hollowed just sufficiently to prevent its falling off. I find that the point of a fine sewing-needle answers best as a pivot, and with this advantage, that it may be so adapted as easily to permit replacement by a new one as often as required.

To secure the dial against movements of the air, it is necessary that it be covered with a hemisphere of glass resting on the stand of the instrument, in the manner of a French shade. The hemisphere, however necessary in this respect, produces an effect which, unless obviated, would render the dial useless: when placed in sunshine, a caustic of reflection illuminates the exact spot of the dial-plate where the shadow of the hair-style ought to fall; hence there could be no shadow. The obvious remedy is to paint the reflecting portion of the interior of the hemisphere with dull black paint.

A lifter constantly sustains the weight of the dial, unless when it is in use, to prevent the effects of friction on the very sharp steel point. The whole instrument is mounted on a pillar, for reasons which will hereafter appear.

When the radius of the dial is about five inches, the shadow of the hair-style, although weak, will reach the graduation in all parts, spread out by penumbra, it is true, towards its termination amongst the noontide long hour-lines; but still, if its centre be observed, adequate to indicate the time with sufficient distinctness for ordinary purposes. If greater accuracy be required, as for setting clocks and watches, where standard time-keepers are not accessible, the following mode of observation will be found sufficient; and herein is one of the peculiar advantages of this construction:—Let the observer place himself in such a situation that, one eye being closed, he can with the other see both the hair-style and the strongest and narrowest part of the shadow united into one line. At that moment, let him glance his eye along the hair-style to the graduation, where the hair will appear upon one or other of

the divisions of the hour-circle, or between two of them; and in this way the time can be easily estimated to half a minute, supposing the hours to be subdivided into spaces equal to three minutes each.

But there may be situations of the sun, or of the dial, or of the observer, or there may be peculiarities of his vision, which would render the ascertainment of the hour by the foregoing method impracticable. In such cases a new method becomes necessary, to attain precision, the object of which is practically to efface the penumbra, the great enemy to all gnomonic observations.

After unsuccessfully trying a number of experiments, I found that, by the employment of the following appendage, definiteness may be given to the spread and weak part of the shadow, and the penumbra reduced to an imperceptible size. It consists of a hoop of brass about two inches in diameter, and three-quarters of an inch in depth, soldered at one end to a circular plate of brass of the same diameter, a sufficiency of the centre of which has been cut out for the insertion of a double concave lens about an inch and a quarter in diameter. The lens should be of about four inches imaginary focus, and of equal concavity on both sides; its precise centre should be found, and permanently marked, by a method well known to opticians. On this centre a very small dot is to be made by applying to it the section of a common pin dipped in strong Indian ink. A handle completes the instrument.

To use this, it is to be placed with its open end opposite the sun, so that the whole bottom shall be illuminated, and that no part of the hoop shall cast its shadow within; for then the axis of the lens will fairly be pointed towards the sun. If the lens be held in this position over the hair-style at such a distance (within an inch or two) as gives the thinnest shadow of the hair, a very large, somewhat dark, oval will appear on the dial-plate, surrounded by a broad luminous border. The shadow of the hair-style will now appear broken into two parts near the middle of its length; the parts diverge from each other, one being in the luminous border, the other in the dark oval. The shadow of the Indian ink dot will appear somewhere in the dark portion as a small oval spot, very weak, and surrounded by penumbra. If the lens be moved to the right or left, as the case may require, the two dislocated parts of the shadow of the hair-style will approach each other, and join end to end, forming one straight black line, which must be made to bisect the shadow caused by the dot of Indian ink. This bisection can be done by estimation with very great accuracy, provided the sunlight be sufficiently strong. The straight black line, thus generated by the reunion of its parts, is now destitute of any perceptible penumbra; is longer and stronger than before, and definite. It is capable of reaching and even passing the most distant figures on the dial-plate, and is so narrow that by means of it the observer may estimate half minutes with correctness; whereas, in its natural state it would fill up a space equal to three minutes.

The use of the Indian ink dot on the lens is this: although by moving the lens one way or the other, the broken ends of the two shadows may be united as already described, they may not truly coincide, yet the eye may not be adequate to detect a minute want of coincidence; but

exact coincidence is insured by bisection of the shadow of the black dot; and if that shadow be made to fall very near the graduation, the hour will be precisely and distinctly indicated. The whole operation, which has taken so long to describe, may be performed in three or four seconds.

I found that a large double convex lens also answered for this purpose admirably, with the exception that, as it required to be held at a great distance from the dial, it was very inconvenient.

As movable sundials are intended chiefly for occasional service, and in cities and towns are best adapted for use in the house, attention is required in the selection of a proper situation. The magnetic bar, it is true, will determine the meridional position of the dial; but that position is liable to be disturbed by the numerous appendages belonging to a house, such as massive fire-grates, window-bars, balconies, locks, hinges, and even nails. The dial is naturally brought to the source of light, the open window; and indeed there is seldom any other situation where it can conveniently be exposed to full sunshine. There, however, independently of the before-mentioned causes of derangement, an unsuspected one lurks unseen, which exerts a more detrimental influence than all the others together. On each side of the window are the sash-weights, which, beside their passive reaction on the magnetic bar of the dial, are generally magnetic in their own nature. When the lower sash is raised, its two weights are lowered, and brought within the influence of the magnetic bar; and, in consequence of their inequality of attractive power, it is difficult to find an intermediate spot where they neutralize each other. Besides, the sun may not be then shining in the intermediate spot. For this, and other reasons assigned, it is necessary that the dial should be furnished with means of obviating the disturbing influences which may cause the instrument to show erroneous time, as I have found it to do even to the amount of half an hour, under some circumstances. The remedy is to be found in the following appendages:—

Erected on the stand of the dial is a brass pin, tapered off to a fine point, which, being bent at right angles over the declination arc, and very close to it, indicates how many degrees (if any) the dial-plate is out of its proper position for showing the hour. This pin may be distinguished by the name of the Indicator.

A brass bar, fixed to the stand of the dial, and projecting beyond its circumference, supports a very small ball of soft iron by an arrangement which permits it to be approached towards the magnetic bar on either side, or removed from it, as the case may require; or it may be turned away entirely.

An arm of wood, consisting of three thin narrow slips, so jointed that they can be folded in when not in use, or drawn out and tightened, is movable round the centre underneath the stand. When drawn out, the position of the bar is horizontal; at its end is a light card-paper box, in which a graduated circle is drawn. This circle is traversed by a compass-needle sustained on a steel point. By the length of the arm, which is two feet, the compass-needle, a very small and light one, is removed out of the influence of the magnetic bar, as well as of the mass of iron from which disturbance was apprehended.

The appendages now described come into operation, when it is found that the dial shows incorrect time, notwithstanding that all its parts are in proper relation and condition; for it is then certain that the proximity of iron is the cause. Let the dial be brought to some unquestionable situation in the room or elsewhere: it will take its just position. Draw the folding arms fully out. Turn the dial in such a manner as will cause the indicator to lie exactly over the index mark on the end of the magnetic bar; both indicator and index mark will then point to the degree on the declination arc which corresponds with the declination of the needle at that period. Note the degree of the graduated circle to which the compass-needle happens at that time to point; or if it do not point to any one exactly, move the arm a little, that it may do so, and tighten the joint.

In this state let the instrument be brought to the place of sunshine, taking great care not to alter the relative position of the parts: it is to be placed in such a position that the compass-needle shall again point exactly to the same degree as it did previously. It will now be found that the dial has turned on its pivot several degrees, more or less, away from the indicator. Advance the iron ball to one side or the other of the magnetic bar, until the latter be attracted to its proper position, which will be when the index mark again coincides with the indicator. The dial will now show solar time correctly, notwithstanding the presence of the mass of iron which caused the disturbance, and will remain in proper position, undeviatingly, while this condition of its parts continues.

Nothing remains to be described except that on the lower part of the glass shade is a table of the equation of time for every day in the year.

The following is a summary of the advantages expected from this kind of sundial, if accurately constructed:—It may be removed from place to place, according to change of sunshine, when it will spontaneously assume its proper position. Its situation, whether temporary or permanent, may be in immediate proximity to the iron fixtures of a house, yet no error of time will result. The very small error occasioned by variation of terrestrial magnetism is easily rectified when its amount is worth while. The reading of the shadow on the graduation is rendered more precise. The penumbra is practically effaced. The error of the common sundial, amounting to two minutes, during the passage of the sun across the meridian, and to one minute before and after that period, does not in this dial occur. Finally, it is obvious that although in point of fact the influence of diurnal magnetic declination is not avoided, its effect on the time indicated is altogether too minute to be appreciable on so small a dial.

In conclusion, it is to be observed that, unless when the hour is required to be known with great accuracy, as for setting clocks, nothing more than simple inspection of the shadow on the dial is necessary.

A catalogue of Donations to the Library received since 9th November last was read, and thanks returned to the several donors.

MONDAY, JANUARY 24, 1859.

JAMES HENTHORN TODD, D.D., President, in the Chair.

THE REV. J. H. JELLETT read a paper—

ON THE REFLEXION AND REFRACTION OF POLARIZED LIGHT.

THE object which the author has in view in this communication is to ascertain how far the theory of light which had been proposed by M. Cauchy can be considered to have been experimentally established by the observations of M. Jamin. For this purpose it is necessary to ascertain—

1. Whether the values of any of the quantities by which a ray of light is defined, as deduced from theory, differ from those given by experiment, by an amount greater than the necessary error of observation.

2. What variation the theoretic expressions admit of, preserving the necessary amount of agreement with observation.

In examining this question, he drew attention to the remarkable fact first noticed by Mr. Haughton, namely, that the expressions given by Cauchy and a modified form of those given by Green, although these expressions are essentially different, agree, so far as the case of reflexion is concerned, equally well with the experimental results of M. Jamin. This agreement between the expressions he accounted for by showing that the four equations of which each system consists may be reduced to the following form:—

One equation containing a constant depending upon the nature of the substance, and distinct from its index of refraction.

Three equations which do not contain any experimental constant.

Of this system of equations, the first alone is different in the two systems, the remaining three being the same in both. He showed from this, that by a proper determination of the experimental constant, a tolerable agreement between these equations may be insured.

He then proceeded to compare the values of the amplitude and phase of the reflected ray, as deduced by M. Jamin from theory and observation respectively, and showed that for certain values of the angle of incidence, the differences were too great to be ascribed to errors of observation.

Examining then the value given by M. Cauchy for the amplitude of the reflected ray, he showed that this expression would admit of very great variation, without ceasing to represent with sufficient exactness the results of observation.

On the whole, assuming the experiments of M. Jamin to have been accurately made, he concluded that these expressions did not represent the facts with sufficient accuracy; and further, that with regard, at least, to the value of the amplitude, the nature of the expression is such as to render an experimental proof of its truth very difficult.

The substance to which these statements refer is the transparent sulphuret of arsenic; this substance is selected because the experimental results of Jamin, and the values given by Fresnel, differ more widely for this substance than for any other. It furnishes, therefore, the best test of any new theory.

Mr. Jellett stated that he had obtained for the new constant, which M. Jamin calls "coefficient of ellipticity," a value sensibly different from that given by M. Jamin. The value of this constant given by M. Jamin for sulphuret of arsenic is

0·0791,

while that obtained by Mr. Jellett is

0·0914.

The Rev. Samuel Haughton made some remarks on Mr. Jellett's paper.

Lord Talbot de Malahide, on the part of T. A. Wise, M. D., presented a cast of a stone cross which had been discovered in Perthshire.

Dr. Wise in the accompanying paper describes this sepulchral cross, recently discovered, and similar in character to a numerous class of crosses well known to Scotch antiquaries.

They are well described and portrayed in two fine works, "The Ancient Sculptured Monuments of Angus," by the late Mr. Chalmers of Auldbar, and "The Sculptured Stones of Scotland," published by the Spalding Club, through Mr. John Stuart, the able Secretary of the Antiquaries of Scotland.

These crosses are, with few exceptions, confined to the part of Scotland north of the Forth, but range through the eastern counties as far as Caithness, and even to Shetland. They are most numerous in the districts formerly occupied by the kingdom of the Picts.

With considerable resemblances to the Irish crosses, they differ in many important respects. They contain, frequently, hunting scenes and very strange animals, such as bears, lions, elephants, centaurs, &c. There are numerous emblems, such as the mirror and spectacle ornament described by Dr. Wise, and also many others which are hitherto unexplained. As a general rule, they have no inscriptions. Almost the only exceptions are the stone at Newton, on the Garioch, which has a Runic or Ogham inscription, and also another in an unknown character; there is also an inscribed stone at Brechin, and there is a stone at Bressay, in Shetland, with an inscription in Runes. A cast of this was exhibited at the Newcastle Meeting of the Archæological Institute; and it is very much to be desired that Professor Graves, who has done so much in this field of research, would give his interpretation of it.

There is another kind of crosses which are not included in those publications, found at Iona, and other parts of the west of Scotland. They are of a Scandinavian character.

ON A CAST OF A STONE CROSS FORWARDED TO THE ROYAL IRISH ACADEMY

BY T. A. WISE, M. D.

THIS cast* was prepared from a beautiful stone cross which was recently discovered at Meigle, in Strathmore, and is considered a good specimen of a numerous class found in that part of Scotland which formed the ancient kingdom of Pictania, that existed from the third to the ninth century. Those crosses are all peculiar in their form, and in the character of their ornaments; are believed to be of a very early date, of which history makes no mention, and they differ from those of the west and south of Scotland. The present specimen will afford the Members of the Royal Irish Academy an opportunity of comparing it with the numerous and beautiful crosses of Ireland.

This cross, like many others, had been broken and thrown down, probably at the time of the Reformation in Scotland, and was recently found on removing a malt-kiln which had been erected one hundred and fifty years ago. The original of this, and three other fragments of crosses and sculptured stones, had been used in the building, and, unfortunately, the one the cast of which is now forwarded to the Academy, was considerably injured by its proximity to the fire-place.

These beautiful crosses of Scotland are from two to fourteen feet in length,† and differ from those in Ireland by being carved in relief from the face of the stone, with monstrous animals in the margin, and on a large proportion of them is carved the beautiful interlaced ornament which has been found in some Irish manuscripts.‡ The back of these crosses represents processions of men on horseback and on foot, with hunting dogs, and various eastern animals, such as lions, elephants, serpents, camels, brahminic-bulls, centaurs, &c.

An interesting peculiarity of these crosses in Scotland is, that thirty-nine have the Christian cross, with more or less decorations; fifty-nine have peculiar symbols, along with the Christian cross; and fifty-one have these symbols alone on erect stones, seven of which are more or less connected with circles of stones;§ so that we have a link between what are called Druidical circles and the stones with the peculiar symbols which seem to be Buddhistical; and then again combined with crosses erected by the large and peculiar sect of primitive Christians.

The eastern symbols on these stones consist of two circles joined together by a belt forming the Buddhist *droge*, or symbol of the Deity;‖ and in the present cast this peculiar symbol appears on the left side of the cross, and merely consists of a circle with half the belt, which indicates the spiritual Deity, or Providence, and, when completed, would

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* By Mr. Laing, Edinburgh.

† Sueno's Stone at Forres is an example, being 23 feet above the ground.

‡ Wilson's "Prehistoric Annals of Scotland," p. 497.

§ I beg to enclose a few copies of an Essay on the subject, which was read before the Royal Society, Edinburgh. See also vol. ii., part 2.

‖ "Sculptured Stones of Scotland," by the Spalding Club.

have formed the Buddhist triad, or "*droge symbol.*" A similar representation is found on other stones, in which the third member of the triad, or organized matter, was a segment of a circle, a bird, and in the present instance appeared to be a monstrous elephant.

Those heathen symbols, in combination with the Christian cross, prove the liberality of their sentiments, when, probably, a large proportion of the Celtic nation were idolaters; and they are peculiarly interesting, as, probably, the same symbols will be found in Ireland and other Celtic countries, and thus prove an analogy in the belief of those nations before they became Christian.

It is probable that the original of the cross now before the Academy was placed over the grave of the chief represented on horseback, on the back of the stone, who had changed the Pagan worship for that of the Christian faith.

The thanks of the Meeting were voted to Dr. Wise for this valuable gift.

MONDAY, FEBRUARY 14, 1859.

JOHN KELLS INGRAM, LL.D., Vice-President, in the Chair.

JOSEPH REAY GREENE, Esq., Professor of Natural History, Queen's College, Cork, was elected a Member of the Academy.

DR. E. PERCEVAL WRIGHT, F. L. S., read a paper by PROFESSOR J. REAY GREENE—

ON THE MORPHOLOGY OF THE HYDROZOA, WITH REFERENCE TO THE CONSTITUTION OF THE SUB-KINGDOM CŒLENTERATA.

THE author commented on the zoological relations of the animal forms included by Cuvier under the classes Polypi and Acalephæ, and showed the necessity of uniting these organisms into a sub-kingdom by themselves, as had been done by Frey and Leuckart, the results of whose labours had been further corroborated by the independent observations of Huxley. For this sub-kingdom the name "Cœlenterata," had been proposed by its founders. The author next proceeded to prove that the classes Polypi and Acalephæ of Cuvier were far from natural, inasmuch as they were framed without a due regard to anatomical characters. He then considered, in detail, the morphology of the groups in question, and, after reviewing the results of the investigations of Huxley, Köellker, Leuckart, Vogt, and others, concluded by presenting the following classification of the Cœlenterate sub-kingdom:—

SUB-KINGDOM.—CŒLENTERATA.

Animals in which the digestive canal freely communicates with the general cavity of the body. Substance of the body consisting of two distinct layers. The peculiar urticating organs termed "thread cells" usually present.

Class I.—Hydrozoa.

Cœlenterate animals, in which the wall of the digestive sac is identical with that of the general cavity of the body, and the reproductive organs are external.

Order 1.—*Hydridæ.*

Animal consisting of a single naked polype. Locomotive.

Order 2.—*Tubularidæ.*

Animal consisting of one polype, or of several connected by a "cœnosarc." Fixed. Polypes naked.

Order 3.—*Sertularidæ.*

Animal consisting of several polypes, connected by a cœnosarc. Fixed. Polypes protected by cells.

Order 4.—*Calycophoridæ.*

Animal consisting of several polypes, connected by a cœnosarc, furnished with natatorial organs. Oceanic.

Order 5.—*Physophoridæ.*

Animal consisting of several polypes, connected by a cœnosarc, with or without natatorial organs. Upper extremity of cœnosarc dilated into a "float." Oceanic.

Order 6.—*Medusidæ.*

Animal consisting of a polype suspended from the under surface of a natatorial organ. Oceanic.

Order 7.—*Lucernaridæ.*

Animal consisting of a polype situated in the centre of a natatorial organ furnished with adherent base. Fixed or locomotive.

Class II.—Actinozoa.

Cœlenterate animals, in which the wall of the digestive sac is separated from that of the general cavity of the body by an intervening space, subdivided into chambers by a series of vertical perigastric partitions, on the sides of which the reproductive bodies are situated.

a. *Parts of the body in number some multiple of five or six.*

Order 1.—*Zoantharia.*

Polypes with simple (rarely branched) tentacula, usually numerous. Solitary or aggregated. Sedentary or locomotive, seldom oceanic.

b. *Parts of the body in number some multiple of four.*

Order 2.—*Rugosa.*

Animal unknown. Corallum thecal, with septa and tabulæ.

Order 3.—*Alcyonaria.*

Polypes with eight fringed tentacula. Always aggregated. Never locomotive.

Order 4.—*Ctenophora.*

Oceanic, free-swimming, transparent, gelatinous Actinozoa, moving by means of vertical rows of ciliated plates.

The author further remarked that the above classification differed more in appearance than in reality from the arrangements of other naturalists. The Hydromedusidæ of Vogt contained all the forms included among the Hydrozoa, as above defined, with the sole exception of the genus Lucernaria. The Acalephæ of Agassiz and Milne-Edwards may be regarded as equivalent to the Hydromedusidæ of Vogt, together with the order Ctenophora. The slowness of zoologists to recognise the true affinities of the last-mentioned group offers, at present, almost the only obstacle to the diffusion of sound views in reference to the subjects discussed in the foregoing paper.

The following antiquities were presented to the Museum :—

By Frederick Grome, Esq. :—A curious bone pin, found in a field between Miltown and Newbridge, county of Kildare, with an iron dagger, and the skeletons of a man and horse; also two encaustic tiles found at Great Connell Abbey, county of Kildare.

By Aquilla Smith, M.D. :—An impression of a seal in the muniment room of the Corporation of the city of Dublin, the legend being "Sigillum Thomæ Cros Custodis le Presonarum."

By Mr. John Evans :—A human skull found built up in a cavity of the wall of Newgate prison, Dublin.

The following Resolution, recommended by the Council, viz. :—"To open a subscription for the purpose of completing the Catalogue of the Museum," having been put by the Chairman—

It was moved—"That the Academy do now adjourn."

A division having taken place, the Chairman declared that the amendment had been carried, and the Academy adjourned accordingly.

MONDAY, FEBRUARY 28, 1859.

James Henthorn Todd, D.D., President, in the Chair.

The Secretary of the Academy announced that a collection of Irish antiquities belonging to the Royal Dublin Society had been deposited in the Academy for exhibition, and that the President had signed a receipt for them in the following terms :—"That each article exhibited shall be labelled as the property of the Royal Dublin Society, and with the name of the donor, in case such can be ascertained; and that the said specimens shall be preserved with equal care as if they were the property of the Royal Irish Academy; and that they shall be returned whenever they are demanded by the said Royal Dublin Society; and if the said seventy-nine specimens be not returned, on being so demanded by the said Royal Dublin Society, then the said Royal Irish Academy

shall forfeit the sum of one hundred pounds sterling;"—whereupon it was—

Resolved—"That the act of the President and Council in accepting this loan of antiquities from the Royal Dublin Society be ratified by the Academy, according to the terms of the receipt signed by the President."

The President having ruled that the vote of adjournment of the Academy at its last meeting had the effect only of postponing the discussion of the recommendation of the Council passed at their meeting of 7th February, 1859, viz.:—"That a subscription be opened for the purpose of completing the Catalogue of the Museum,"—the discussion was resumed accordingly, and on a division the proposition of the Council was adopted by a majority of four, the numbers being—15 for the Resolution, and 11 against it.

The Secretary of the Academy read a letter from W. R. Wilde, Esq., on the subject of the preparation of the Catalogue;—whereupon it was—

Moved by J. F. Waller, LL. D., and seconded by the Rev. Charles Graves, and resolved:—"That Mr. Wilde's letter be referred to the Council, with a view to its being entered on the Minutes of the Academy."

Sir William Rowan Hamilton, LL.D., communicated the following paper:—

ON SOME QUATERNION EQUATIONS CONNECTED WITH FRESNEL'S WAVE-SURFACE FOR BIAXAL CRYSTALS.

1. The ellipsoid of which the three semi-axes are usually denoted as a, b, c, in statements of the Fresnelian theory of the wave-surface in a biaxal crystal, being here represented by the equation,

$$S\rho\phi\rho = 1,$$

where the vector function ϕ has the distributive and other properties described by Sir W. R. H., in his Seventh Lecture on Quaternions, it follows from the physical principles, or hypotheses, of Fresnel, that a small displacement, $\delta\rho$, of a molecule of the ether in a crystal, gives rise to an elastic force, which may be denoted by $\phi^{-1}\,\delta\rho$. But if this displacement, $\delta\rho$, be (as is assumed) tangential to a wave-front in the medium, to which the vector μ is normal, and of which the tensor $T\mu$ denotes the slowness of propagation, so that μ may be called the Index-Vector, then the tangential component of the elastic force must admit of being represented by $\mu^{-2}\,\delta\rho$. Hence the normal component of the same force (supposed by Fresnel to be destroyed by the incompressibility of the ether) must admit of being denoted by the symbol,

$$(\phi^{-1} - \mu^{-2})\,\delta\rho;$$

which symbol must, therefore, admit of being equated to a vector of the form $\mu^{-1}\,\delta m$, δm being a small scalar. We are, therefore, at liberty to write the following symbolical expression for the displacement supposed by Fresnel to exist:

$$\delta\rho = (\phi^{-1} - \mu^{-2})^{-1}\,\mu^{-1}\,\delta m.$$

But it has been supposed that the displacement $\delta\rho$ is tangential to the wave, or perpendicular to μ; if therefore we write,

$$\tau\delta m = \mu^{-1}\,\delta\rho, \text{ or } \tau = \mu^{-1}\,(\phi^{-1} - \mu^{-2})^{-1}\,\mu^{-1},$$

then τ is at least a *vector*, *even* on the principles of Fresnel: while, on those of Mac Cullagh and of Neumann, it would have the direction of the *true* displacement, or vibration, within the crystal. And thus, *without any labour of calculation*, but simply by the *expressing* of the fundamental *conceptions* of Fresnel's theory in the LANGUAGE of Quaternions, Sir W. R. H. obtains an *Equation of the Index-surface*, under the following SYMBOLICAL FORM:—

$$0 = S\,\mu^{-1}\,(\phi^{-1} - \mu^{-2})^{-1}\,\mu^{-1}; \qquad \text{(a)}$$

which is easily transformed into the following:—

$$1 = S\,\mu\,(\mu^2 - \phi)^{-1}\,\mu. \qquad \text{(a')}$$

He has also verified, that when he writes,

$$\phi = \alpha^{-1}\,S\,.\,\alpha^{-1} + \beta^{-1}\,S\,.\,\beta^{-1} + \gamma^{-1}\,S\,.\,\gamma^{-1},$$

α, β, γ, being three rectangular vectors, whereof the lengths are a, b, c, an easy quaternion *translation* enables him to pass from these last forms to certain others, although less concise ones, for the equation of the index surface, expressed in rectangular co-ordinates; one, at least, of which latter forms (he believes) was assigned by Fresnel himself.

2. To pass next to the *Equation of the Wave-surface*, let ρ be the vector of that surface; or the vector of Ray-velocity; or simply, the RAY-VECTOR. It is connected with the index-vector, μ (if this last vector be supposed to be measured in the direction of wave-propagation *itself*, and *not* in the *opposite* direction,) by the relations,

$$S\mu\rho = -1, \qquad S\rho\delta\mu = 0;$$

with which may be combined their easy consequence,

$$S\mu\delta\rho = 0,$$

which assists to express the *reciprocity* of the two surfaces. Hence, by some *very unlaborious* (although, perhaps, *not obvious*) processes, depending on the published principles of the Quaternions, and especially on those of the Seventh Lecture, but in which it is found to be convenient to introduce an *auxiliary vector*,

$$\upsilon = (\mu^2 - \phi)^{-1}\,\mu,$$

(which may be considered to have both geometrical and physical significations,) Sir W. R. H. infers that υ is perpendicular to ρ; and also that it may be thus expressed as a function thereof:—

$$\upsilon = (\phi - \rho^{-2})^{-1}\,\rho^{-1}.$$

An immediate result is, that the "Equation of the Wave" may be *symbolically expressed* as follows:—

$$0 = S\rho^{-1}\,(\phi - \rho^{-2})^{-1}\,\rho^{-1}\,; \tag{b}$$

or, by an easy transformation,—

$$1 = S\rho\,(\rho^{2} - \phi^{-1})^{-1}\,\rho. \tag{b'}$$

Of these formulæ, likewise, the agreement with known results (including one of his own) has been verified by Sir W. R. H., who has also found that it is as easy to *return*, in the quaternion calculations, from the wave to the index-surface, as it had been to *pass* from the latter to the former: the only difference worth mentioning between the two processes being this, that when we interchange μ and ρ, in any one of these formulæ, we are at the same time to change the *symbol of operation*, ϕ, to the *inverse operational symbol*, ϕ^{-1}.

3. From the expression (b), by the introduction of two auxiliary and constant vectors, ι, κ, such that (as in the Lecture above cited) the following identity holds good:—

$$S\rho\phi\rho = \left(\frac{T(\iota\rho + \rho\kappa)}{\kappa^{2} - \iota^{2}}\right)^{2},$$

Sir W. R. H. has lately succeeded in deducing, in a new way, a less symbolical, but more developed, *quaternion form* for the Equation of the Wave, which he communicated in 1849 to a few scientific friends, and which he wishes to be allowed to put on record here: namely, the equation,

$$(\kappa^{2} - \iota^{2})^{2} = \{S(\iota - \kappa)\rho\}^{2} + (TV\iota\rho \pm TV\kappa\rho)^{2}\,; \tag{c}$$

which exhibits the *physical property* of the two vectors, ι, κ, as *lines of single ray-velocity*; and is also adapted to *express*, and even to *suggest*, certain *conical cusps* and *circular ridges* on the Biaxal Wave, discussed many years ago.

In the course of a recent correspondence, on the subject of the quaternions, with Peter G. Tait, Esq., Professor of Mathematics in the Queen's College, Belfast, Sir W. R. Hamilton has learned that Professor Tait has independently arrived at this last form (c) of the Equation of Fresnel's Wave; and he hopes that the *method* employed by Mr. Tait will soon be, through some channel, made public. In the meantime he desires to add, for himself, that he is not to be understood as here offering any *opinion* of his own on the rival merits of any *physical hypotheses* which have been proposed respecting the *directions* of the *vibrations* in a crystal, or other things therewith connected; but merely as *applying* the Calculus of Quaternions, considered as a Mathematical Organ, to the *statement* and *combination* of a few of those hypotheses, especially as bearing on the Wave.

(*To be continued.*)

WEDNESDAY, MARCH 16, 1859.

JAMES HENTHORN TODD, D. D., President, in the Chair.

THE Secretary of the Council read the following Report from the Council:—

REPORT.

THE history of the Academy for the past year does not present much which calls for remark on the part of the Council.

In presenting their Report for the Session 1857–58, the Council stated to the Academy that during the previous year the printing of their "Transactions" had been almost entirely suspended, in consequence of deficiency in our funds.

The Resolution then adopted by the Academy, as also the completion of the first part of the Catalogue, having removed this difficulty, the printing of our "Transactions" has been resumed; and the following papers have been completed, and are now nearly ready for publication:—

Rev. Dr. Robinson on "The Lifting Power of the Electro-Magnet."

Rev. Dr. Lloyd on "The Determination of the Earth's Magnetic Force."

Dr. Kinahan "On the Genus Oldhamia."

Professors Jukes and Haughton on "The Lower Palæozoic Rocks of the South-East of Ireland."

Lieutenant Renny on "The Constants of the Barometric Formulæ."

These papers together make about twenty sheets.

The Academy will observe that the papers above enumerated belong exclusively to the department of Science. It is a matter for regret that no addition has, during the past year, been made to our "Transactions" in either of the departments of Polite Literature or Antiquities. The Council trust, however, that this is to be ascribed to accidental causes, and not to any permanent relaxation in the activity of our Members.

The twenty-third volume of our "Transactions" is now almost ready for publication. It will contain, besides the papers already enumerated, the following, which were printed before the Stated Meeting of 1858:—

In Science, Rev. George Salmon on "The Degree of a Surface reciprocal to a given one."

Lieutenant Renny on "The Barometric Measurement of Heights."

Professor Downing on "The Draining of Lake Haarlem."

Mr. Forster on the "Molecular Constitution of Crystals."

In Polite Literature:—From the Rev. Dr. Hincks, "On the Assyrian Personal Pronoun." Rev. James Wills, "On Dreams." Rev. Dr. Hincks, "On a Tablet in the British Museum."

In Antiquities:—From the President, "On an ancient Irish Missal."

Besides these papers, which have not yet been published, the twenty-third volume contains:—Professor Haughton's "Memoir on the Diurnal Tides on the Irish Coasts." Mr. Donovan, "On the Deflections of the

Galvanometer producible by Attrition and Contact of Metals;" and Mr. Mallet, "On the Construction of Artillery."

These papers have been already published.

The Academy have received during the past year many interesting communications, notices of which have appeared in our Proceedings.

In Mathematics we have had communications from Sir William R. Hamilton, Rev. Professor Graves, and Mr. Stoney.

In the Sciences of Observation and Experiment, from Dr. Kinahan, Professor Jukes, Professor Haughton, Professor Jellett, Mr. Donovan, Professor Greene, and Mr. Jennings.

In the department of Medical Science the Academy will remember that an interesting Report on the remarkable case of M. Groux was laid before us by a Committee which had been appointed to investigate the matter.

In Polite Literature we have had communications from Mr. Crofton and Mr. Drennan.

In Antiquities, from the President, Mr. Wilde, the Archdeacon of Ardfert, and Dr. Reeves.

It was with very great regret that the Council found themselves obliged to suspend all works connected with the Second Part of the Catalogue of our Museum; but the exhaustion of the fund which had been appropriated to the purpose of completing it left them, unfortunately, no alternative. Conscious, however, that so important a work should not remain unfinished, the Council have taken the only means in their power for completing it, by recommending the Academy to open a subscription for that purpose. This recommendation having been adopted by the Academy, it now rests with the individual members to decide whether or not this work shall be completed. It is highly desirable that the registration, at least, of the articles in our Museum should be finished, as this is necessary for their safe keeping.

The Council would remind the Academy that Mr. Wilde has devoted much of his valuable time to this object, and has collected a great deal of important information on the history of various articles in the Museum, which, but for his zeal and industry, would, in all probability, have been entirely lost. The best and almost the only way in which the Academy can manifest their gratitude to Mr. Wilde for his disinterested services will be by contributing to a fund which will enable him to continue and (if the fund collected be sufficient) to complete his undertaking.

Four Cunningham Medals were presented during the past year: two in Science, one in Polite Literature, and one in Antiquities.

In the department of Science the medals were awarded to the Rev. George Salmon, for his "Researches in Analytic Geometry;" and to Mr. Cooper, for his "Catalogue of Ecliptic Stars."

In Polite Literature, a medal was awarded to the Rev. Dr. Wall, for his "Researches in Oriental Literature," and in Antiquities, to the Rev. Dr. Reeves, for his edition of "Adamman's Life of St. Columba."

The Council have much satisfaction in stating that the finances of

the Academy are steadily recovering from the drain produced on them by the payments made, some years since, for the liquidation of the expenditure of former years. All bills for printing, &c., have been discharged up to the present date. There are no outstanding liabilities; and the Council trust that, by the exercise of a judicious economy, satisfactory provision may be made for the immediate publication of all papers of literary or scientific interest.

The Academy has lost by death during the past year eight Members, viz.:—

JOHN PURSER, Esq., Sen.; elected 8th January, 1849.
HENRY JOSEPH MONCK MASON, LL.D.; elected 22nd June, 1812.
ROBERT HARRISON, M. D.; elected 25th January, 1850.
SIR PHILIP CRAMPTON, Bart.; elected 30th January, 1840.
REV. WILLIAM DIGBY SADLEIR, D. D.; elected 25th February, 1835.
THOMAS HAWKESWORTH LEDWICH, M. D.; elected 12th May, 1856.
HENRY CLARE, Esq.; elected 12th February, 1844.
VERY REV. JAMES GREGORY, Dean of Kildare; elected 11th Dec., 1837.

And three Honorary Members, viz.:—

ROBERT BROWNE, M. D.
GEORGE COMBE, Esq.
DAWSON TURNER, Esq.

Nine Members have been elected within the year, viz.:—

Rev. Charles B. Gibson.
Edmond T. Palmer, Esq.
Thomas Brooke, Esq.
Sir Henry J. Brownrigg.
Venerable Frederick Goold, Archdeacon of Raphoe.
His Grace the Duke of Manchester.
Alphonse Gages, Esq.
James G. Hildige, M. D.
Joseph R. Greene, Esq.

No Honorary Members were elected.

Resolved—That the Report of the Council be adopted.

The following Supplement to the Report was laid on the table, and ordered by the Council to be printed.

The following list of Antiquities purchased from the 16th of March, 1858, to the 16th of March, 1859, was supplied by W. R. Wilde, Esq., in accordance with a Resolution of the Committee of Antiquities, adopted at the recommendation of the Council, to the effect that a descriptive list of donations and purchases, together with the articles themselves, and the cost thereof, should be laid before the Academy every quarter.

The articles are arranged according to the classification adopted in the Catalogue, and numbered in continuation of the different species in the printed Catalogue, or the manuscript registration. Mr. Wilde begs to add, that if this mode of registering the purchases and donations be persevered in, it will in future serve as a continuation of the Catalogue, and save the Academy much expense.

Stone Materials.—A long, round celt, of syenitic greenstone porphyry, composed of dark-green hornblende, and crystals of pink felspar, well polished, 7 inches long, and 2¾ broad; numbered in continuation of the printed Catalogue, 514.

A curved flint-flake of the knife form, 3 inches long by 1 inch broad; No. 1277. Both these specimens formed part of a collection of sixteen articles, principally bronze celts and palstaves, procured from Mr. J. Dillon, of the county of Limerick, for £2 17 6

Thirteen flat pieces of stone, circular, quadrilateral, and oblong, &c., most of them perforated, and all more or less ornamented, similar to those described at page 125 of the printed Catalogue, and numbered in continuation thereof, from 15 to 27, in Rail-case C. They were all discovered in the Ballinderry Crannoge, and were bought, along with several other articles of bone, bronze, and iron, said to have been discovered in the same locality, from P. Fagan, for £2 0 0

A crystal globe, 1¾ inches in diameter, encircled with two silver bands, to which a handle is attached; one of these cross-bands opens with a hinge. It is similar to those crystal balls already in the Museum, and described at page 127 of the printed Catalogue, and is now No. 3, in Rail-case C. It had been in the possession of the late Mr. Boylan, of Grafton-street, for several years, and cost, with the following article,— £4 0 0

An oval crystal ornament, set in silver, having the reverse engraved with an Irish scroll, and some vestiges of a figure. To be registered among the Ecclesiastical Antiquities.

Earthen Materials.—A very beautiful cinerary urn, now numbered 49, in continuation of those in the printed Catalogue. It is of the vase shape, 5½ inches high, 6½ in diameter of mouth, and 7⅓ in the widest part. Although the material of which it is composed is not of so fine a character as that of many of the other urns in the Museum, the style of ornamentation is unique, and much more complicated than in any other specimen. It was found in a stone chamber at the moat of Sionan, near Horseleap, county of Westmeath, and was purchased from P. Fagan, for £0 15 0

Four beads, one of vitrified paste, and three of rough coloured glass, purchased along with the former, and now numbered 181 to 184 in Rail-case D.

Vegetable Material.—A sword-shaped piece of black oak, 2 feet long, with an aperture in the handle, No. 157, also from Ballinderry.

Two wooden pins, numbered 15 and 16, in Rail-case E, in continuation of page 214 of the printed Catalogue. The former, which is 5½ inches long, is very beautifully decorated with an indented pattern in the form of a Grecian scroll. Like most of the articles of this description, they were found in a crannoge—that of Ballinderry.

A two-horse yoke, in a very fine state of preservation, and formed out of a piece of ash; 2 feet 10 inches long, and resembling No. 142 in the printed Catalogue, after the articles in which it follows, as No. 154. It was found in the bog of Tubberdony, near Dervock, in the county of Antrim, and was purchased from J. O'Donnell, for . . . £0 15 0

Two flat wooden platters, or butter dishes, of willow, circular, and differing in shape from any of those already in the collection; numbered 155 and 156; both have side-handles. The former is 15 inches, and the latter 12½ inches in diameter. They were found in the same locality as the horse-yoke, and obtained from the same person. Cost, ... £0 10 0

Animal Material.—Fifteen bone pins, of different patterns, all more or less ornamented, and some with attached heads. They vary in length from 3 to 9 inches, and occupy the numbers from 304 to 318, on Tray C. No. 319 is a bone knife, 7¾ inches long. Nos. 320 to 345 are twenty-six flat pieces of bone, ornamented, and resembling those portions of stone described under the head of "Amusement," at page 125 of the printed Catalogue, also those already referred to in this list, and the bone plates on Tray B. All these articles, together with the pins and knife, were found in the Ballinderry Crannoge, and form part of the purchase of miscellaneous articles obtained from that place.

A bone comb, beautifully ornamented, 2½ inches long, and 1⅝ deep, with a triple open decoration at top. It is the finest of its class in the collection, and possesses a peculiar interest from the side pieces being grooved, apparently for the purpose of receiving the clasp and rivet of a metal tooth intended to replace one of the lost bone ones. In continuity with similar specimens of household economy and the toilet, it will appear as No. 159 on Tray A. It was procured from the Ballinderry Crannoge, and cost £0 5 0

Metallic Materials.—Eight bronze celts and axes, the former exhibiting several ornamental patterns not shown by any other specimens in the collection. They are now numbered from 617 to 624, in continuation of the registry of these articles, and have been placed in Rail-case L. This collection is said to have been made in the county of Limerick, and was purchased, with the stone celt and several other articles, from Mr. Dillon, for £2 17*s.* 6*d.* No. 617 is a long flat celt, 6¾ inches in length, much corroded on one side, but the lacker or varnish well preserved on the other face, which is slightly ornamented. No. 618, a long celt, 6¼ inches, with a broad edge, imperfect at top, but covered with a punched ornamentation on both sides, the patterns of which are different. No. 619, one of the most perfect celts of the long, narrow character, in the collection, highly lackered all over, and ornamented on both surfaces near the cutting edge with double lines of dots. It is 5¾ inches long. No. 620, a lunette-edged celt, 5½ inches long, and 3 inches broad, with rudimentary stop; the surface is much corroded on one side, the lacker is well preserved on the other, and covers a unique form of punched ornamentation, worked with great regularity. No. 621, ditto, 4⅝ inches long, and 2⅝ inches broad, with rudimentary wing and stop; very perfect in the cutting edge, and ornamented with spiral groovings on the side edges. No. 622, a winged celt, or palstave, lunette-faced, 4¼ inches long. No. 623, a rude, small celt, socketed and looped, 2¾ inches long. No. 624, a small, broad, socketed, and looped celt, only 1½ inch in length; it is one of the least of its class in the col-

lection, and apparently was never cleaned off, as the mould-marks remain.

A large winged palstave celt, 7½ inches long, with marks of hammering over the blade. It was found in the Silver River, in the townland of Coleraine Middle, in the King's County. It is numbered 609 in Rail-case L, and was purchased from P. Fagan, with the iron hatchet, No. 234, from the same place, for £0 15 0

A fine bronze spear-head, imperfect at top, numbered 87, on Tray Y; found at Ballymore, in the county of Westmeath. It, together with the cinerary urn, No. 49, the bronze mould, No. 97, and eleven other articles, was purchased from P. Fagan, for . . £1 8 9

A spear, or javelin-head, 3¾ inches long, No. 247, in continuation of the registry after Tray MM. It is the only one of its class or size in the collection in which the side-loops run into the blade. It was purchased from J. Fotterell for £0 7 6

Two small javelin or arrow-heads; No. 248, which is 3¼ inches long, and No. 249, which is 2¾ inches long. Purchased from Mr. Dillon, with the collection of celts already described.

The blade of a short, broad dagger, 5½ inches long, and 1⅞ broad at the bottom, where it is perforated with two holes for passing the rivets which attached it to the metal handle, like those swords and daggers on Trays CC.

A bronze mould of hard brass, No. 97 in Rail-case P, 4 inches long, and 1 inch broad, having three heraldic devices upon it—viz., a griffin passant;—a stag courant;—a hare courant;—and an animal which Sir Bernard Burke says is probably "a wolf passant." They are well cut, and each is surrounded with a square fillet. It was found near Durrow, in the King's County, and purchased along with the spear-head No. 87, and other articles. It is the only article of the kind which has yet been discovered in Ireland, at least that we have any record of.

A bronze celt-shaped chisel, 4⅓ inches long, including the tang, No. 98 in Rail-case P. It was obtained with the foregoing.

A bronze tube, No. 66 on Tray TT, found in Inchmore Island, Lough Ree, Upper Shannon; apparently a portion of a still-worm.

A bronze breast-pin, 4 inches long, with a wheel-shaped ornamented head—the only one of the kind in the collection. It was found at Ballinderry, and is now numbered 497 in Rail-case P.

Two slender bronze pins; one 6¾ inches, the other 2¾ in length; the latter has a square head, ornamented on each of its sides. They were obtained along with Mr. Dillon's collection, and are now numbered, respectively, 502 and 503.

No. 504, a bronze pin, with a curious nugget-like head, as if the metal ran in the casting,—found in a street-cutting in Bride-street, in the city of Dublin, and purchased from T. Geoghegan for . . £0 2 6

A very beautiful bronze bridle-bit, No. 158 on Tray NNN; 11⅓ inches long, and quite perfect; found six feet below the surface of the bog of Leechnabeg, near Peter's Well, five miles from Gort, in the county of Galway, and purchased from Mr. R. M'Clintock for £1 0 0

A portion of harness, consisting of a ring and three loops, probably a portion of the breeching; it is both cast and engraved, and is one of the best specimens of the kind in the Museum; portions of the leather remain attached to the loops, and show the way they were fastened with studs and rivets; it is said to have been found in the River Nore, and recently came from the collection of the late Dr. Kane, of Kilkenny. It was purchased from J. Fotterell for £0 17 6

A triangular piece of perforated copper, 2½ inches wide, and resembling the stone and bone articles already alluded to at page 125 of the printed Catalogue. It was found at Ballinderry, and purchased from P. Fagan, as a portion of the lot along with the spear-head and urn. It is now among the miscellaneous metal articles in Rail-case P, No. 1.

Iron.—A light, thin, broad-bladed hatchet, or gallowglass axe, No. 234, on Tray I, discovered in the Silver River, King's County, and sold with the bronze palstave celt from that locality, for . . . £0 15 0

A thin, narrow arrow or javelin-head, bent into an awl shape, with a long, small socket, No. 41 upon the Tray containing the collection of articles found at Ballinderry. It is 7½ inches long, was probably used in the chase, and is the lightest implement of the kind in the collection.

A small, light horse-shoe, No. 14 on Tray P, 4¼ inches across, with six holes equidistant, and each squaring about ¼ of an inch; found at Loughnavally, county of Westmeath, and purchased from P. Fagan, along with the two foregoing articles, as a part of the collection which included the bone pins and stone articles.

A small circular sheet-iron box, ¼ of an inch in diameter, found in the cave of Kilpatrick, parish of Horseleap, county of Westmeath. No. 4 in miscellaneous iron articles.

A casting of two grotesque figures, purchased from P. Lamb for £0 5 0

Silver.—A collection of fifteen pieces of wrought silver, chiefly portions of flat armillæ, and weighing 12 oz. 18 dwts. They were purchased from Mr. Donegan, who stated that he procured them from the county of Galway. Having been long in the earth, the metal has become exceedingly friable; several of the specimens are ornamented; they are now numbered 35 to 38, 50, 68, 69, 79, 80, 193 and 194, in the arranged collection of silver articles belonging to dress and personal decoration. Among these articles is an imperfect bracelet, No. 50, with the usual characteristic punched ornamentation on the outer surface; also a twisted neck torque, No. 193, received in four pieces, but which I have restored. It measures 5 inches in diameter, and is formed of three plain twisted wires, with their extremities soldered together so as to form solid tapering ends: see No. 193. No. 194 is a torque-like armlet, also restored, and measuring 3½ inches in diameter; it is solid, quadrangular in section, and ornamented on its two outer surfaces with punched triangular indentations.

Gold.—A small gold disc, 1½ inches in diameter, composed of two very thin plates, grooved with a fine thread-like ornament on the external surface, and encircled by an overlapping band. It is evidently an

ornament, and weighs 2 dwts. 19 grs. It was purchased from Mr. Donegan, who can give no account of the circumstances under which it was discovered, for £0 15 0

Five gold armillæ, weighing together, 3 ozs. 9 dwts. 14 grs., and purchased from Mr. Donegan, at the rate of £4 per ounce. They formed a part of four pairs of bracelets, viz., one plain, one twisted, and two flat; discovered in a field belonging to a man named Byrne, in the townland of St. John's, near Castledermot, county of Carlow. The land had been previously tilled, and the clay was soft. The articles were all rolled together, much crushed, and bound round with fragments of the flat bracelets precisely in the state in which I first exhibited them to the Council. In the field in which they were found runs a small stream, on which is a shallow called the Battle Ford, and near the place where the gold was discovered a large granite rock had recently been blasted, and it is conjectured that the gold may have been hidden underneath its edge. After a short time the finder sold the lot to a watchmaker in Carlow, at very much beneath its intrinsic metallic value. The watchmaker proceeded to Dublin, but was unable to procure a purchaser, so he left them with a friend, who disposed of them to Mr. Donegan, from whom I procured them, and, having restored the broken pieces of the flat bracelets, with the sanction of the Committee of Antiquities, I procured two pair, and one specimen of the unornamented set. I am much indebted to Dr. O'Meara, of Carlow, and the Rev. Mr. Gorman, R. C. C., of Castledermot, for the history of all the circumstances attending the discovery, but the further particulars of which are unnecessary. Owing to the circumstance of there being no proper place yet provided in the Museum for the arrangement of the gold articles, numbers cannot be attached to them; but as some of them are the only objects of the kind that have as yet been exhibited in Ireland, the following description may serve to identify them:—One plain, circular, and bearing marks of hammering. Two of the torque pattern, each composed of a square bar of gold, twisted, but left plain at the ends. Two thin, flat bands, plain on the inside, and grooved or corded with fine parallel longitudinal lines on the outer surface. This form of ornamentation, which is similar to that upon the small circular plate of gold described above, would appear to have been effected by some pectinated tool. These bracelets, although so like, are not matches; their fellows have been disposed of, one to a dealer in Dublin, and the other to an English collector. In one of these in our collection, the edge is turned over, and deeply grooved on the outer side. Cost of four of these, ... £11 16 10

Ecclesiastical.—A copper crucifix, 10 inches long by 6 wide; the arms of the cross enclosed within an oval. It is perforated all round the edge, as if for attachment to some flat surface, probably a shrine or feretory. The figure is antique, draped at the waist with a short tunic, a portion of the decoration upon which is still visible. The head is surrounded with a mural crown, like those on some of the oldest crucifixes in the collection, and beneath it is a head-dress falling to the shoulders. The orbits are filled with lead. This article is said to have

been for many years in the possession of an ecclesiastic in Drogheda, and was purchased from J. Fotterell for £5 0 0

Coins and Medals.—Fifteen Danish silver pieces, and two Anglo-Saxon coins of Ethelred, in a very good state of preservation. They were purchased from Mr. R. Murray, of Mullingar, for . £3 0 0

A small collection of Greek coins, purchased from M. Daly for 1*s.* 6*d.*

Total cost of articles purchased by the Committee of Antiquities during the year ending 16th March, 1859, ... £41 18 1

The Secretary of the Academy announced that, in pursuance of the Resolution agreed to at the last meeting of the Academy, Mr. Wilde's letter had been laid before the Council, and that the Council assented to its being entered on the Minutes of the Academy.

It was then Resolved—That Mr. Wilde's letter be entered on the Minutes of the Academy, with the exception of certain passages which he desired to omit as having a personal reference.

"1, Merrion-square, North,
"28*th February*, 1859.

"Dear Sir,—As there seems to be some misapprehension on the part of Members of the Academy respecting the state of the Museum, and the second part of the Catalogue, and as a recent resolution of Council directed 'all works whatsoever connected with the second part of the Catalogue to be stopped,'—at the same time that the Council recommended a subscription to be opened for the purpose of completing that book, I beg to lay the following statement before the Academy.

"On the 9th November, 1857, the following resolution, recommended by the Council, was passed by the Academy:—'That all moneys derived from the sale of the Catalogue, after the expense of advertising, &c., be devoted to the publication of the second part of that work.'

"Coincident with that recommendation the following Resolution was adopted by the Council:—'That Messrs. Carson, Haughton, Gilbert, and Wilde, do form the Committee to whom the full control of the sale of the Catalogue shall be intrusted.'

"The Treasurer has long since been furnished with materials for making out an exact account of the receipts from the sale of Part I., and the expenditure incurred in the preparation of Part II. of the Catalogue, up to the 16th March, 1858. By that account, when it is brought before the Academy, may be seen how I have disposed of the moneys voted for the preparation of Part II.

"In the Report of Council, read at the last Annual Meeting, all particulars of the Museum and its Catalogue were fully laid before the Academy. That Report says—'The MS. Catalogue is now in process of completion, irrespective of any cost to the Academy, out of the price of Part I., which it is expected will also pay for the completion of the illustrations, provided the Members who have not already subscribed will do so. Thus, in process of time, should the Academy be in funds,

and inclined to complete the history of the collection, it will only have to pay for the printing and paper.'

"At the end of the session in July last, I laid a Report on the subject of the Museum and Catalogue before the Council, and it was inserted on the Minutes of the 19th of that month—to the following extracts from which I would draw the special attention of the Members of the Academy.

"In reply to the circulars addressed to Members by the Treasurer and the Secretary of Council, orders were received for 345 copies, 44 of which remained unpaid for. The public had purchased either through booksellers, or direct from the Academy, 75 copies, making in all a sale of 420 copies up to 17th July, 1858, which produced, as I then understood, the sum of £82 6*s.* 2*d.*, of which £8 remained due by Members. With that sum, I stated in my Report, that I had completed the following work:—'All the objects composed of animal material, amounting to 560 specimens, exclusive of unmanufactured animal remains, or zoological specimens; the bronze articles, numbering 2898; all the iron articles to the amount of 485; all the articles kept together as "Finds," and numbering 748; the silver collection, amounting to about 230 specimens, and 180 of the gold ornaments, amounting altogether to 5101 articles, have been arranged, numbered, and registered.

"'The registration specifies or refers to documents either in print or writing, and contains all that is at present known about each article. Wherever it was possible, and that we could identify the articles according to the "numbers" and "letters" in the "Old Registry" of the Museum, we have specified such in a column set apart for that purpose, and the new number has been added (for the present in pencil) to the "Old Registry;" but as that book was not continued after the year 1853, and as more than four-fifths of the entries merely specify the size and weight of the article, it has afforded comparatively little information. All the old numbers of either our own or the "Dawson" or "Sirr" Catalogues, which still remain, are attached to the reverse side of each article. All the cards and labels originally attached to the articles in the Museum have been preserved, and on each has been written the number which the article now bears in the present arrangement; so that they can be referred to in the revision and correction of any Catalogue which may hereafter be published.

"'Those only who have been engaged for months on a work similar to the foregoing, especially upon such an incongruous mass as the Museum presented prior to March, 1857, can form any idea of the time, labour, and research, required in the identification of these antiquities; a single specimen often taking above fifteen minutes' search to identify.

"'The MS. registration which is now laid on the Council-table can only be regarded as the material or rough draft for the formation of a Catalogue similar to Part I. At the same time, it serves as a complete registration of the articles according to their new arrangement, and, as such, may be used until that work is completed. I shall require it while writing the MS. of the Catalogue. It now consists of 325 folio pages, and has been completed at a cost of £43 18*s.* 4*d.*

"'The registration of the Gold Ornaments has not been completed nor can it be so until proper cases are provided in the safes at each end of the Museum, as originally intended by the Board of Works. Upon this subject the Committee of Economy have reported to the Council.

"'As many as 240 illustrations have been drawn on wood, and paid for from the funds of the Catalogue: of these, only two are of gold articles, and five of silver,—so that both these materials may be said to be as yet undrawn. Of the 240 articles which have been drawn on wood, 100 have been cut, and paid for, and the remainder are now in the engraver's hands. The cost of these latter will be about £35. As it is not possible to complete the MS. of the Catalogue without having the illustrations before me, I have induced the engravers to proceed with the work on the understanding of being paid one-half the cost when finished, and the other half at the end of March, 1859. The former part I hold myself bound to pay.

"'The numbering has been completed by means of the old printed figures remaining since the former part, or cut out of Catalogues, &c., without any additional expense to the Academy. But I look on the present numbering as only temporary. Kelly, the porter of the Academy, is quite competent to number each article separately in paint, and might employ a portion of his time during the vacation in so doing, provided the Council would give him some remuneration in addition to his wages. If this is not soon done, great injury will accrue to the collection, as the numbers at present attached to the articles for the purpose of registration are not only unseemly, but cannot be expected to last longer than a few years. Not having any funds at my disposal for printing labels in continuation of those already adopted, that most necessary part of the work has not yet been completed; I therefore request the Council to sanction the expenditure from the funds of the Academy, of a sum not exceeding £3 for that purpose. This is immediately necessary—not merely for the benefit of visitors, but in compliance with the Treasury Minute, which requires all public Museums receiving Parliamentary grants to be supplied with such labels, as already communicated to the Secretary of the Academy.

"'Some of the printed Catalogues have been sent on sale to the Academy's London bookseller, and the work still goes off from the office; but as we have not the means of advertising it, and no person to push it with the trade, the sale must naturally be slow; yet I have reason to hope that it will eventually pay the entire expenses of the registration of the Museum, and the illustration and preparation for the press, of the second Part. Until, however, 200 more copies are disposed of, this cannot be effected. I, therefore, request the Council to take some means of increasing the sale among the Members. In the meantime, as there is a sum of £8 still due for the registration and transcription of the Catalogue, I trust the Council will direct the Treasurer to have the money paid at once.'

"That debt of £8, due for work, and balanced by the sales of the un-

paid Catalogues, was paid off during the autumn. Besides the gross number stated in that Report, I beg to observe that 305 articles have since been registered, inclusive of some additions to the Museum by purchase and donations during the past year,—thus showing the total amount of registered articles, in succession from Part I., to be 5406, and the MS. registration increased from 325 to 393 pages.

"Knowing that the sale of the Catalogue continued, I applied, in December, to the Assistant Secretary to pay some small outstanding accounts for registration and wood-cutting, when I was informed that the Treasurer had directed all the money in hands to be paid for binding the first Part of the Catalogue, that sum having been omitted in the monthly audits from August, 1857, to December, 1858, owing, I am informed, to the negligence of the bookbinder, although he had furnished the Academy's account for other work.

"Upon appealing to the Council against what I considered a misappropriation of the funds, 'devoted by the Academy to the publication of the Second Part' of the Catalogue, that body directed the Treasurer to charge the cost of binding to the general account of the Academy, which Resolution was forwarded to me on the 8th instant, and with it the accompanying:—

"'The Committee of Economy in their Report, adopted by the Council, recommended—"That in consequence of the funds from the sale of the Catalogue being now almost entirely exhausted, it be recommended to the Council, that all bills for wood-cuts, &c., for the second Part of the Catalogue be called in, and that all work whatsoever connected with the Second Part of the Catalogue be stopped."'

"To that communication I addressed an answer on the 19th instant, in which I alluded to the specific agreement made between me and the Academy, by its Resolution of November 9, 1857. I referred the Council to my Report of the 19th of July, 1858, and the account attached thereto, to show that the expenditure had not then exceeded the sales of Part I., but, on the contrary, had left a balance of 17*s.* 7*d.* I also stated that—

"'Knowing that the sale of the Catalogue must be slow, and finding that there were many matters to be done in the Museum of greater urgency than the wood-cutting, I stopped both engravers, the one within the month, and the other as soon as he had completed the blocks upon which he was then engaged, and I have not had a single block engraved since the early part of last August. The total sum due to the engravers at that period was £14 8*s.* 6*d.*, one-half of which I liquidated according to my intention, as stated in the Council Minutes.'

"By an order of Council, dated 1st November, 1858, a sum of £3 was voted for descriptive labels, in accordance with the Government letter to that effect. These, with considerable labour, I prepared: and employed Mr. Eagar to arrange and attach to the different trays, &c., as I presume the Council did not intend that I myself should spend a week or more in the adjustment of such matters. Another portion of extra work imposed on me, and paid for out of the proceeds of the Ca-

talogue, was drawing up for the Committee of Antiquities a list of the articles purchased during the last year, in accordance with the recommendation of Council.

"The whole debt incurred for work done in the Museum from the date of my Report in July last to the present day is £6 5*s*., and for making a fair transcript of a portion of the Catalogue, the sum of £2, being, with the cost of engraving, £22 13*s*. in all, spent in seven months, to meet which 194 Catalogues have been disposed of, thus leaving a balance on the credit side of the account. So that, at the close of an arduous work, extending over more than eighteen months, and dispensing upwards of £100, I am happy to be able to show that I have not exceeded the trust reposed in me by the Academy, and that there is, therefore, no necessity for the Treasurer, however anxious he may be to show a clear account at the end of the year, to apply to the Academy for any money to make up the surplus expenditure under this head.

"You will be good enough to inform the Council that I have acted promptly on the order contained in its Resolution, and 'stopped all work connected with the Catalogue,' viz., the labelling of the silver ornaments, the registration and numbering of the Ecclesiastical Antiquities (partly done), and the transcription of the manuscript of the Catalogue of bronze articles for printing.

"When preparing the first Part of the Catalogue, to meet the exigency of the Meeting of the British Association, I was under the impression that the book would be—and I much regret that it was not—given to the Members by whose money it was compiled. This is, I believe, the first time the Academy has had any profitable return from its publications.

"Not having the charge of the accounts, it only remained for me to keep the expenditure within the limits of the *sales*, at an average return of 4*s*. per copy. The total number of books sold has been 614, which should have produced £122 16*s*. (and of which number 568 have been paid for), upon the strength of which I expended £104 12*s*. 1*d*., but as I have been informed by Mr. Clibborn that the net return from the copies paid for has been only £110 4*s*., I presume that the difference has been expended in postage. As the 46 copies now due for by Members, and which may be considered as good debts, and on which there is no postage, will produce £9 2*s*., a considerable balance will remain in favour of the Academy at the end of the account.

"Allow me to remind the Academy of this fact:—Since Dr. Petrie produced his great work on the 'Ecclesiastical Architecture and Round Towers of Ireland,' read to the Academy in 1833, and published as our twentieth volume, in March, 1845, we have printed 2127 pages of Transactions, of which 1343 were devoted to Science, 765 to Polite Literature, and only 19 (furnished by Dr. Todd and myself) to the subject of Antiquities. Had original papers upon Antiquities been supplied, no doubt they would have been published and illustrated, but as that has not been the case, I have only to observe that, during the last fourteen

years, that branch of this institution (which was chartered equally for the advancement of Science, Polite Literature, and Antiquities) has not had its share of the money spent upon printing. It will be in the recollection of the Academy that, according to the Treasurer's statement two years ago, the impoverished condition of our finances had chiefly arisen from the expenditure incurred in printing and illustrating our Transactions.

"The third Resolution informs me that the Council recommend the Academy to open a subscription for the purpose of completing the Catalogue of the Museum. It was with considerable surprise I heard of the intention of that Resolution an hour before it was passed. Should it be adopted by the Academy, with the money collected I would strongly and urgently recommend the Council to complete the arrangement, numbering, labelling, and manuscript registration of the Museum, including the proper arrangement and display of the gold ornaments in the iron safes intended for that purpose, and one of which has now been erected for upwards of seven years without having been made use of. A proper case or cases will also be required for the Ecclesiastical Antiquities. This subject of cases I entered fully upon in my letter to the President during the summer vacation, and which letter, I beg to observe, met with the approval of those with whom chiefly rested the recommendation to the Government of such works.

"If the Council desire it, and the Academy, either by subscription or a vote of money, pays for it, I am ready to complete the registration when the proper cases are supplied. And I can now assure the Council, as I did on several former occasions, that this is a matter of the utmost moment and urgency. If the means are placed at my disposal, and I am not again stopped in the midst of the work, I will very shortly have the arrangement of the Museum completed, and all the articles now remaining, except the coins and medals, registered, and I think at a cost of £10 or £12. The remaining part or parts of the Catalogue may be completed at a subsequent period by myself or others; but until the arrangement of the Museum has been finished, and all the engravings made, and the manuscript more advanced, it would be impossible to estimate, even by approximation, what number of pages will be required in such a work.

"In bowing to the authority of the Council, and thus for the present ending my labours, given gratuitously to the Academy for the benefit of Irish Antiquities, I beg to assure the Members that my chief endeavour has been to arrange and register our too long neglected Museum, and to place on record now, while there are persons living who can afford the information, all that was valuable or authentic connected therewith; and that I never asked either Council or Academy to print one page of the continuation of a work which, although devoted to a subject not valued by a large proportion of our Members, has, I believe, neither lessened the prestige of the Academy, decreased the interest in our Museum, nor lowered the cause of Irish Archæology and Ethnology.

By 614 sales up to 16th March, ...	£122	16	0
Thus expended:—			
To Prospectus, Circulars, and Postage, as per Treasurer's account, to 31st March, 1858, .	10	6	3
Drawing and Wood-cutting, ...	41	2	0
Registration of Museum, ...	50	3	4
Transcribing Catalogue, ...	4	0	0
	£105	11	7

"I am yours truly,

"W. R. WILDE.

"*To the Secretary of the Royal Irish Academy.*"

In accordance with a Resolution of the Council, the Secretary of the Academy read the following letter from Colonel Larcom:—

"PHŒNIX PARK, *3rd March*, 1859.

"MY DEAR GRAVES,—Lord Wrottesley's Address to the Royal Society has brought again to my mind a subject we were speaking of some time ago, viz.:—That we have no portraits of our three last Presidents, Hamilton, Lloyd, Robinson. Where, in the march of Science and of intellect in Ireland, can we move without coming into contact with one or other of these names? Let us redress this injustice to ourselves before they pass away; for, wanting their portraits on our walls, we have failed to claim them for our own.

"The portraits of Presidents which we now possess have been painted by subscription, in, however, equal honour, no doubt. But subscriptions, when we raise them as we often do, can be advantageously supplied in other ways, and, as a continuous mode of providing portraits of public men, a subscription is a clumsy machinery. It is a noble distinction to fill our Chair, and it is still more so to be installed in perpetuity before the Members of the Academy for all time.

"Why not, then, ask each President to present his own portrait on leaving the Chair? Let each of the three I have named be now applied to, and let it be understood henceforward that every President, at the close of his Presidency, be expected, without any especial request, to do so. Fix a size, a form of frame suitable to the place or room in which it may be thought best to place them, in either a President's Gallery, or, perhaps, over the bookcases in the Library. This must, of course, be done by resolution of the Academy, on the recommendation of Council.

"Would you throw out the idea for consideration, at the next Meeting of Council?

"Your obedient servant,

(Signed) "THOMAS A. LARCOM.

"Lord Wrottesley's Address is at page 499, No. 33, Proceedings, Royal Society of London."

After some discussion, it was resolved that Colonel Larcom's letter be referred to the Council, for the purpose of determining how the object therein proposed may be best carried into effect.

The Ballots for the annual election of the President, Council, and Officers, having been scrutinized in the face of the Academy, the President reported that the following gentlemen had been duly elected:—

PRESIDENT.—James H. Todd, D.D.

COMMITTEE OF SCIENCE.—Rev. George Salmon, M.A.; Rev. Samuel Haughton, F.R.S.; William H. Harvey, M.D.; Rev. J. H. Jellett, M.A.; Sir William R. Hamilton, LL.D.; Robert W. Smith, M.D.; Rev. Joseph A. Galbraith, M.A.

COMMITTEE OF POLITE LITERATURE.—Rev. W. H. Drummond, D.D.; Rev. Charles Graves, D.D.; John Kells Ingram, LL.D.; John O'Donovan, LL.D.; Rev. Samuel Butcher, D.D.; Rev. Joseph Carson, D.D.; John F. Waller, LL.D.

COMMITTEE OF ANTIQUITIES.—George Petrie, LL.D.; Charles Haliday, Esq.; John T. Gilbert, Esq.; Rev. William Reeves, D.D.; Lord Talbot de Malahide; Eugene Curry, Esq.; W. Henry Hardinge, Esq.

TREASURER.—Rev. Joseph Carson, D.D.

SECRETARY OF THE ACADEMY.—Rev. Charles Graves, D.D.

SECRETARY OF THE COUNCIL.—Rev. John H. Jellett, M.A.

SECRETARY OF FOREIGN CORRESPONDENCE.—Rev. Saml. Butcher, D.D.

LIBRARIAN.—Rev. William H. Drummond, D.D.

Clerk, Assistant Librarian, and Curator of the Museum.—Mr. Edward Clibborn.

The President nominated, under his hand and seal, the following Vice-Presidents:—Rev. George Salmon, M.A.; John K. Ingram, LL.D.; Rev. William Reeves, D.D.; Lord Talbot de Malahide.

MONDAY, APRIL 11, 1859.

JAMES HENTHORN TODD, D. D., President, in the Chair.

THE REV. DR. REEVES read the following—

MEMOIR OF THE CHURCH OF ST. DUILECH.

ST. DUILECH* is one of those early Irish ecclesiastics whose memory is preserved in the Calendar and local association, but of whose history, and even date, almost all documentary evidence has perished. Ledwich, indeed, refers to a statement, that a life of the saint was preserved at Malahide;† but such a record, if it ever existed, is now unknown; and in the absence of any mention of the saint's name in our Annals, we are obliged to fall back upon his pedigree as the only available material even for conjecture as to the age in which he lived. He is set forth in the sacred genealogies‡ as the son of Malach, or Amhalgaidh, son of Sinell, and eighth in descent from Fergus Mac Rosa, whose date is referred to the Christian era. But, allowing thirty years to a generation, this would only bring him down to the year of our Lord 240; so that several generations are manifestly omitted. However, there are other saints of the same race, the dates of whose obits, or the names of whose contemporaries are recorded, and whose relative distance from a common head will

* It was the fashion in the last century to make St. Duilech a Dane. The process was effected by presuming that the name was the same as *Tullock*, which was a familiar form of *St. Olave*. St. Olave's festival is the 29th of July; but in Ireland it appears to have been kept on the 1st of August. At that day we find among the *Prætermissa*, in the Acta Sanctorum, the following notice:—"Dolochus seu Tolochus peregrinus in tabulis Hibernicis hac die notatus est; verum, cum solum nomen ibi reperiam, exspecto, qui me de vita, ætate, et maxime de cultu doceat" (Aug., tom. i., p. 3 *b*, 1733). None of the Irish Calendars have any name like these at Aug. 1, and St. Pellegrini, the Irish hermit, who gave name to Monti di S. Pellegrini, is the only Irish saint at this day who merits the title *peregrinus*. St. Tullock's-lane, off Fishamble-street, Dublin, derived its name from the chapel of St. Tullock, or Olaf ("Ecclesia Sti. Olavi," estimated in the Papal Taxation of 1291 at ix^{s}. a year.) In reference to which the following remarks are cited by Ledwich from a survey of the city and diocese, published in 1747:—"In Bove-street, now called Fishamble-street, stood formerly a chapel of ease to St. John's Church, dedicated to St. Doulach, an anchoret, whose feast is celebrated on the 1st of August; on which day, and during its octave, is visited a famous well in Fingal, between Balgriffin and Kinsaley, about five miles from Dublin, contiguous to a church sacred to the memory of this venerable solitary, *whose life was formerly preserved at Malahide, but now not to be met with*" (Antiquities of Ireland, p. 146, second edition). But this notion concerning the identity of SS. Duilech and Tuloch, though prevalent in the early part of the eighteenth century, was erroneous, the former being of Irish extraction, whose day was the 17th of November, while the latter was a Dane, whose festival was the 29th of July.—See Lanigan, Eccles. Hist., vol. iii., p. 359; Dr. Todd's Introduction to the Obits, &c., of Christ Church, p. lxxxiii.

† See the passage in italics in the preceding note.

‡ *Senchas Naomh Erend*, in the Book of Lecan, fol. 38*ad*, where he is styled Duilech Clochair.—Book of Ballymote, fol 120*bg*; Macfirbis, Genealog. MS. (R. I. A.), p. 733.

measure that of St. Duilech. St. Mochoemhog, or Pulcherius, who was *ten* degrees, died in 656; Cruimther Fraech, who was *nine* degrees, was a contemporary of St. Columcille, who died in 597; St. Iarlath of Tuam, who was *eight* degrees, was a little senior to St. Brendan, and flourished about 540; and lastly, St. Mobhi,* surnamed *Mac Ui Alda* (from Alla, a common ancestor with St. Duilech), was uncle to St. Duilech, and *seven* degrees, and his obit is recorded by Tighernach at 630. We may, therefore, taking an average of the dates of these ecclesiastics, all of whom were of the race of Conmaicne, son Fergus mac Rosa, assign the year 600 as about the age in which St. Duilech flourished.

His festival is the 17th of November; and in the calendar of Christ Church he is styled "Sanctus Dulech Episcopus et Confessor,"† though in the Martyrology simply "Sanctus Dulech Confessor."‡ But whatever may have been his ecclesiastical rank, his patronage was very limited, for, besides the church under consideration, I know of none other where he was commemorated, unless *Cillduleg*,§ which was the Irish name of Grange Gorman, was derived from him.

That there was an early local veneration of his memory appears from the Feilire of Ængus (a composition of the commencement of the ninth century), where at his festival, November 17, he is introduced in the verse:—

la Duilech cain clochair.
With Duilech the beautiful, of Clochar.‖

After him, in 1171, Maelmuire, or Marian O'Gorman, in his metrical Calendar, at same day, notices

Duilech craibdech clochair.
Duilech the devout, of Clochar.

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* He is to be distinguished from St. Mobhi, surnamed *Claireneach*, the patron saint of Glas Naoidhen (Glasnevin), who died in 544, on the 12th of October; and from Mobhi Caillech of Domhnach Broc (Donnybrook), whose day is September 30. The present is Mobhi of Cluain Fannabhair, Dec. 13. In the Grange of Milverton, about three miles north of Lusk, is an ancient cemetery, with the traces of a small chapel, called *St. Moree*, and near it a holy well, called *St. Movee's Well*, at the head of which is a large stone supported on rests, like a cromlech, and having a small incised cross. The water of this well was believed to possess great virtue in cases of ague and sore eyes.

† Obits of Christ Church, p. 71. ‡ Ibid., p. 179.

§ In 1186 Pope Urban III. confirmed to the Church of the Holy Trinity *Cellduleg*; in a note on which Archbishop Alan writes *Grange Gorman* (Regist., fol. 175*a*, *ad calc.*). King John confirmed the original grants to the same house, specifying the donors' names, and among them *ex dono Cithurici filii Absolea* (Sitric son of Amlaf) *Kealdulig* (ib., fol. 175 *b*); upon which Archbishop Alan notes *Killduleg*, i.e. *Grangegorman* (ib., fol. 176*a*, *ad calc.*). Luke, Archbishop of Dublin, *circ.* 1220, confirmed these possessions, and among others, *Grangiam eorum ultra pontem, quæ vocatur Kyldulyc*; upon which Alan notes *alias Celldulcg etiam Gorman* (ib. fol. 176*b*). These entries are worthy of notice, for Archdall, followed by others, reads *Bealdulech*, which he identifies with Baldoyle (Monast. Hib., p. 148). Mr. D'Alton, on the other hand, makes Kealdulech to be St. Doulaghs (Hist. Co. Dublin, p. 225), though elsewhere he returns to Baldoyle (ib., p. 173).

‖ Leabhar Breac, fol. 40*b* (MS. R. I. A.).

Upon the former of which is the gloss:—O Clochair Duiligh fria Faeldruim andess .i. i taeb Suird Colaim cille,—'of Clochar-Duiligh, by Faeldrum* on the south, i. e. beside Sord of Columcille.'

And upon the latter:—Fri Faeldruim andess i Finegall, 'by Faeldrum on the south, in Fingall.'

Or, as O'Clery, more fully, in the Calendar of Donegall:—Duileach Clochair, fri Faeldruim an dess .i. Fine Gall:† agus Clochar Duilich ainm a baile, la taob Suird Cholumchille. Do fhocht Commaic mic Fergara mic Rosa mic Ruidhraidhe do. 'Duilech of Clochar by Feldruim, on the south, in Fingal; and Clochar-Duiligh is the name of his town, beside Swords of Columcille. He was of the race of Conmac, son of Fergus, son of Ros, son of Rughraidhe.'

Thus, *Clochar* is given as the Irish name of his church in native documents, ranging from 800 to 1600.

But, like many primitive foundations, it lost its local importance in the twelfth century, when superseded, on account of position, family interest, or some other cause, by the parish church. In the Bull of Pope Alexander III., which confirmed to St. Laurence O'Toole, in 1179, the possession of his see, mention is made of many ancient churches in the county, both north and south of the city, but none of St. Duilech's: there is, however, a denomination called *Tertia Pars de Clochair*‡ [cpian Clochair], which may have denoted the site and land of this ancient church, then waste.

The parish that absorbed St. Duilech's cell was Ballygriffin, which probably first obtained its severalty, as it got the name of *Griffinstown*, under a Welsh settler. The new parish church was founded close to the manorial castle of Balgriffin, and its outline is still discernible on the sward at the left-hand side entering the avenue of Balgriffin Park. It is not marked on the Ordnance Survey,§ and might escape any eye but one accustomed to the shades of extinct churches. It consisted of a nave and chancel, about eighteen yards long. The churchyard also is under meadow, but a faint outline of its precincts remains. This church was under the patronage of St. Sampson, a Cambrian saint,‖ and thus the parochial name and the dedication agree in indicating a Welsh occupant about the time of the English Invasion.

In the taxation of 1291 the "Ecclesia de Balygriffyn" is rated at £8, a large sum for those days; but no notice is taken of St. Duilech's Chapel;

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* Faeldruim, i. e. "Wolf-hill," now *Feltrim*, a remarkable eminence in the parish of Kinsaley.

† That is, the 'territory of the strangers,' not as if Fionn Gall, 'White strangers or Norwegians,' which is sometimes stated. Even in Anglo-Norman records the etymological form *Finegal*, *Finagall*, is preserved.

‡ Regist. Alani, fol. 1*a*. In the confirmation of the possessions of Christ Church by Pope Urban III. (1186) the name is written *Trianchochair* (Reg. Alani, fol. 175*a*).

§ Ordnance Survey, county of Dublin, sheet 15.

‖ His day is July 28. See Act. SS. Julii, tom. vi., p. 568; Mabillon, Act. SS. O., Bened., tom. i., p. 174; Rees, Essay on the Welsh Saints, pp. 228, 253.

nor indeed does its name occur in diocesan or legal records till the close of the fifteenth century. About the year 1400 Thomas Comyn, who was seised of the manor of Ballygriffin and its appendant advowson of the church of St. Sampson of Ballygriffin, with the approbation of the Pope and the license of the Crown, assigned the advowson of the church, with two acres of land, to the prior and convent of the church of the Holy Trinity for ever.* Subsequently, Mary, the widow of said Thomas, claimed the advowson, and on the death of William Norragh, the rector, presented one John White; but, on a hearing of the case, her claim was disallowed; and towards the close of the century Walter Fitzsimon, Archbishop of Dublin, confirmed to the cathedral of the Holy Trinity the church of Ballygriffin with its glebe, and the *Chapel of St. Dolachy* in that parish, together with the tithes and oblations pertaining to the same.† This is the title of Christ Church to the appropriate rectory of Balgriffin and the advowson of St. Doulagh's, which are enjoyed by the precentor of that cathedral.‡

Archbishop Alan's parochial survey of the diocese, called the *Repertorium Viride*, compiled in 1532, notices the parish church of Ballygriffin, with a glebe of two acres, called *Cloghavagh*, granted to the church of the Holy Trinity by Thomas Comyn, but, what is remarkable, he makes no mention at all of the chapel of St. Duilech.

However, in the recasting of parochial relations in the diocese after the Reformation, the relative conditions of this church and chapel were inverted, and the Regal Visitation of 1615 represents St. Dowlocks as the parish church, and Ballygriffin as a ruined chapel pertaining to St. Dowlocks:§ and so it virtually continues to this day.

The building which now serves as the parish church is a mean structure, lying up to the north side of the ancient tower.‖ The inhabitants of the neighbourhood distinguish the two edifices by the names of *the Church*, and *the Castle*. On the present occasion I shall not attempt any architectural description of the old building, as its details have been very satisfactorily set out by Mr. John S. Sloane, in an excellent paper which he read, May, 1856, before St. Patrick's Ecclesiological Society, and

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* Regist. Alani, pp. 47–49, Trin. Coll. Dub. copy, now wanting in the original.

† "Ecclesiam de Ballygriffine una cum gleba ejusdem, et capellam Sti. Dolachy in eadem parochia cum decimis et oblationibus eidem pertinentibus."—Reg. Alani, p. 42 (copy in Marsh's Library; p. 33 of copy in Trin. Coll. Dublin—this part being now wanting in the original).

‡ See "Second Report on Ecclesiastical Revenue and Patronage in Ireland" (1834), pp. 42, 184, 185, 300.

§ "*Ecclesia St. Dowlocks.*—Residens. Idem minister (*sc.* Patricius Beghan de Baldoyle) legens. Ecclesia et cancella, bene cum libris. *Balgriffin.*—Capella ruinata, spectans ad St. Dowlocks."

‖ It is reported to have been erected within the memory of a person still living. However, there must previously have been an edifice on the same site, as the structure of that part of the tower which is enclosed in the church proves. Indeed, we can hardly refer to any chamber in St. Doulagh's proper the assertion in the Survey of 1747: "The steeple is still up, as is also the church, which is now much smaller than formerly. Divine service is performed there once a fortnight."—Ledwich, *Antiq.*, p. 146.

which has since been printed.* Suffice it to say that this pile, which measures about 48 by 18 feet, comprises seven apartments and three stone staircases, and while its position, east and west, and the character of the eastern portion indicate its employment as a place of worship, its other features show that its use, as such, was limited to the purposes of an individual hermit, or a small community, who occupied the building.† It would seem that soon after the erection of the parish church of Ballygriffin, in the twelfth century, a chapel was built on or beside the site of St. Dulech's original cell, then probably a ruin, and that in its construction reference was had to the requirements of a recluse who immured himself therein, and only admitted occasional worshippers. The pile, as it now stands, consists mainly of three compartments, the east portion, the west portion, and the tower; these are coeval in their structure, though differing in the character of their masonry, and seem to point to the early part of the thirteenth century as the period of their construction. The principal window in the south wall of the eastern portion, which is one of the oldest features in the building, Mr. Sloane refers to about the year 1230. Supposing, then, the church to have been erected at that date for the combined purposes of a chapel and an anchorite's abode, we may conceive that several interruptions may, in the lapse of years, have taken place in the eremitical character of the ecclesiastics who occupied it, and that, from time to time, it may have been the abode of an ordinary chaplain. But we have, fortunately, one document on record, which expressly states the nature of its occupation in the year 1406, which I shall now read, and indeed it was the discovery of it which suggested the present communication. It is a letter of Indulgence, entered in the original registry of Nicholas Fleming, Archbishop of Armagh, preserved in the Registry Office, among the records of that see:—

"*Litera Indulgenciæ concessa Anachoritæ de Seynt Doulagh.*

"Universis almæ matris Ecclesiæ filiis ad quos præsentes literæ nostræ pervenerint, Nicholaus, &c. Quoniam, ut ait Apostolus, &c. Cum igitur dominus Eustagius Roche‡ capellanus, vir vitæ laudabilis et conversationis honestæ, anachorita sit inclusus in capella beate Mariæ Virginis ac sanctorum Apostolorum Petri et Pauli§ in Roghomyr‖ Seynt

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* Drawings and descriptions of St. Doulagh's Church, more or less correct, are to be seen in Ledwich's Antiquities, p. 144; Grose's Antiquities, vol. ii., p. 78; Miss Beaufort's "Essay on the State of Architecture, &c., in Ireland," in "Transactions of the Royal Irish Academy," vol. xv., Antiq., p. 233; "Dublin Penny Journal," vol. i., p. 265; Wakeman's "Handbook of Irish Antiquities" (frontispiece); and a description in Brewer's Beauties of Ireland, vol. i., p. 236; and Bell's Essay on Gothic Architecture, p. 105.

† Ware mentions *St. Dulachs* as one of the anchorite's cells of Ireland.—Works, vol. ii., Antiqq., p. 237.

‡ An earlier Eustachius de Rupe, Constable of Dublin in 1207, held 3 carucates of land in Lusk.—Rot. Lit. Claus. Tur. Lond., p. 78*b*; Rot. Chart. T. L., p. 172.

§ It is to be observed here that the hermit's cell is the Chapel of the *B. Virgin and SS. Peter and Paul*, not *St. Dulachs*.

‖ This may be a clerical error for *Cloghyr*, the ancient name of St. Doulagh; but see *Bothomer*, *infra*.

Dulagh vulgariter nuncupata, Dublinensis dioecesis; ad cujus sustentationem, et dicti loci reparationem, atque ornamentum ejus, non suppetunt facultates, Vestram universitatem hortamur in Domino quatenus cum nuncius seu procurator Anachoritæ prædicti ad vos venerit pro elemosinis fidelium Christianorum petendis et habendis, ipsum benigne admittatis, ac sua negotia parochianis vestris sedulo exponatis, ipsos inducentes verbo pariter et exemplo ut ad opus tam meritorium juxta suas facultates conferant subsidia caritatis. Et nos, ut mentes fidelium ad id devocius excitemus, omnibus subditis nostris, et aliis Christi fidelibus, de suis peccatis vere confessis et contritis, quorum Diocesani hanc nostram Indulgentiam ratam habuerint pariter et acceptam, qui ad sustentationem Anachoritæ præfati, ac reparationem et ornatum ejusdem loci, quicquam de bonis sibi a Deo collatis contulerint pia mente, de Dei omnipotentis suæque præcelsæ genitricis Mariæ, ac Sanctorum Johannis Baptistæ et Patricii patronorum nostrorum,* ac omnium Sanctorum, misericordia, et auctoritate confisi, quadraginta dies indulgenciæ concedimus per præsentes. Damus insuper nostris parochianis licentiam per præsentes, qui ad præfatam capellam causa devotionis accesserint in futurum, ut eidem domino Eustachio sua peccata valeant confiteri, et ab eo pro eisdem penitentiam recipere salutarem. In cujus rei testimonium sigillum nostrum præsentibus est appensum. Datum apud Athirde xv°. die mensis Maii, anno Domini M°.cccc^mo.vi.°, et nostre Consecrationis iii°."†

At this date the fabric seems to have undergone repair, and possibly some slight changes may have been made in its structure; and indeed, there are certain features of the building which indicate as their period the early part of the fifteenth century. After this, records again leave us for a time. But the building itself, by its principal east window, speaks of some change or further repairs at the commencement of the following century, for the window is plainly of that age, and professes a comparatively late insertion. Here again a record in point presents itself. By an inquisition sped before John Fele, of Cowduff, escheator of the county of Dublin, and returned into Chancery, it was found that John Burnell, of Balgriffyn, gent., granted to one John Yong, chaplain, and his successors, for the maintenance of a chantry in the *chapel of St. Dulach*, in the county of Dublin, all messuages, lands, and tenements in Bothomer‡ Balinacarryk,§ and Netilbed,‖ with their appurtenances, of the value of £4 per annum, royal license not having been had.

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* In various entries of the Armagh Registers, St. John the Baptist and St. Patrick are jointly styled "patroni nostri."

† Registrum Fleming, fol. 2*a*; Registry Office, Armagh.

‡ Now known as the townland Bohammer, lying next St. Doulagh's on the north. The name, as written above, bears a great resemblance to *Roghomyr* in the Indulgence, which may be a clerical error for *Boghomyr*.

§ This may be the modern denomination Ballymacartle, called also Ballymarta.

‖ This name is now locally forgotten.

Pardon was, on the 22nd of January, 1506, granted to the said John Yong, and his possession of said lands confirmed.*

Under this new appropriation of the building its final change was no doubt made, and its most modern features attached to it.

The Rev. Dr. Lloyd read a paper on "Light reflected and transmitted by thin Plates," which was referred to the Council for publication in the Transactions.

Mr. Wilde communicated the following account of three crannoges, or stockaded islands, discovered in the counties of Leitrim, Longford, and Antrim. He also presented and described a number of donations, some of which were found in connexion with these crannoges. He said:—

"On the part of the Earl of Leitrim, who presented the remains of a single-piece, flat-bottomed canoe, on the 30th November, 1858, I beg to remark that it was discovered at Lough Rinn, barony of Mohill, and county of Leitrim, in the year 1847. It is of oak, but not black, like that obtained from bogs; is 13 feet long, and 2 broad, with nearly parallel sides, now about 4 inches deep, and square ends, somewhat similar to that figured in Shirley's 'History of the Territory of Farney,' page 210. The sides are now nearly imperfect, and, like other articles of wood presented to the Museum, it would have split, but that it has been recently hooped with iron. In continuation of similar articles belonging to the Academy, it will be marked No. 6 in the registration, to follow that given at page 205 of the printed Catalogue. His Lordship has kindly accompanied his gift with the following notice, which I have recently received from him:—

"'The boat was found in the mud when the lake was lowered, near an old castle at the point of the peninsula from whence this place and district takes its name. The district was formerly called Conmaicne-Moyrein. In front of the old castle there is an island, now covered with natural wood of ash and thorn, and at the time the lake was lowered I found that this island was formed of wooden piles of very slight scantling, but perfectly sound. The paling was interlaced and pegged down in a very rude manner, and the island appeared to have been formed inside of it, and raised upon a similar description of work. Two other ancient boats, but of a different form, were found in the same locality, upon the lowering of the waters, and also a boat-chain composed of iron rods looped at their ends.' A similar form of boat-chain was found in one of the Strokestown crannoges.

"From this description it is manifest that we have here another crannoge, or stockaded island, in Ireland, in addition to those I have already described in the first part of the Catalogue,—this being the twenty-first discovered in the county of Leitrim. It is the only wooded crannoge of which we have had any notice. Lough Rinn is mentioned in the Annals of Clonmacnoise, and of the Four Masters, at the year 1345. *Rinn* gene-

* Calendar. Cancellariæ Hib., 21 Hen. VII., p. 272*b*, n. 8.

rally means a point of land extending into the sea, or a lake. The locality in which this crannoge existed belonged originally to the Mac-Rannells.

"I beg to record the discovery of a crannoge in the bog of Derryhollow, parish of Duneane, and barony of Toome, near Randalstown, in the county of Antrim, and of which I was furnished with a short account in July last by Mr. Lardner, a very intelligent mechanic of that place. It is, he says, 93 feet in diameter, piled all round, as may be seen, by a portion of each piece of timber appearing above the present surface. Within the enclosure were found stone hearths with marks of fire upon them, and also a number of weapons, tools, and culinary implements, chiefly iron, as is usual in such cases, together with sharpening-stones, pieces of chain, &c., and objects of personal decoration. Most of these have been disposed of by the finders; and many are now in the collection of the Rev. Mr. O'Laverty, of Belfast, who informs me that several copper, bronze, and wooden dishes, as well as weapons and ornaments, were also found in this crannoge, as well as some very curious bronze pins, now in his possession, and which have been figured in the 'Ulster Archæological Journal,' vol. iv., p. 269, and vol. vi., p. 103, as well as a coin of Charles II. This latter serves to fix the date of perhaps the latest occupation of this island fortress. The same gentleman writes to me: 'About sixty years ago, a sheet of water two acres in extent still existed at Derryhollow, to the southward of the island, and nearly surrounding it. The island was constructed on oak piles, and originally surrounded by a stockade driven into the bed of the lough, and bound together by horizontal beams of oak, which were morticed to the piles. Outside this, at the distance of eight yards, there are several other oaken piles standing round the island.'

"Partially within the enclosure was found a very perfect single-piece boat, formed out of an oak-trunk, 20 feet 9 inches long, and 4 feet 7 inches broad, with the sides 20 inches deep. It is said to be in good preservation; and, could it have been obtained at a reasonable cost by the Academy, it would, I think, have been an addition to our collection.

"It is greatly to be regretted that these specimen of the ancient naval architecture of Ireland have not been better preserved. Of all the boats found in the crannoges discovered and reported on by the Board of Works, not one specimen found its way into the Academy, nor any other public institution that I am aware of. I recently made inquiry after the largest and most perfect boat found in connexion with the Strokestown crannoges, and was informed that it had been cut up within the past year for roofing materials, by the new occupier of the townland. And I have very recently received a letter from Moate, to say that the best of the oaken boats belonging to the Ballinderry Crannoge had been split up into fire-wood. It was one of the original objects of the Committee of Antiquities to look after matters of this description throughout the country; and I would now suggest to that body the propriety of preserving and obtaining as many of these ancient boats as still exist.

"According to an Inquisition of James I., four crannoges existed in the Antrim district; and our learned colleague, Dr. Reeves, has just sent me the following notice of the one which I have now brought before the Academy. 'The Inquisition of 1605 states that in the Faughne-feugh, now the Feevagh, chiefly represented by the parish of Duneane, with Cranfield, now part of Drummaul (for which see Reeves's "Ecclesiastical Antiquities," p. 343),—"*Est quidam lacus vocatus Lough-direare, in quo est Insula fortificata;*" this I suppose to be the seat of your crannoge. Some years ago I received a communication regarding the uprooting of an artificial island on the road from Randalstown to Toome, and it was described as on a lakelet in the bog, called Lough Ranel, in the townland of Derryhollough, which is, I believe, in Duneane parish.'

"I laboured during the last eight months to procure some of the antiquities found in this crannoge, but unsuccessfully, until within the last few weeks, when I was given the following articles by the Rev. Mr. O'Loughlin, parish priest of Antrim, in whose name I beg to present them to the Academy. A circular stone, 4 inches across, perforated in the centre, decorated at top, and not unlike the upper stone of a pot-quern. A small distaff or spindle whorl of red grit, $1\frac{1}{2}$ inches in diameter; and a water-worn pebble with a natural perforation through it, and which may have been used as a net-weight or sink-stone; these are now numbered respectively 36, 67, and 128, in continuation of the stone collection already set forth in the printed Catalogue.

"A whet-stone, 4 inches long, No. 84.—A curved smooth stone, 5 inches long, with some rudely carved devices on it; for the present numbered 30. A celt-shaped, smooth, flat stone, about 6 inches long, evidently a natural formation, and very like the modern polished stone used by linen weavers to give a gloss to the web, and called a 'rubbing stone,' or 'rubbing bone,' as sometimes a smooth horse-shank is employed for that purpose. It is No. 31 in the addition of miscellaneous articles to the stone collection. Two fragments of exceedingly rude pottery, one of them unglazed, No. 10, and the other, No. 11, showing the very earliest attempt at the manufacture of glazed ware which I have seen in Ireland. The first is a portion of a small pipkin, between 3 and 4 inches wide, and $2\frac{3}{4}$ high, with a rude indented band round the top, and bearing marks of the long-continued action of fire; in composition it is very similar to our oldest cinerary urns, than which it is more compact in the grain, though less artistically formed. We have only two other vessels like it in the Academy, No. 8, Fig. 112, and No. 9, already described in the Catalogue, and which latter appears to have been used as a crucible, and contained, when found, several broken pieces of bronze apparently about to be smelted.

"Insignificant as these pieces of pottery may appear to some, they are not without their interest to the ethnological inquirer into the state of the fictile art in Ireland, from the ninth to the sixteenth century, the probable date of these crannoges; between which period and the prehistoric times of the sepulchral urns we have not the slightest vestige of pottery. Crannoges are, in fact, the only places in which the remains of

domestic pottery could well be preserved, but I greatly fear that such articles have not attracted sufficient attention, as, with the exception of the very beautiful pitcher obtained through the Rev. Mr. Archbald, from the county of Down crannoge, and of which I have given a figure in the first part of the Catalogue (see page 158), not one scrap of ancient pottery has reached our Museum from the crannoges.

"In all the Swiss *pfahlbauten* fragments of pottery and earthen vessels have been discovered. We are also indebted to my friend for two metallic articles found in the same locality, a narrow iron hatchet or wood-splitter, called in Irish *Tuogh Connaidh*, and in Welsh *Buyal kennt.* It is 8 inches long, and 1⅓ inches wide at the cutting-edge, and will be numbered 259 in our collection of axes; also a bronze needle or bodkin, 3 inches long, with the eye unusually perfect.

"I have recently been informed by the Earl of Granard that, in a small island, about 200 yards off shore, in the lake formed by the Shannon at Castleforbes, county of Longford, he discovered traces of stockading and enlargement, together with a sort of coarse wicker-work surrounding it. Several bronze pins were found in the excavations; and from the account given by his Lordship, it is quite manifest that this islet also was a crannoge.

"The subject of crannoges, stockaded or fortified islands, which I had the honour to bring the first notice of before the Academy nineteen years ago, and upon which I have published an essay in the Catalogue, has recently attracted much attention among the learned, both in the British Isles and on the Continent. Mr. Digby Wyatt brought the subject before the Institute of British Architects in London last year. A paper was read the year before last in the Society of Antiquaries of Scotland by Mr. Joseph Robertson, showing that upwards of thirty crannoges existed in the lakes of that country, and he informs me that there are documentary notices of these structures from the twelfth down to the middle of the seventeenth century, when one was dismantled by order of Parliament. He also states, in a letter which I recently received from him, that 'a crannoge, which there is every reason to believe was a palace of the Scottish kings before A. D. 1097, was, in 1232, bestowed by one of them upon a neighbouring monastery. In 1508 the monastery granted a lease of the crannoge to an ecclesiastic, making him bound to make heaps of stones for its defence from the waters of the lake. The lake has been drained, and the oak piles of the crannoge are found to have been protected by heaps of loose stones.' Much valuable information may be anticipated from the forthcoming Essay of Mr. Robertson upon these vestiges of the early habitations of the Celtic race in Scotland. In the meantime, he has, with extreme liberality, furnished me with the following list of localities in which crannoges have been discovered, and which I publish for the benefit of any antiquarian tourists who may visit Scotland before that work appears:—

"The Isle of the Loch of Banchory, in Kincardineshire; the Peel of Loch Cannor, in Aberdeenshire; St. Margaret's Inch, in the Loch of Forfar; the Isle of Loch Tummell, in Perthshire; Loch Dhu, in the Isle of Bute;

the Isle of Rothiemurchus, or Loch-an-Eilan, Invernesshire; Loch Brora, in Clyne, in Sutherlandshire; the Isles of the Loch of Cluny, and Loch Tay, in Perthshire; Loch Fergus, in Kirkcudbrightshire; Loch Cleik-im-in, near Lerwick, in Shetland.

"Another communication was made to the British Association, on the same subject, in September last; and at a recent meeting of the Geographical Society of Berlin, Herr Ritter read a paper 'On the Palework Buildings on the Shores of the Swiss Lakes;' in which he has endeavoured to point out two different forms, contra-distinguished, according to the old Scandinavian theory, into the Bronze and Stone periods: but, so far as I can yet learn, his knowledge of these structures has been gleaned altogether from the writings of my learned friend and correspondent, Dr. Ferdinand Keller, of Zurich, who, in addition to his work, 'Die Keltischen Pfahlbauten in den Schweitzerseen,' published in 1854, and of which I have given an account in the Catalogue, has just issued another most interesting memoir in the 'Transactions of the Society for Fatherland Antiquities in Zurich,'* in which he has done ample justice to our Irish investigations, copied several of our drawings, and acknowledged the originality of the Academy in this matter. He has also recorded the discovery of similar structures in Savoy on the German side of the Lake of Constance.

"What must strike one as the most remarkable fact attending these discoveries is, not only the extraordinary similarity of the structures themselves and the way in which they were placed, but that identity in form and use of the articles found therein, both warlike and those employed in the chase, as well as the culinary and domestic implements, and the objects of personal decoration, or those employed in the toilet. The crannoges of Randalstown, Lough Rinn, and Castle Forbes, will make the forty-ninth of these fortified islands discovered and recorded in Ireland since my original description of Dunshaughlin in 1840.

"The philologists trace the spread of the Celts by letters, words, and certain grammatical forms of expression in inscriptions, or by glosses and obsolete terms found in ancient writings, but have not as yet arrived at any very definite or precise conclusions, and certainly have established but few historical facts; here, however, in these crannoges, although we cannot tell whether their makers and original occupiers spoke Sanscrit or Celtic, we have presented to us demonstrative proof of their habits of life, skill in the arts, and domestic usages preserved for hundreds of years, in what Keller not inaptly terms their 'water towns.' These vestiges of man's handiwork not only determine with greater precision the track and spread of this branch of the Indo-European family, but really afford us a tolerably good idea of their character and social condition. In the arrangement of our Museum I have, under the head of 'Finds,' preserved collections of typical articles procured from the Dunshaughlin and Strokestown crannoges; and when the Academy is in a condition to con-

* Mittheilungen der Antiquarischen Gesellschaft, Band xii., Heft 3.

tinue that part of the Catalogue descriptive thereof, attention, no doubt, will be paid to these most valuable evidences of the state of society in these structures. In the Helvetian 'Pfhalbauten,' Keller asserts that the dwelling-houses were circular, formed of wood, and thatched with reeds,—such was probably the case with those in Ireland, the circular form being that of the oldest of our habitations, as the Cloghauns of Kerry and Aran, and the form still preserved in many of the houses in the village of Keem, in Achill. The fact that ours were also formed of wood may explain the expressions used in our Annals, which describe the destruction of these places by storms and floods, or the 'burning' of these 'islands' by predatory native chiefs, or plundering Danes. Another peculiarity of the Irish crannoges is that of each having a common hearth, probably to lessen the chance of accidental burning, as there was usually a great number of persons residing in each crannoge.

"There is still much to be expected from future explorations, but this, I think, I am warranted in stating, that the remains of flint and stone weapons and tools, in the Swiss crannoges, show that they were constructed by a people in a less advanced state than those who made the Irish crannoges, and that they were chronologically much anterior. Certainly the evidences derived from the antiquities found in ours, and which are chiefly of iron, refer them to a much later period than the Swiss; while we do not find any flint arrows, or stone celts, and but very few bronze weapons, in our crannoges. Moreover, we have positive documentary evidence of the occupation of many of these fortresses in the time of Elizabeth, and some even later.

"In the Swiss lakes two forms of *pfhalbauten* have been observed, one in which the artificial structure was like our Irish crannoge, placed in a natural shallow at some distance from the shore, and only accessible by a boat which has usually been found in connexion with them; the other is that in which the fortress was connected with the shore by a piled gangway or pier, but this may have been the result of the peculiar circumstances of the locality. We have the same kind of thing in Ireland, as shown by the description given by Mr. Kelly of that at Cloonfinlough. This, however, is a very ancient description of dwelling, for Herodotus informs us that Megabyzus was unable to conquer the people on the shores of the Prasian Lake, whose dwellings were constructed in the following manner:—'In this lake strong piles are driven into the ground, over which planks are thrown, connected by a narrow bridge with the shore. These erections were, in former times, made at public expense; but a law afterwards passed, obliging a man for every wife whom he should marry (and they allow a plurality) to drive three of these piles into the ground, taken from a mountain called Orbelus. Upon these planks each man has his hut, from every one of which a trap-door opens to the water.'*

"The subject of these crannoges is suggestive of an interesting ques-

* Terpsichore, Book v., par. 16, Beloe's translation.

tion in geology and physical geography, viz. :—How they came to be submerged and consequently unnoticed for so many years, and what have been the causes thereof. In Switzerland the several discoveries of these stockaded islands have been attributed to the winter of 1853-54, which having been unusually dry and cold, the lakes, deprived of their usual supply from the mountains, fell far below the lowest level on record.

"When our Irish crannoges, 'little tree [or wooden] islands' were first constructed, and, perhaps, as long as they continued to be used and repaired, the surrounding country was well wooded, especially with oak and alder, and the lakes rose on the average but to a certain level. As the timber was cut down, and the country became 'cleared,' these fastnesses were destroyed or deserted, and probably the growth of bog choking up the natural outlets of these lakes, the islands therein became obliterated, not by any submersion of the land, but by the rise of the water; subsequently, after the lapse of probably two centuries, these structures were again brought to light by drainage of two kinds,—one, the result of the general progress of civilization and gradual agricultural improvement throughout the counties of Meath and Antrim, where the lakelets in which the crannoges were discovered have altogether disappeared, as at Dunshaughlin and Randalstown—the other resulting from the sudden and direct withdrawal of the waters of a lake or district by the recent arterial drainage effected by the Board of Public Works in the counties of Leitrim and Roscommon."

The Rev. Dr. Reeves made the following supplementary observations to Mr. Wilde's paper on certain Crannoges in Ulster:—

"The most valuable of the Ulster Inquisitions is one which was sped at Antrim on the 12th of July, 1605, to ascertain the bounds and contents of the territory of Lower Clandeboy. It remains of record, but the original is in part illegible. A good office copy, however, which was produced in 1692, in the cause of Dr. Samuel Mathews against Dr. Claudius Gilbert, and was recently re-employed in the cause of Templemore and Donegall, is preserved among the See papers of Down and Connor. In it I found the four following notices of crannoges in the county of Antrim:—

"I. '*Tuogh Munterrividy*:—Et quod est infra metas et bundas ejusdem le tuogh quoddam stagnum vocatum Loughernegilly in quo est insula fortificata.'

"The territory of Munterrividy comprehended the parishes of Drummaul and Shilvodan, with parts of Antrim and Connor, and forms the eastern portion of the present barony of Upper Toome. The north-western boundary is represented as passing through a certain moor, called 'the bogg of Moan-loughernagilly,' leaving the lake called Loghernagilly in this tuogh. This name is now utterly unknown in the district, and the moin, or 'bog,' to which it gave title, is a large tract of turf made up of Kilknock bog, Aughterclony bog, Ballybollen bog, and

Gillistown bog, being portions of the parishes of Drummaul, Ahoghill, and the Grange, which meet here.*

"The lake, of which about two-thirds lie in the townland of Kilknock, and the rest in Ballybollen and Gillistown, is situate in the north-west angle of the parish of Drummaul, and is commonly known as Kilknock Lough. In former times it covered about fifty acres, but was drained about the end of the last century by Captain O'Neill of Ballyminstra. By this drainage the crannoge was brought to light, and the oak piles on which it was constructed were exposed. It is described by those who remember it as of a nearly circular form, and about 60 feet in diameter. There were also the remains of a wooden hut on it, constructed of oak beams. These timbers were removed, and some of them at present form part of the roof of a neighbouring barn. An old boat was found at the same time in the lough. Owing to some disputes which afterwards arose as to the ownership of the drained land, the outlets of the water were allowed to close up, and in consequence a considerable portion of the former bed was again submerged, and the island, from fresh deposits, lost its original shape. A few years back there were four or five acres of clear water surrounding the island, the remainder of the lough being a marsh. The island can be reached by wading, but it is only distinguishable from the rest of the marsh by its firmness. The tops of the oak piles are covered to a considerable depth with soft boggy matter, but can be felt with a pole seven or eight feet long. They are said to be about two feet in diameter. A paved causeway, which was covered to the depth of eight or nine feet with bog, leads down to what used to be the edge of the water. The bog around the lake is thickly studded with trunks of oak-trees, varying from one to three feet in diameter, and has evidently been at a remote period the site of an extensive wood.

"II. '*Tuogh-Nefuigh*:—Est in eodem tuogh quidam lacus vocatus Loughdireare in quo est insula fortificata.'

"This territory, which includes the parishes of Duneane, Cranfield, and the Grange, is commonly called *the Feevah*, which name, as also *ne Fuigh* in the above compound, is evidently the Irish Fiodhadh, 'wooded land.' It forms the western portion of the present barony of Upper Toome.† About two miles west of Randalstown, on the road to Toome, is Derryhollagh, a townland in the parish of Duneane.

"In this was a bog-lake called in modern times Loughravel, a corruption of the ancient Loughdireare.‡ This is the place referred to in Mr. Wilde's communication.

"III. '*Tuogh de Muntercallie*:—Est in eodem le tuogh quidam lacus sive stagnum vocatum Loughtoman, in quo est insula fortificata.'

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* Ordnance Survey, county of Antrim, sheet 37, N. W. corner.

† Called Fiodhadh in the gloss on the Feilire at Oct. 30. Dun-da-en, "fort of two birds," now Duneane, is there said to be in it. See Reeves's "Eccles. Antiq.," pp. 86, 300.

‡ Ordnance Survey, county of Antrim, sheets 43 and 49.

"The name Muntercally, in Irish Muinceŗ Cheallaiġ, 'family of Kelly,' is now locally forgotten. The district, however, included that portion of the parish of Ahoghill which is situate in Lower Toome, west of the Main Water.*

"Loughtamand, as it is now called by the country people, is a lakelet which has been drained, situate in Lisnahunshin, a townland of the parish of Craigs, but previously to 1835 in that of Ahoghill. It lies on the road from Ahoghill to Rasharkin, being about 4½ miles north-west of the former village.

"The lough is bordered on the east and south by traces of bog, and enclosed on the north and west by hills, three in number, from two of which the country slopes down with a regular fall to the Bann. Between the hills on the north and north-west there is a considerable depression, and at this point a small stream flowed, carrying off the surface water, which, being deepened, served as a drain for the lough. Before the withdrawal of its contents, about thirty acres Irish were submerged, the water varying in depth from seven to ten feet. It was drained about forty years ago by Earl O'Neill's orders, but, from neglect of the drains, the water once more accumulated in the hollow. However, it has been again drained, and is now under pasture. The outline of the basin is well defined, and, on the east side, the banks of the bog which formed the margin are from twenty to thirty feet in perpendicular height. It is of an irregular oval shape, about a mile in circumference. The island is situated about the middle, but somewhat nearer to the north and east sides. It was visible even before the drainage, and had a stone house upon it, said to have been a stronghold of the M'Quillans. The island was of a circular form about seventy yards in diameter. In the draining operations the main cut was carried across the long diameter of the lough, from south-east to north-west, and ran through the middle of the island. In cutting this part of the drain, the workmen came upon several oak piles, which, on investigation, after the water of the lough was drained off, turned out to be the ribs of a crannoge, situate in the centre of the island. These piles were from seventeen to twenty feet long, and from six to eight inches thick, driven into the bed of the lough, and projecting above this bed about five or six feet. They were bound together at the top by horizontal oak beams, into which they were morticed, and secured in the mortice by stout wooden pegs. Above the top of these piles there was about three or four feet depth of earth; and it was only when this earth had been removed, from time to time, that the wooden structure was discovered in its integrity. The piles were twenty-six in number, and were arranged in a circle of about fifteen yards diameter, in the centre of the island, and just under where the stone house stood. From the effect of cattle trampling over it, and persons digging down in search of treasure, the island is now reduced to the level of the surrounding ground. The horizontal beams

* Ordnance Survey, county of Antrim, sheet 31, N. E. corner.

have been removed, and used for various purposes. Not more than a dozen of the piles now project above the surface, and that only about one or two feet. The drain just formed a tangent to the circle of piles, touching it on the east, where some of the piles were dragged up on being laid bare. During the draining operations a single-piece oak canoe was found, about thirty yards from the island on the north-west side. It was in tolerable preservation, and was removed to Portglenone House, where it remained for some time, till Lord O'Neill claimed and had it removed to Shane's Castle, where it is said to be still in existence. The following articles have been found in this island from time to time: two iron swords; a small anvil, very bright and clean; a pair of scales, and several small hammers; several gold pins; metal dishes; small axe-heads; an iron cauldron, of a low, dilated shape; and a stone of a yellowish-white colour, beautifully polished, about twelve inches long, three and a half broad, and two thick, accurately squared at the sides, having a round hole about an inch and a quarter deep, and half an inch in diameter at each end, the top surface and one of the sides being covered with carved devices. Lord O'Neill obtained the swords; the anvil, scales, and hammers were sold by the finder, for trifling sums, to a pedlar and rag-gatherer. The iron cauldron is in use as a potato pot. A quern also, which was found, is preserved in a neighbouring house. The polished stone was given by the finder to a friend, to make a 'rubbing-bone' for his web. It is stated that a few feet below the present surface of the bed of the lough, a paved causeway of stone, about five feet broad, leads from the western margin of the lough across to the island. This establishes a striking similarity between the crannoge and some of the Swiss *pfahlbauten*.

"IV. '*Tuogh de Clinaghartie*:—Et est in eodem le tuogh quidam lacus alias stagnum vocatus Loughinchefeaghny, in quo est insula similiter fortificata.'

"This territory comprised the parish of Kilconriola, with that portion of Ahoghill lying east of the Main Water, and represents the eastern section of the barony of Lower Toome. The name is preserved in the neighbourhood of Ballymena, in the form *Glenagharty*, and one side of the first Presbyterian meeting-house there used to be called 'the Glenagharty aisle.' It is the Irish Clann Ṗacarṫa, and refers to the sept who once occupied the tract.* About two miles and a half north-north-west of Ballymena the new road to Ballymoney passes through the townland of Loughmagarry, having on the right a low-lying rank meadow, which in winter becomes very moist.† This was formerly a lake similar to those above described until it was drained in the latter half of the last century by Mr. Hugh Campbell of Ballygarvey, the tenant under Mr. Adair. The island stood at the side of the lake, remote from the new road, and near the western margin, where the bank rises

* See Reeves's "Eccles. Antiq.," p. 344.
† Ordnance Survey, county of Antrim, sheet 32.

rather suddenly from the hollow. It is now merely a knoll, resembling a little gravel hill; but it is fresh in the recollection of the neighbours that it was a stockaded island, having an external framing of oak piles, and the interior composed of gravel and clay. It is stated that several articles of curiosity have been found here, but time has dispersed them all. The name of the townland bears no resemblance to that in the Inquisition, but the large townland which joins Loughmagarry on the west, and of which it appears to have been a sub-denomination, is called *the Fenagh*, that is, Ḟioḋnach, and formerly gave name to the whole. The *Loughinchefeaghny* of the Inquisition is a compound of Loch-inse-Fioḋnaiġ, 'lake of the island of Feenagh.'

"These four crannoges are interesting in a civil point of view, as being, each, the accompaniment or head-quarters of a little territorial chieftaincy. They were the little primitive capitals of the four Irish tuoghs or districts, which, being combined in pairs about the beginning of the seventeenth century, went to form two English half baronies, exactly preserving their main boundaries; and though the names and sites have for ages been forgotten, and find no place in the Ordnance Map or any other survey or description, yet, with the Inquisition of 1605 as the pioneer, they have been satisfactorily traced out.*

"Together with these, it may be well to put on record the names of some other crannoges which existed in the same and adjacent counties.

"V. *Loch Crannagh*.—In the townland of Cross, over Fair Head, in the parish of Culfeightrin, is the lake of the above name, covering twenty-four acres and a half. It is called from a small, but beautifully defined island, artificially formed in the centre of it.

"VII. *Loughinsholin*.—A small lake, a little north-west of the village of Desertmartin, gives this name to the great barony in the south of the county of Londonderry. Correctly written it is Loch inse Ua Ḟloinn, 'Lake of Inis-O'Lynn.' It was so called from *Inis Ua Fhloinn*, or 'O'Lynn's Island,' a small stockaded island situate near its eastern margin. It probably obtained this name while the O'Lynns, or the Ui Tuirtre, were on the west of the Bann, ere they were forced by the O'Kanes into the south-west of the county of Antrim. The barony was formed in 1591 out of the two territories called Glenconkane and Killetra, and this little island must have been considered an important spot when the lakelet which contains it gave name to so great a tract.†

"In Friar O'Mellan's Irish Journal of the Rebellion of 1642 we find the following notices of this island:—

"1642, 27 April. Tanaic sluaġ Cul raṫain ar Cormac O Neill mac Feidlim oig go Roilgeaċ dar creaċaḋ 'sdar marḃaḋ a muintir leo .i. clann Uilliam. Arra sin doiḃ go loċ inis I Luinn agus go Muine mor go ttarla in da ṡluaġ a bfogus da roile. Do cruin-

* In identifying Nos. 1 and 3 there was considerable difficulty, and the merit of their discovery is due to Mr. William Millar, of Ahoghill. No. 2 has been known to the writer for several years, and No. 4 was identified by him about twelve years ago.

† See the note in Primate Colton's Visitation, pp. 76, 125.

nigeadar iomad creaċ, agus do teiċeadar na coirideaċta go Dun Gemunn tar eis moran do lomaḋ. Do pill in gall co Loċ inis O Luinn. Do cuiredar Ruaiḋri ballaċ O Mellan diarraiḋ an oilein ar Seaan O hagan mac Eoġain mic Emuinn oig. Do diul-tran fon [oilen] iad. Do sgaoilsead ar gunna mor baoi aca tri hurcuir, agus ṫogsat de o sin amaċ. Fillsead da ttigiḃ go mor e a dalac.

"'The Coleraine detachments came upon Cormac O'Neill, son of Fedh-lim Og, at Rayleagh, and robbed and killed his people, namely, the Clann William. Thence they proceeded to Lough-inis-olyn and to Mo-neymore, until the two forces were near one another. They collected a great deal of spoil, and the creaghts fled to Dungannon ; after plundering extendedly, the English returned to Lough-inis-olyn. They sent Rory Ballagh O'Mellan to demand the island from Shane O'Hagan, son of John, son of Edmund Oge. It was refused them. They then fired three shots from a cannon which they had with them, and departed from the place, returning to their homes laden with spoil.'

"1643, Aug. 25. Do bi barḋaḋa Seain I Agan ar inis Luinn. Tangadar na naiṁde da iarraiḋ, agus ni bḟuaradar. Do tarru-ing siad sruṫ oile san loċ 'sdo stopadar an sruṫ do bi ag sileaḋ uaḋa, gur baiṫeaḋ an toilen. Do rigne barḋaiġe an oilein faraḋ a ttig an oilen. Do marḃaḋ fear diḃ ar an araḋ re piler gunna moir. Giḋeaḋ diultrad an toilen do toirbeirt ar aon ċor. Do chuaiḋ fear diḃ san snaṁ gur bris an ċoraḋ 'sgur imṫig an naiṁuid.

"'Inis-O'Luin was garrisoned by Shane O'Hagan. The enemy came and called on them to surrender, which they refused to do. They then stopped up a stream which ran out of the lake, and turned the course of another into it, so that they contrived to flood the island. The gar-rison kept watch in the island-house, and one of their men was killed by a cannon-ball while on watch. However, they refused to surrender the island on any terms. One man, in attempting to swim away, had his legs broken. The enemy at length departed.'

"1645, March 7. Do loisc muintir Agan Inis I Luinn duireas-baiḋ bḟṫa 'sdo leansat siar an general.

"'The people of O'Hagan burned Inis O'Lynn, for want of provi-sions, and followed the General eastwards.'

"The island has been dismantled of its oak piles, and is now reduced to an unseemly bank, overgrown with reeds and bushes.

"On the Ordnance Map the lake is named *Lough Shillin*,* which ra-ther disguises the true form of the name."

Lord Talbot de Malahide made some remarks on Mr. Wilde's paper.

Sir W. R. Hamilton gave an outline of his paper "On certain Equa-tions in Quaternions, connected with the Theory of Fresnel's Wave Sur-face."

* County of Londonderry, sheet 41.

Mr. Wilde presented to the Museum, on the part of the Rev. Mr. M'Loughlin, P. P. of Antrim, a number of articles found in one of the crannoges described in his paper (p. 135).

MONDAY, APRIL 25, 1859.

JAMES HENTHORN TODD, D. D, President, in the Chair.

MR. WILDE presented several donations, and made the following remarks on them:—

"On the part of His Excellency the Earl of Eglinton, two iron basket-hilted swords, Nos. 160 and 161, each three feet long in the blade, with fish-skin handle covers and buff leather under-guards. They were found in an old press in the Privy Council Chamber in Dublin Castle, and were procured for the Academy through General Larcom.

"By reference to the 'Proceedings' for April 12, 1858, we find at p. 41 the acknowledgment of a collection of bronze pins from the neighbourhood of Gweedore. As neither the name of the noble donor nor the circumstances under which they were found has been mentioned, I beg to record the following communication from Lord George Hill upon the subject:—'The ancient pins which I presented to the Royal Irish Academy were found at different times, within these four or five years, upon the shore of the townland of Magheraclogher, in the district of Gweedore, parish of West Tullagh-obegley, barony of Kilmacrenan, and county of Donegal. There are shifting sand-hills on various parts of the coast, the wind and rain affecting which, expose these ancient relics to view; and also the remains of the habitations of the former inhabitants, who must have retreated inland as the sands encroached upon them.' These pins will be kept as a separate find, illustrative of the style of art in such articles used at their time, and in the locality from which they were obtained; but in numerical order they will follow after No. 504 of the bronze pins described in the manuscript registration, and the list of purchases for the year 1858-59. See also the 'Ulster Archæological Journal,' vol. vi., p. 351.

"I allude to the circumstance of these numbers here, because I look upon it as of the greatest importance, that in all future donations made to the Academy, some distinctive mark should be attached to the objects, by which they can be subsequently recognised in the Museum, and that everything that is known about them should at once be furnished to the editor of the 'Proceedings' for publication. Had this been done when we first began to collect and to record these donations, a catalogue would have been formed of immense value in the present day. As, however, the Committee of Antiquities have undertaken to present the Academy, once a quarter, with an account of the various articles which have been purchased, as well as of such donations as have not been already described, I hope to see adopted a better mode of recording the history, and a better form of identifying those antiquities which come into the Museum, either as purchases or donations, for the future. It is right

that the Academy should know that the manuscript Museum Catalogue, such as it was, has not been written up for a considerable length of time. If the plan I propose is followed out for the future, the records of all additions to our catalogue will be a matter of comparative ease. Besides, the proper public acknowledgment of these donations is gratifying to those who have given, and may prove an incentive to those who still have to give.

"On the part of Richard Maguire, Esq., of Newgrange, county of Meath, I beg to present a rather rare form of bronze pin, No. 524, discovered in the rampart of one of the circular enclosures which lie between the great tumulus of Newgrange and the River Boyne; it possesses peculiar interest from the circumstances of the locality in which it was found.

"On the part of Marcus Harty, Esq., C.E.—A very beautiful cinerary urn, now numbered 50 in the collection. It is 4 inches high, 5½ broad in the widest portion, which is a little above the middle, and 3½ inches in the clear of the mouth. The ornamentation upon it, although performed by a rude instrument, exhibits considerable skill and handiwork. The form of the vessel is very graceful, and the lip has been decorated in a manner similar to the external surface. It was found in June, 1849, in the centre of a stone cairn on the top of Tibradden Mountain, county of Dublin, in a stone chamber filled with charcoal and burned bones, of which latter there is a collection on the table, and although so great a length of time has elapsed since they were deposited, they exhibit unmistakeable evidences of the rapid action of fire. A second urn was found in the same tumulus, but was so much broken, that no portion of it remains to the present day. Mr. Harty has added to the value of his donation by affording an accurate drawing and ground plan of the mound, together with a tracing of the road from Dublin to the spot, and both of which are deposited in the archives of the Academy.

"Also from Mr. Harty, a crescentic piece of cast bronze, No. 65 in the registration of Miscellaneous Articles. It was found in a gravel pit near the River Boyne at Navan, immediately beneath Athlumny Castle. What renders it particularly interesting to the antiquarian is, that it presents all the appearance of having been the ferule at the end of an ancient sword scabbard, an implement which we do not possess an example of in the Academy, nor indeed in any other collection of Irish antiquities that I know of.

"From Mr. Hayes, of Moate, county of Westmeath, I present two curious ancient single-piece shoes. Having carefully examined and completed the catalogue of leathern objects during the past year, I can speak as to the value of this donation, to which, although we have many objects of a like nature, we have nothing identical in the Museum. Although right and left shoes, they are of totally different patterns, and, I should say, belonged to different periods. The first, now No. 13 in our collection, is a left-footed, round-toed shoe of the pampoota shape, with an open-work front, so that it was not intended to keep out the wet. It is sewn with a thong both in the back seam and along the open-work, and was laced to the foot with leathern sandals like the modern pampoota. 'It was found in the bog of Buggaun, parish of Ballymore, near Moate, in July, 1858, many feet under the surface;' and, adds the

donor, 'there was no appearance of a crack or flaw in the bog where it was found, which was the case with the other shoe.' No. 14 is a right-footed shoe, pointed at the toe, but also composed of a single piece of thick tanned leather; it has a triangular seam behind, and an overlapping upper in front, which is gathered in along a seam of beautiful workmanship, and presenting an interlacement of the material itself. A similar form of decoration is often observed in Irish art, both in metal-work and upon our illuminated manuscripts; thus showing that, even in leather manufacture, a *style* of art influenced the taste of the mechanic up to the period when this shoe was worn. The seam is closed with gut, and, therefore, I would place this shoe as second, in point of antiquity, to the first specimen described, which is sewn with leather. It also was found in the bog of Buggaun, but not in the same locality as the former.

"On the part of Dr. Ringland, I present an antique bronze spoon, No. 52, originally tinned, and bearing a curious trade-mark on the inner surface of the bowl, consisting of three spoons enclosed within a circle, and which was evidently struck after the casting, as shown by the indentation on the convex side. Although not of very great antiquity, it is an object of interest in continuation of similar articles in the Museum, after which it will come in as No. 52.

"On the part of Mrs. Rothwell, of Rockfield House, Kells.—A unique bronze pin, No. 525, with three rings passing through the stem, and decreasing in size from above downwards. This pin is now imperfect, being but three inches in length; it was found at Dunshaughlin, and formed a portion of the collection of articles from that locality possessed by the late Mr. Rothwell.

"On the part of George Sandford Wills, Esq., of Castlerea, county of Roscommon, two antique horse headstall ornaments of the usual spur shape, similar to those already in our collection, where they form Nos. 178 and 179 on Tray PPP; the one is 12, and the other 13 inches long. They differ slightly in character, but were evidently pendant and swinging, as shown by the worn loops at the ends of the prongs. Both have knobs at the handle-like extremities, but the loops for attachment to the bridle differ considerably, being in one specimen continuous with the side of the prongs, and in the other projecting at right angles to them. Having tried articles of this description on different horses, I find that they will not fit on the head either in front of the ears, or hanging under the jowl, like some of our modern bridle ornaments of leather and hair, but must have hung from the bit, in which position they to a certain extent prevented the horse from grazing while caparisoned, and, according to some trainers whom I have consulted, prevented the animal kicking. Both these articles were found in the neighbourhood of Castlerea, the one at Creggane, and the other at Clooncunra. It will be in the recollection of the Academy that I recently presented another specimen found at Emlagh, in the same locality (see No. 173, described at p. 19).

"On the part of Joseph H. Smith, Esq.—A very rare and curious iron small-sword, No. 142 on Tray G, now 16 inches long, remarkable for the blade being composed of barred open-work for about 6 inches; it was found at Dunshaughlin, and is alluded to in the 'Proceedings,' vol. i., p. 420, in 1840, when it was exhibited to the Academy.

"From Arthur A. Nugent, Esq.—The upper stone of a quern, No. 36 on the ground floor, beneath the south-western staircase. It is 12 inches in diameter, and 4½ deep, was found in a bog near Portaferry, and presents a unique form of ornamentation, being grooved like a melon.

"On my own part I present a collection of sixteen articles, viz., six stone celts of different sizes and shapes, but all capable of being classed under some of the heads under which the other celts in the Museum have been arranged and numbered, in continuity with which the first of these will form No. 521. They vary in length from 4 to 7½ inches, and some of them are remarkable for the sharpness as well as the wave-line of the cutting edge. They were all found in the bed of the Shannon.

"Examined by Mr. Haughton, their composition is as follows:—No. 521, fine-grained syenite; No. 522, syenitic slate, probably metamorphic; from the northern or central districts. No. 523, mica slate; No. 524, clay ironstone; from a colliery district. No. 525, fine-grained white sandstone; and No. 526, sandstone, containing specks of green silicate of iron; probably derived from the Connaught side of the river.

"No. 21.—A dagger-shaped stone, sharp at both ends, similar to those weapons already described at page 34 of the 'Catalogue.' Like most of those we already possess, 'it was taken up in the bucket of the dredger from the bottom of the Shannon above the new bridge at Athlone, opposite Northgate.' It is about 12 inches long, and 1⅛ inches wide in the broadest part, and is composed of hornblende slate.

"No. 270, the blade of a bronze dagger; of the broad shape, 9 inches long, and 1¾ broad at the base, with a detached metal-rivcted handle, like those on Tray CC.

"No. 78, a very perfect iron spear-head, 7¾ inches long, with the rivet remaining, and projecting a considerable distance beyond the outer surface of the socket, like Nos. 11 and 49 in the registration.

"No. 79, a rude fragment of another iron spear-head, 5 inches long.

"No. 80, a remarkable four-sided iron spear, or pike-head, of which there is a more modern specimen in the collection; it is about 22 inches in length, including a portion of the socket, which remains.

"No. 162, an iron knife-shaped sword, or skein, with a broad back, very perfect in the blade, which, with the tang, measures 19½ inches. There are several similar specimens on Tray F. All these weapons are said to have been found in the Shannon.

"Nos. 526, 527, 528, and 529, are four bronze cloak-pins, which I procured many years ago in the southern islands of Aran. The first of these is, for its size and form, one of the most elegant specimens of casting in the Academy's collection.

"No. 21, an iron key of antique shape, and probably of the sixteenth century; in a very good state of preservation.

"No. 158, a portion of an antique wooden chair, containing two mortices. The ornamental circular knobs have more the appearance of being carved than turned. It also was found in the bed of the Shannon."

Parke Neville, Esq., presented a small bronze pin with a movable looped head, found in Upper Exchange-street, at a depth of eighteen feet below the surface of the ground.

MONDAY, MAY 9, 1859.

JAMES HENTHORN TODD, D. D., President, in the Chair.

SIR W. R. HAMILTON resumed the reading of his paper—

ON CERTAIN EQUATIONS IN QUATERNIONS, CONNECTED WITH THE THEORY OF FRESNEL'S WAVE SURFACE.

IF $S\rho\phi\rho = 1$ be the *equation of an ellipsoid* (or, indeed, of any other central surface of the second order), then the *identity*,

$$\rho^{-1} V\rho\phi\rho = \phi\rho - \rho^{-1} = (\phi - \rho^{-2})\rho,$$

proves that the vector, $\sigma = \phi\rho - \rho^{-1}$, is perpendicular at once to ρ and to $V\rho\phi\rho$. But $V\rho\phi$ has the direction of a line tangent to the surface, which is also perpendicular to the semidiameter ρ, because $\phi\rho$ has the direction of the normal to the surface, at the end of that semidiameter. Hence σ is *normal* to the *plane* of the *section*, whereof ρ is (not merely a *semidiameter*, but) a *semiaxis*; the other semiaxis having the direction of $V\rho\phi\rho$. But $\rho = (\phi - \rho^{-2})^{-1}\sigma$; ρ and $\perp \sigma$;

$$\therefore 0 = S\sigma(\phi - \rho^{-2})^{-1}\sigma; \tag{1}$$

and this last formula, which (when developed either by the $\alpha\beta\gamma$ or by the $\iota\kappa$ form of ϕ), is found to lead to a *quadratic equation*, relatively to ρ^2 (or to $T\rho^2$), must, therefore, give, in general, the *two* scalar values of the *square* of a *semiaxis* of the *section* perpendicular to σ, when the *direction* of this normal σ, or of the plane itself, is *given*.

Suppose now that the normal σ is erected *at the centre* of the ellipsoid, and that its *length* is made equal to the length of one of the semiaxes ρ of the section, we shall have, of course, $T\sigma = T\rho$, and may write

$$0 = S\sigma(\phi - \sigma^{-2})^{-1}\sigma, \tag{2}$$

as the equation of the *locus* of the extremity of σ: that is, according to Fresnel, of the *wave surface*. But this is just the form (b), when we write ρ for σ.

Rev. Professor Graves read a paper—"On a Gaulish Inscription," noticed by M. Pictet in his recent work.

Mr. Wilde read the first part of his paper—"On the unmanufactured Animal Remains in the Academy's Museum."

Rev. Joseph A. Galbraith read a note by Lieut. Renny, explaining that the table printed at p. 639 of his paper, read June 14, 1858, was founded upon figures published in the monthly tables of the "Bibliotheque Universelle;" and that it now appears, from a communication by M. Plantamour, that a correction of + 0·79 should be applied to these numbers, as the equation of the Geneva barometer.

MONDAY, MAY 23, 1859.

Rev. Samuel Haughton, A. M., F. R. S., &c., in the Chair.

W. R. Wilde, Esq., read the continuation of his paper "On the unmanufactured Animal Remains in the collection of the Academy."

MONDAY, JUNE 13, 1859.

James Henthorn Todd, D. D., President, in the Chair.

With the leave of the Academy, Mr. E. Clibborn read the first part of his paper—

ON THE USE OF THE DISTAFF AND SPINDLE CONSIDERED AS THE INSIGNIA OF UNMARRIED WOMEN.

The object of the author was to explain how far the use of the distaff and spindle could be considered applicable in literature and art, as insignia of women, in different countries, and at different times.

In contra-distinction to a paper published in the "Archæologia," vol. xxxvii., by J. R. Akerman, Esq., it was contended that, as unmarried women, in the middle ages, were considered *spinsters*, and as married women, or wives, were considered *weavers*, the application of the implements used by spinners might with propriety be assigned as insignia to the unmarried, but not to the married, whose proper insignia should connect them with the loom or its productions, rather than with spinning.

It was explained, that the usage by Shakspeare of the words "distaff," "distaff-women," and "spinster," clearly implied a different, and indeed an opposite meaning, as insignia, for the distaff and spindle; and also proved, that, in the instances where married women claimed to use, or intended to use the distaff, they tacitly declared their intention of repudiating their marriage vows. They thus indirectly proclaimed themselves free from the control of their husbands, and so, were practically acting as unmarried women; the distaff was, consequently, a fitting but exceptional insignia for them. Instances from Shakspeare were given, to show that the general notion of rebellion, public as well as private, on the part of women, was indicated by the distaff, apparently in contra-distinction to the spindle; and Shakspeare, in so using the distaff, had the warrant of antiquity, the Fates appearing to be almost always armed with distaffs; and other goddesses, like Minerva, hold the distaff as the emblem of dominion, rule, or power, but not of marital obedience, and domestic subjection, indicated by the spindle, which, as an insignia of the unmarried woman, had almost opposite meanings to the distaff, also considered as an emblem of condition.

It was suggested that the same rules of language which gave us the terms *spinster* and *distaff-woman* for single females, derived from the spindle and distaff, should also supply another name for women, considered unmarried, from the ancient name in English of the verticillum, or

"wharrow," used to give momentum to the spindle, and maintain its rotation after the act of twisting, and casting it from the hand of the spinster. In this act the verticillum was often lost, dropped, and, not thought worth the trouble of picking up, it was often cast away as worthless.

After a long search, it was at last found that the heraldic description of the coat of arms of the family of Trefuss, in "Guillim's Display of Heraldry," p. 300, supplied the obsolete English name given above of the verticillum, and thus completed a series of titles for unmarried females, proving that the three instruments used by the spinsters of antiquity and of the middle ages had suggested English words; as if the several implements, the spindle, the distaff, and the wharrow, had been considered insignia of those denominations of women who were, or who claimed to be, unmarried, or who acted as if they were unmarried; consequently, it was inferred that the three instruments used by spinners formerly might be considered as proper insignia of unmarried women, or married women in marital rebellion, but not of married women properly so called, who, as *wives*, were considered by the analogy of language to be *weavers*, and who continued to act up to those vows of obedience to the laws of the land and morality to which they promised to conform for life when they were married.

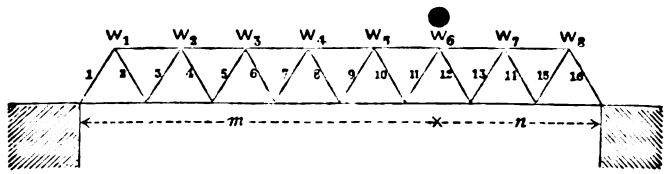
It was explained that the cases quoted in Mr. Akerman's paper, in which it was inferred that the spindle and distaff, taken together, were the insignia of wives, or weavers, as well as of *spinsters*, or spinners, when properly investigated, led to a different conclusion, and that the proper insignia of the woman considered to be a *wife* should always imply the loom or its productions, a warp or woven fabric, and not a mere thread or yarn, or any instrument used for spinning it.

Bindon B. Stoney, C. E., M. R. I. A., read a paper—

ON THE APPLICATION OF SOME NEW FORMULÆ TO THE CALCULATION OF STRAINS IN BRACED GIRDERS.

Until within the last ten years our knowledge respecting the strains in the vertical portion or web of flanged girders has been very limited, and crude and imperfect views still prevail respecting the duty which this portion of a girder has to perform. Various, indeed, have been the opinions of so-called practical men on the subject. Some say the web keeps the flanges apart; others conceive that it holds them together; but comparatively few have perceived that its essential duty is to transmit the vertical pressure of the load to the abutments, producing in so doing horizontal strains in the flanges, or, if they have acknowledged this to be its proper function, they have failed to follow out their reasoning to its legitimate result, viz., that the web sustains strains which are essentially characterized by the oblique direction in which they act, and which can be practically determined both in direction and amount, enabling the engineer to dispose of the material in the most economical manner, so that its full capabilities of sustaining strain may be called into play.

In investigations respecting braced girders, it is desirable, as in other researches, to proceed from the simpler to the more complex case. I shall, therefore, first consider the strains produced by a single weight, in a girder containing but one system of triangles (Fig. 1). And I would here observe, that this paper contains merely a modification and extension of the principles of bracing already ably investigated by W. B. Blood, Esq., and R. H. Bow, Esq., who were the first to apply accurate methods of calculation to diagonally braced girders.



Suppose that the weight W_6 divides the girder into segments containing respectively m and n bays. On the principle of the lever, the pressure on the right abutment $= \frac{m}{l} W$, that on the left $= \frac{n}{l} W$; l representing the number of bays in the whole span $(= m + n)$.

Now each of these components of the weight is transferred to the abutments through the diagonals, for vertical forces cannot pass along the horizontal flanges. Consequently, $\frac{m}{l} W$ is transmitted through each diagonal on the right of W; and this quantity is the vertical component of the strain in each of these diagonals. The actual strain is to its vertical component as the length of the diagonal is to the depth of the girder, or, calling the angle of inclination of a diagonal to a vertical line θ, we have the strain in each diagonal in the right segment—

$$\text{Strain} = \frac{m}{l} W \sec \theta. \qquad \text{(I.)}$$

In the left segment—

$$\text{Strain} = \frac{n}{l} W \sec \theta. \qquad \text{(II.)}$$

The strains in the diagonals of each segment are alternately compressive and tensile.

If the load be uniformly distributed, so that the same weight rests upon each apex, or if it be symmetrically disposed on either side of the centre, the strains in the diagonals gradually increase from the centre towards the ends. Any two diagonals equally distant from the centre sustain all the intermediate load. If they are tension diagonals, the weight is suspended, as it were, between them; if they are compression diagonals, it is supported by them as oblique props. Each diagonal conveys therefore to the abutment the pressure of the weights between it and the centre, and the sum of these weights constitutes its vertical

component. Hence, if there be n weights between any given diagonal and the centre, we have for a uniform load

$$\text{strain} = n\text{W} \sec\theta, \qquad \text{(III.)}$$

W being the weight resting on each apex.

When the load is a moving load, such as a railway train, the maximum strain in any diagonal occurs when the front or end of the train is passing it. If, for instance, a train of carriages cover the right segment of the girder, diagonal 11 sustains the maximum compression which the train can produce in it; for if a weight rest upon any apex in the other segment, some portion of this weight will tend to pass to the right abutment through diagonal 11, producing in it a tensile strain, that is, a strain of an opposite kind to that produced by the train, and so will diminish the amount of the compression which existed before the additional weight was added.

On the other hand, the maximum tension in diagonal 11 occurs when the train covers the left segment, and any weight resting upon the right segment will tend to diminish this. Hence, the maximum strains in any diagonal occur when the passing load covers one or other segment into which it divides the girder; and these strains may be obtained by tabulating those produced by each weight separately, and then selecting that combination which produces maximum strains.

The annexed Table represents this method applied to the girder, Fig. 1.

The length of the girder = 80 feet, and the load = 1 ton per running foot, which is equivalent to 10 tons resting upon each apex. Let the angle $\theta = 30°$,—whence $\sec\theta = 1{\cdot}154$; and let l = the number of bays in the span, = 8.

	W_1	W_2	W_3	W_4	W_5	W_6	W_7	W_8	Maximum Compression.	Maximum Tension.	Uniform Load.
1	+10·8	+9·4	+7·9	+6·5	+5·1	+3·6	+2·2	+0·7	+46·2	0·0	+46·2
2	+ 0·7	−9·4	−7·9	−6·5	−5·1	−3·6	−2·2	−0·7	+ 0·7	−35·4	−34·7
3	− 0·7	+9·4	+7·9	+6·5	+5·1	+3·6	+2·2	+0·7	+35·4	− 0·7	+34·7
4	+ 0·7	+2·2	−7·9	−6·5	−5·1	−3·6	−2·2	−0·7	+ 2·9	−26·0	−23·1
5	− 0·7	−2·2	+7·9	+6·5	+5·1	+3·6	+2·2	+0·7	+26·0	− 2·9	+23·1
6	+ 0·7	+2·2	+3·6	−6·5	−5·1	−3·6	−2·2	−0·7	+ 6·5	−18·1	−11·6
7	− 0·7	−2·2	−3·6	+6·5	+5·1	+3·6	+2·2	+0·7	+18·1	− 6·5	+11·6
8	+ 0·7	+2·2	+3·6	+5·1	−5·1	−3·6	−2·2	−0 ·7	+11·6	−11·6	0·0

The letters in the upper row represent the weights at each apex, and the numbers in the first column, the diagonals in order of position.

The number found at the intersection of a diagonal with a weight represents in tons the strain produced in the diagonal by the weight in question. The sign + prefixed to a strain signifies that it is compressive; the sign – that it is tensile.

The 10th and 11th columns contain the maximum strain of both kinds, compressive and tensile, which the moving load can produce. These are obtained by adding the numbers in the several rows—first, those expressing compressive strains; and, secondly, those expressing tensile.

The last column contains the strains which the load produces when distributed uniformly all over. These are obtained by adding algebraically the strains in the several horizontal rows; or, more simply, by taking the difference of the two preceding columns.

The table, on examination, will be found to corroborate what has been already stated, viz., that the maximum strains in the diagonals occur when the passing load covers, not the whole girder, but one segment merely.

Thus, in the 6th row from the top, we find that weights 1, 2, and 3, in the left segment, produce compression in diagonal 6, while all the weights in the right segment produce tension. If, however, the load cover the whole girder, the resulting strain is equal to the *difference* between the sum of the tensile and the sum of the compressive strains, i. e. is the same as would occur if weights 4 and 5 alone rested on the beam.

The preceding method is the usual one; if, however, we wish to express the maximum strains by formulæ, we must divide Girders into two classes:—

Class A.

Girders in which the first loaded apex is distant one *whole bay* from the abutment.

Let there be n loaded apices between any given diagonal and the abutment. The strain produced by the weight at—

$$\text{The 1st apex} = \frac{W}{l} \sec \theta.$$

$$\text{2nd apex} = 2\,\frac{W}{l} \sec \theta.$$

$$\text{3rd apex} = 3\,\frac{W}{l} \sec \theta.$$

. . . . . .

$$n^{th}\ \text{apex} = n\,\frac{W}{l} \sec \theta.$$

The maximum strain is equal to the sum of these separate strains. Hence—

$$\text{Max. strain} = (1 + 2 + 3 + \ldots\ldots n)\,\frac{W}{l} \sec \theta.$$

$$\text{Max. strain} = (1 + n)\,\frac{n}{2}\,\frac{W}{l} \sec \theta. \qquad \text{(IV.)}$$

Class B.

Girders in which the first loaded apex is distant one *half-bay* from the abutment. The strain produced by the weight at—

$$\text{The 1st apex} = \frac{W}{2l} \sec \theta.$$

$$\text{2nd apex} = 3\frac{W}{2l} \sec \theta.$$

$$\text{3rd apex} = 5\frac{W}{2l} \sec \theta.$$

. . . . . .

$$n^{th} \text{ apex} = (2n-1)\frac{W}{2l} \sec \theta.$$

Summing up these, we have—

$$\text{Max. strain} = \{1 + 3 + 5 + \ldots (2n-1)\}\frac{W}{2l} \sec \theta.$$

$$\text{Max. strain} = \frac{n^2}{2}\frac{W}{l} \sec \theta. \qquad \text{(V.)}$$

Example:—The maximum tension in diagonal 11, Fig. 1, occurs when weights 1, 2, 3, 4, and 5 rest upon the girder, in which case $n = 5$, and we have—

$$\text{Max. strain} = \frac{25}{2} \times \frac{10}{8} \times 1{\cdot}154 = 18 \text{ tons.}$$

This should equal the maximum tension in diagonal 6, already tabulated, which it does.

Lattice Girders.

To proceed, next, to the lattice girder.—And first, I may remark, that latticed bracing has no theoretic advantage over a single system of triangulation; its advantages are entirely of a practical nature, consisting in the frequent support which the tension diagonals give to those in compression and which both give to the flanges.

Long pillars are serious practical difficulties, and the lattice tension bars subdivide what would otherwise be long pillars into a series of shorter ones, and hold them in the direction of the line of thrust. That this does not injuriously affect the tension diagonals will be evident when we reflect that the longitudinal strain produced in them by the deflection of a strut bears the same ratio to the strain transmitted through the strut as the deflection or versine of the curve bears to the half strut—an amount quite inappreciable in practice. If, for instance, a strut be ten feet long, and its central deflection equal one-inch (an amount much greater than ever occurs in practice), the longitudinal strain produced by this deflection in the tension bar, which intersects the centre of the strut, and restrains it from further deflection, equals $\frac{1}{60}$th of the thrust passing through the strut; so that in most cases a stout wire in tension would be sufficiently strong to hold the struts in

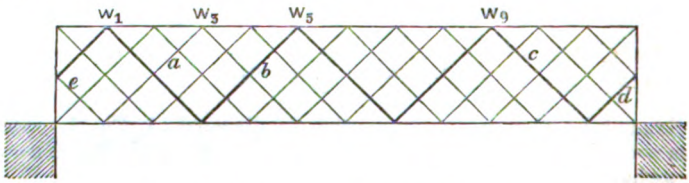
the line of thrust; and this reasoning applies to deflections both in the plane of the girder and at right angles to it.

This consideration shows that the apprehension of long compressive bars yielding by flexure—an apprehension expressed by the most eminent advocates of the plate or continuous web—need not deter us from applying diagonal bracing to girders exceeding in length any girder-bridge hitherto constructed.

It also serves to explain the otherwise anomalous strength and rigidity of lattice girders whose struts as well as ties are formed of thin bars. Such a mode of construction is, however, more or less defective. The struts should be formed of angle-iron, or the material should be thrown into some other form than that of a thin bar, which is quite unsuitable for resisting flexure at right angles to the plane of the web.

In order to calculate the strains of a lattice girder, we must consider each system of triangulation separately.

Suppose, for instance, a load distributed over the upper flange of the girder represented in Fig. 2—



The strains in any diagonal, b for example, are produced by the weights resting upon the apices of its own system of triangulation, W_1, W_5, and W_9, and the weights on the other apices do not affect it at all. The maximum compressive strain in diagonal b occurs when apices 5 and 9 of its system alone are loaded, and 1 is free from load, and in general, the maximum strain in any diagonal occurs when the moving load covers the greater segment of the girder, but is due merely to those weights which rest on the apices of its own system. The end pillars act as girders as well as pillars, for they transmit to the flanges the horizontal resultant of the strains in the diagonals which intersect them. This resultant is in general of small value, for it is the *difference* between the horizontal components of the strains in the intersecting diagonals. The strains in the bracing of lattice girders may be obtained by tabulating the strains produced by each weight separately, as already explained. This is, however, a tedious process, and they may be more conveniently obtained by the use of an equation obtained as follows:—

Let W = the weight liable to rest on each apex.

l = the number of bays in the span.

d = the number of bays in the depth.

n = the number of bays between the $\left\{\begin{matrix}\text{top}\\\text{bottom}\end{matrix}\right\}$ of the given diagonal and the further abutment, when the load traverses the $\left\{\begin{matrix}\text{top}\\\text{bottom}\end{matrix}\right\}$ flange.

p = the integer number of times that its own system occurs between the $\left\{\begin{matrix}\text{top}\\\text{bottom}\end{matrix}\right\}$ of the given diagonal and the further abutment, when the load traverses the $\left\{\begin{matrix}\text{top}\\\text{bottom}\end{matrix}\right\}$ flange, = the integral part of $\frac{n}{2d}$.

Let there be n bays between the diagonal b and the right abutment; then, on the principle of the lever, the portion of W_6 which is transmitted to the left abutment through b equals $\frac{n}{l}W$; of W_9 equals $\frac{n-2d}{l}W$.

The maximum compressive strain in diagonal b is equal to the sum of these quantities multiplied by sec θ, and equals—

$$\{n+(n-2d)\}\frac{W}{l}\sec\theta.$$

In general, the maximum strain in any given diagonal equals—

$$\{n+(n-2d)+(n-4d)+(n-6d)+\ldots+(n-2pd)\}\frac{W}{l}\sec\theta.$$

$$\text{Max. strain} = (n-pd)\,.\,(p+1)\frac{W}{l}\sec\theta. \qquad \text{(VI.)}$$

In diagonal a, for example, we have—

$$n = 9$$
$$d = 2$$
$$p = 2$$
$$l = 12.$$

Hence

$$\text{Max. strain} = (9-2\times 2)\,.\,(2+1)\frac{W}{l}\sec\theta = 15\frac{W}{l}\sec\theta.$$

This diagonal is never subject to tension from a passing load on the top flange, since there is no upper apex belonging to its system in the left segment.

When the load is uniform, the strains in the bracing may be calculated by equation III., observing that the coefficient n will, in a lattice girder, represent the number of those weights which occur between any given diagonal and the centre of the girder, and which rest only on the apices belonging to its system of triangulation. When a lattice girder contains three or more systems of triangles, a slight ambiguity occurs respecting the strains, if the load be disposed on both sides of the centre. Take, for example, W_3 and W_9, which belong to different systems, but rest on apices equally distant from the centre. The whole of W_3 may be conveyed to the left abutment through diagonals a and e, and the whole of W_9 to the right abutment, through diagonals c and d, without producing strains in the other diagonal of either system, which, indeed, might be suppressed as far as these weights are concerned. But, again, $\frac{3}{12}$ths of W_3 may be transmitted to the right abutment, and $\frac{9}{12}$ths to the

left, through the diagonals of its own system, and similarly with respect to W_9. Hence there arises a slight ambiguity respecting the strains, as they may go in either way, or partly in one, partly in the other. If, however, the girder be strong enough to sustain the strain, in whichever way it is conveyed, the safety of the structure is secured, and practically a very slight difference in the resulting strains ensues whichever method of calculation is adopted.

MONDAY, JUNE 27, 1859.

JAMES HENTHORN TODD, D. D., President, in the Chair.

J. R. KINAHAN, M.D., read an account of the discovery of certain wooden implements, found in connexion with the bones of *Megaceros Hibernicus*, in a marl-pit in the county of Clare.

J. B. Jukes, M. R. I. A., called attention to the recent observations made by Mr. Prestwich and others, in England and France, the tendency of which is to establish the coexistence of the human race with some of the races of animals now extinct, such as mammoths and bears.

The PRESIDENT read a paper—

ON THE GROUNDS FOR SUPPOSING THAT THE NAME OF THE TRIBE OF ISSACHAR OCCURS IN EGYPTIAN INSCRIPTIONS. BY THE REV. EDWARD HINCKS, D.D.

THE alleged occurrence of the name of Issachar, as of a people in Palestine, in the inscriptions of Rameses III., has been used as an argument against the opinion so generally entertained by recent Egyptologists, that the Exodus did not take place till near the end of the nineteenth dynasty. In the present paper I propose to consider, without reference to the chronological question, whether this reading of the name be admissible. As respects the latter part of the name, I cannot suppose that any objection can be made. It concludes with a double, or sometimes a single K and R. Before these we have an *unfledged bird;* and the question to be considered is, whether this can represent *Iss*, or any sound which can have passed into *Iss;* for though this be the modern pronunciation, grounded on the Masoretic points, it may not have been the ancient pronunciation.

I will endeavour to prove the two following propositions:— 1st. In certain cases, of which this is one, it is admissible to supply a vowel before the consonantal character which begins a word. 2nd. The value of the *unfledged bird* was the double consonant ST. If these propositions be established, nothing more will be required to justify the reading Istakkar, or Istakar, from which Issakar naturally flows. As to the first of these propositions, I must begin with stating that since the publication of my paper "On the Number, Names, and Powers of the Letters of the Hieroglyphic Alphabet," I have been led to alter my views very considerably. So far, however, from returning to the old views, from which I there expressed my dissent, I have gone much further from them. I am now satisfied that the Greek transcriptions of the Ptolemaic age and the Coptic equivalents of hieroglyphic words are still less to be depended on than I then supposed, and that the Egyptian

characters which were not syllabic were *consonantal*, like the Phœnician and Hebrew, as contrasted with *alphabetic*, like the Greek and Coptic. I mean to say that, properly speaking, there were no vowels. What have been supposed to be such were really breathings or semi-vowels. They in some instances indicated the vowels that were to be supplied; but vowels had in every instance to be supplied.

A comparison of the Cuneatic or Assyrian and the hieroglyphic or Egyptian methods of writing, will best show my meaning. The Assyrians had characters representing complete syllables, consisting of two consonants and a definite vowel between them; and they had characters representing incomplete syllables, either a consonant followed by a definite vowel, or a consonant preceded by a definite vowel. A combination of a character representing an incomplete syllable of the former kind, and of a character representing an incomplete syllable of the latter kind, would be equivalent to a character representing a complete syllable. Supposing there be twenty-two distinct sounds in the language, and that each complete and incomplete syllable were to be represented, 22 × 22 × 3, or 1452 complete, and 22 × 6, or 132 incomplete syllables, would have to be represented. It would be scarcely possible, however, to devise such a number of Cuneatic characters, and it would be absolutely impossible to recollect them. It is, consequently, a matter of necessity that several syllables should in many cases be represented alike, and that many complete syllables should be without representations. For example, בָּח בָּא and the incomplete syllable בַּ, might have one character to represent them; and, again, אַבְ, הַבְ, יַבְ, עַבְ the incomplete syllable בְ and the five corresponding syllables which have פְ in the place of בְ, might have one character to represent them all. Those complete syllables which neither occurred in the inflexions of common roots nor in combinations of preformatives, or of a preformative and an initial radical, might be left without any representatives. The number of syllables that it would be desirable to represent might thus be reduced to less than a quarter of the whole number in existence. The number of characters in use was also limited in another way. The characters originally represented objects, and stood for sounds which were the names of those objects, or signified some action which they would suggest. An incomplete syllable could not, therefore, have any proper representative. Its representative must properly denote some complete syllable resembling this, which was a significant word. For example, the class of ten syllables (eight complete and two incomplete), mentioned above, might have for their common representative a nose, אַף; a similar class with *i* instead of *a* for the vowel, might have for their representative corn about to be reaped, אִב; and another class with *u* for the vowel might be represented by a bird, עוֹף.

All this is well established; and I have been strongly impressed with the opinion that the hieroglyphic system of writing is much more likely to have been analogous to this than to that of the Greeks. We know

that there were some decided differences between the Egyptian system and that of the Assyrians. The Egyptians had fewer elementary sounds to express than the Assyrians. Their characters which represent complete syllables represented, generally speaking, three complete syllables, which would be distinguished in the Assyrian system; as the vowel of the syllable might be either *a*, *i*, or *u*. And, again, not only might the representative of two incomplete syllables be used to represent a complete syllable, but one or both of these representatives of incomplete syllables might be added to the representative of the complete syllable; which is never the case in Assyrian. It does not, however, appear to me that any of these differences is inconsistent with there being a general conformity between the two systems in respect to the sounds to be represented. The elements of Assyrian writing are not vowels and consonants, as in the writing of the Greeks; but incomplete syllables, consisting of consonants (including breathings and semi-vowels), preceded by a vowel, or followed by a vowel. I now think that the elements of Egyptian writing were of the same nature, the only difference being that the vowel sounds included in the elementary syllables of the Egyptians were undetermined. While the Assyrians would require six characters to represent the consonant *m*, namely, the representatives of the elementary syllables *am*, *im*, *um*, *ma*, *mi*, and *mu*, the Egyptian would require but two. I propose to transcribe these by -M and M-, using the hyphen to represent an undetermined vowel. The former of these is the transcription of the *owl* or *boat-frame*; the latter is that of the *sickle*. According to this view of the matter, there are no vowels, properly speaking. In my former paper, thirteen years ago, I reduced the number of vowels to a very few. I now admit none whatever. The *leaf* which I formerly took for the breathing, *aleph*, I now consider to be an initial *aleph*, and represent it by A-, restoring that letter to its ancient power; and the *eagle*, which I formerly took for the vowel *a*, I now take for a terminal *aleph* or -A. The *arm*, which I formerly valued as *'Ayin*, I now value as terminal *'ayin*, writing it on the same principle -O. It is the same with semi-vowels. I consider the *quail* or *duckling* to be an initial W, and the *knotted cord* a terminal W; and the pair of leaves to be a terminal Y. Thus I transcribe the name of Ptolemy, as found on the Rosetta stone, by -P, -T, -W, L-, M-, -Y, -S; and I would pronounce this in five syllables, supplying the requisite vowels as follows:—*ipt-aw-lim-ay-us*. The rules for supplying vowels are very simple. When a terminal consonant is preceded by an initial consonant, they are to be made to form one syllable, a vowel being supplied between them, as in the third syllable of this word *lim*. When a terminal consonant is not so preceded, it must have a vowel supplied before it, unless a terminal consonant precedes it, with which it can coalesce. An example of this coalescence occurs in the first syllable *ipt*; and it is possible that the two last syllables may have been pronounced *ays*. If an initial consonant occurs without a terminal consonant to follow it, it must have a vowel supplied after it, and must constitute a syllable by itself. The mode of reading the first syllable of this word which I propose will ap-

pear strange. In like manner I must read the name of Phthah –P,–T,–H, *ipt-ah;* and that of Psamitik, –P, –S, –M,–T, –K, *ips-am-it-ik;* all the consonants in these names being terminal. I justify this by the name of the town which the Greeks called Primis. Its hieroglyphic name has been found in inscriptions there, and is –P, –R, –M *ip-ir-im.* It has been handed down to this day by oral tradition, and is now pronounced *Ibrim.* Even in this word, where the second consonant is *r,* the junction of which with a preceding consonant is, comparatively speaking, so easy, the Egyptians prefixed a vowel. Much more must it have been necessary to do so, when the word began with such a combination as PT, which even Europeans find it difficult to pronounce. To complete what I may have to say on the subject of transcription, I will here observe that I should transcribe such a character as the *embattled wall* (or *basket*) by M–N; and if this were followed by a complementary –N, I would use an Italic in place of a Roman capital for this, expressing the remainder of the syllable by a Roman capital, and enclosing the whole in a parenthesis, thus—(M–. –*N*). On the same principle, I should transcribe the word for "life," when written with three characters (O–. *N.*–*KH*) *'unkh;* thus indicating that the first character might represent the whole word. As a general rule, any of the three vowels may be supplied; but Greek transcriptions, Coptic equivalents, and sometimes analogous words in other languages, will often suggest the proper vowel. When these fail, I will supply *e,* as Lepsius has done in similar cases. I came to the conclusion that this was the proper manner of valuing the hieroglyphic characters by *a priori* reasoning, from what I had discovered respecting the Cuneatic characters. I have since tested this conclusion by examining a number of hieroglyphic words, the reading of which, according to the principles here proposed, seems preferable to that which has been heretofore adopted. For example, the fields in which the blessed were supposed to dwell have been heretofore called the fields of *aaru* or *aalu.* Omitting, however, the plural termination, we have in inscriptions of the eighteenth dynasty the forms A–. –A. L–, A–. L – and –A. L–, all of which, supplying the vowel *i* from the analogy of the Greek, I read *ilu* or *il.* The plural termination, sometimes written W–, and sometimes only indicated by the *three small bars,* I take to have been *wi.* The fields *iluwi* were the ἠλύσιον πεδίον of Homer. The form of the Greek word, however it originated, is clearly that of Πηλουσίον, which is the hieroglyphic P–. L–. *pilu.* In a future paper I hope to give other examples, together with a list of the elementary syllabic characters with their values. At present I can only point out some exceptions to this mode of valuing the characters which exist, with what I take to be the reason of their existence. As in the case of the Assyrian characters, those which represent elementary syllables could not have represented these only. They must have represented also complete syllables, and such as were also words. For the very same reason the hieroglyphic elementary characters must also have represented words; and it may be that these words were different from any that were composed of the elementary syllable. For example, the *owl,* as an elementary syllable, denoted –M; but as a word it denoted M–O. The name

of the owl was probably *mu'*, in connexion with which I might make a long digression. All, however, that I need now say is, that the *owl* when accompanied by the *arm*, which was often made to intersect it, and by no other character in the word, was to be read (M–. –O). It had different significations, as "from," *mi'* (compare Heb. מִן, מִ), and "give," *mu'* [comp. Lat. *mun-us*], or in the imperative *ma'* (Copt. ⲙⲁ and ⲙⲟⲓ). The sound of the *'ayin* was almost certainly that of a nasal, but the Egyptians scarcely distinguished it from *aleph*. Thus the name of the *owl* was reduced to *mu;* and the character was thus read, especially in foreign words, and especially when followed by the *arm*. In other words, the *owl* had, besides its ordinary value (the indefinite syllable – M) a definite syllabic value *mu*, which it admitted in exceptional cases; as, for example, in the names of the country *Mushusha*, and the city *Qarqamusha*. The *boat-frame*, which was a perfect equivalent of the *owl*, had the same values. Of these names, the former is written with the *boat-frame* and *arm* (with special exceptional value *mu*), the *garden*, the *eagle*, the *knotted cord*, the *eagle*, the *garden*, and the *eagle*. The *eagles* are expletive characters, and are to be passed over; the three characters preceding these are SH–. –W. SH–, which should be read *shuwsha* or *shúsha*. The latter name is written with the *knee*, the *eagle*, the *mouth* and *bar*, the *knee*, the *eagle*, the *owl*, the *arm*, the *garden*, and the *eagle*. Omitting the *eagles* and the *bar*, which are expletives, and giving their special value to the *owl* and *arm*, we have Q–. –R. Q–. mu. SH– which I read as above. The former of these words is the Greek Μόσχος, as I stated in my former paper; *usha* is the termination of the nominative singular, answering to ος; *mush* is what the Assyrians (who had no SH in their language, and could not pronounce it) converted into *musk*. They spoke of the country, *Muski*, in their genitive, and of the *Muskaya*, its inhabitants. *Qarqamusha* is another nominative. In Greek it would be written Γάργαμος, like Πέργαμος; but it is not found. In Assyrian it is written *Qarqamusk*. Both these names, as well as many others of places in Northern Syria and to the northward of it, occurring both in the Egyptian and in the Assyrian texts, are, beyond all question, Indo-European. In my former paper I committed an error in identifying *Qarqamusk* with Κιρκήσιον. It lay far to the north of this city, and on the opposite bank of the Euphrates. This is one instance of a terminal consonant having a special value in which it is initial; and we can have no reason to suppose that it is the only such instance. The *basin*, –K, has for its expletive the *eagle;* its name was, therefore, K–A. It occurs in the proper name I am considering, sometimes twice, and sometimes only once. I see no way of accounting for this but by supposing that, though generally terminal, it might, like the *owl*, have a special value in which it was initial. It has this value also in the name of Canaan, where it is initial; and this determines its special value to be *ka*. As for the character which begins the word, it has been proved to contain the same consonant as the *long serpent*. It has been considered of late as its homophone; but, according to the principles here laid down, it is more natural to consider the one as an initial consonant, the other as a terminal

one. Now, the *long serpent* begins the name of Tyre, where it must needs be initial; it is, therefore, a fair inference that the *unfledged bird* represents the same consonant terminal. Calling, then, this consonant for the present Z, I say that, according to probability, founded on the analogy of similar characters, this name may be transcribed –Z, –K, ka, –R, and read *iz-ak-kar*; or, if the second *basin* be omitted, *iz-ak-ar*. It is no objection to this that the *unfledged bird* is followed by a *small vertical bar*, which, according to most Egyptologists, is to be sounded as a vowel. I do not go so far as Baron Bunsen, who, in a review of my paper of 1846, at the end of the first volume of the English translation of his "Egypt's Place" (in which, by the way, he misrepresented my line of argument, and took no notice of the proofs on which I chiefly relied), affirmed that this bar indicated that the character terminated a syllable. I do not say that a character followed by that bar *always* terminates a syllable. It would naturally indicate the contrary; it stands for a character which, with the object represented, would compose the name of that object; but, being an expletive character, it is often to be omitted, especially in proper names. The *mouth* with the *small bar* is generally to be read –R when medial; and I believe that it should generally be so read when initial; as in the name which has been read *Rebo*, which I read *Arba*, the Arabs. I now pass to my second proposition—that the value of the consonant which, when initial, was represented by the *long serpent*, and, when terminal, by the *unfledged bird*, was ST. In my former paper I showed that it represented the Hebrew *Tsaddi* or *Zayin*. Now, I have elsewhere proved that the value of the Assyrian letter corresponding to the latter of these had the value *sd*; and that which corresponded to the former had the strengthened sound of this; so that it would represent the Arabic *sad* followed by *ta* or ﺼﺕ. The Egyptians did not use these rough combinations; and what they would naturally substitute for them would be ST. It is thus probable that this was the value of those characters; and the probability is increased by the following coincidences, though they do not place the value beyond question. The word which signifies "to hate" is found written with (M–, –*S*), T– and (M–, –*S*) Z–. This is just what would happen if Z were = ST. I read the word *mis-ti*; and consider it to be connected with μισέω. The retention of the σ, which, if it had originally stood alone between two vowels, would have been dropped, and the length of the vowel before it, are both accounted for by supposing σ to have been originally στ. Again, the word "to scatter" is written with (Z–, *R*), which is transcribed by Σωρ. Here, again, the retention of the σ (which, if it had stood alone, would, according to analogy, have been changed into the aspirate) points to an earlier form Στορ; as the pronoun σύ is derived from an earlier στύ. But the Greek root of the same signification is στορ (whence στόρνυμι, &c.) in which the double consonant is retained. There is another character which is used to express the same complete syllable; and it appears to me that in this the *mouth* should be read L. This, at least, seems to be its value in ancient inscriptions. I would transcribe it by (Z–, –*L*). I speak of the

character which is supposed to represent a *bundle of reeds*. As a root, this seems to signify "to clothe or wrap up," and so may be connected with στέλλω. I repeat, that I do not consider these analogies as proofs. I only regard them as heightening a previously existing probability. But even if it should turn out that the consonantal value of this character was some other modified sibilant, the syllable *is* or *iss* might still be derivable from that with a vowel supplied at its beginning. Enough, I trust, has been said to show that the reading *Issakar* is not a mere arbitrary one, but that arguments which appear to have some weight may be adduced in its favour. Whether or not this opinion is sound, must be decided by others. I have no doubt that the truth will ultimately prevail.

There are many points of great interest to which I have in this paper merely alluded; at a future period I hope that I may discuss them at greater length.

Sir W. R. Hamilton communicated the concluding part of his paper "On certain Equations in Quaternions, connected with the Theory of Fresnel's Wave Surface."

W. R. Wilde, M. R. I. A., exhibited:—1. The head of the old Connaught ox, as an illustration of his remarks made at a former meeting. 2. Some gold ornaments found recently in the county of Kildare, at Ballinderry, near Enfield, and a number of bones of horses and other animals discovered at the same time. 3. An ancient crozier, found in the county of Cavan, and known as the "Crozier of the O'Bradys." 4. A MS., called the "Plunket MS.," and now the property of the Earl of Fingal. Mr. Wilde gave a description of the MS. and its contents.

Sir W. R. Hamilton handed in a letter, addressed to him by Mr. Graham, of Markree Observatory, containing observations on Donati's Comet.

Markree Observatory, Colloony, Nov. 6, 1858.

Dear Sir William,—At the conclusion of our series of observations of Donati's Comet I was encouraged, by the length of arc described since the first discovery, to undertake the calculation of the orbit, in the hope of being able to settle the question of ellipticity to my own satisfaction. The observations selected, freed from aberration and parallax, were—

	Greenwich M. T.	Rt. Ascen.	Declin.
1858, June, . . .	8·35573 . . .	141° 15′ 38″·7 . . .	+24° 27′ 42″·7
„ August, . .	25·52010 . . .	156 30 21 ·2 . . .	+33 6 21 ·4
„ October, . .	16·28287 . . .	243 58 1 ·7 . . .	−16 18 41 ·2

Made at Florence, Washington, and Markree respectively.

I first attempted to represent them by a parabola, and obtained the following set of elements:—

T = 1858, Sept. 29·97161 Greenwich M. T.
π = 294° 18′ 39″·5 } Mn. Eqx.
Ω = 165 15 52 ·0 } 1858·0
i = 116 56 26 ·3
$\log q$ = 9·761856.

But the calculated place for the mean observation differed from the observation by 40 minutes of arc.

I then set to work to represent the observation without any hypothesis as to the nature of the conic section described. The result is—

T = 1858, Sept. 29·95894 Greenwich M. T.
π = 294° 27′ 40″·1 } Mn. Eqx.
Ω = 165 20 46 ·5 } 1858·0
i = 116 58 59 ·6
ϕ = 84 45 2 ·3
log. q = 9·7623494
log. a = 2·1397158
Period, 1620 years.

The corrections of calculated by observed places are—

	In Long.	In Lat.
June 8,	− 0″·9	+ 1″·5
Aug. 25,	− 0 ·1	+ 0 ·3
Oct. 16,	− 0 ·4	0 ·0

Of course, I cannot answer for the accuracy of the observations; but I endeavoured to select those which were best adapted to answer the end proposed.

Leaving room for a wide margin in regard to the major axis of the orbit and its dependent period, this much seems now established,—that the Comet is travelling in an ellipse. The agreement in the several sets of elliptic elements, determined independently from separate data, is calculated to inspire confidence in astronomical observations and calculations. Take, for instance, the Perihelion passage:—

Bruhns makes the time	September,	29^d	22^h	53^m	Greenwich M. T.
Löwy,	,,	,,	23	2	,,
Graham,	,,	,,	21	1	,,

The perihelion distance, taking the Earth's mean distance from the Sun at 95,000,000 miles, is according to—

Bruhns,	54,952,520 miles.
Löwy,	54,957,220 ,,
Graham,	54,963,330 ,,

The extreme difference in the results for the time of perihelion passage being 9 minutes, in perihelion distance 10,810 miles, about a 5000th part of the whole distance—something like an error of 1 foot in measuring an English mile.

A few deductions from the elements given above, thrown into a popular form, may be interesting.

The aphelion distance is about 275 times the Earth's mean distance from the Sun, about 9 times the distance of Neptune—26,000,000,000 miles.

The light and heat at perihelion are 3 times greater than what we receive from the Sun; at aphelion, 76,000 times less.

The aphelion distance is 476 times the perihelion—so that the light and heat at perihelion are 226,000 times greater than at aphelion.

Seen from the Comet at perihelion the diameter of the Sun would subtend an angle of 55′ 23″; from aphelion, 7″. So that, in the latter position, our luminary would only appear as an intensely brilliant point.

The velocity at perihelion is 127,000 miles per hour; at aphelion, only 267 miles per hour.

The Comet was in the plane of the ecliptic coming northward a little before noon on March 26th, its distance from the Sun being 298,000,000 miles,—consequently more than 200,000,000 miles beyond the orbit of the Earth. It was in the plane of the ecliptic going southward about midnight on the 18th October, when its distance from the Sun was 67,000,000 miles, 28,000,000 miles within the orbit of the Earth. We are then in no danger from this member of our system.

Its nearest approach to Venus was on October 18th, at 3 in the morning, when the distance of the two bodies was 8,360,000 miles. Its nearest approach to the Earth was on October 11th, at midnight, when the distance from us was 51,000,000 miles. So that at Venus the Comet must have appeared 37 times brighter than it did to us.

The Comet was in the plane of the orbit of Venus on October 20th, at half-past 9 P.M. Its distance from the Sun—69,621,000 miles. Rad. Vect. of orbit of Venus—69,105,000 miles. Difference—516,000 miles. Longitude of descending node for orbit of Venus—343° 37′ 14″. Venus was in that longitude October 13^{d} 5^{h}. Had the Comet then been seven days earlier, it would have approached within half a million miles of Venus, would have been about 100 times nearer than it was to us at its nearest approach, and its disk and splendour would have been 10,000 times greater.

I fear you will hardly consider these details worth the reading. My reason for giving them is that in case you think it worth while to bring the elements before the Academy, the remarks may help to take away the meagre appearance of a few lines of figures which have cost me some hours, indeed days, of laborious calculation.

Yours, my dear Sir William, very truly,

A. GRAHAM.

Sir William R. Hamilton.

The thanks of the Academy were given to the Right Hon. the Earl of Fingal for having granted Mr. Wilde permission to exhibit the Plunket M.S., called "The Sight of the Blind," and make the extracts from it to be published in the Proceedings.

The Academy then adjourned.

Mr. Wilde read the following paper at the Meetings of the 9th and 25th of May, 1859 (see pp. 163 and 164):—

UPON THE UNMANUFACTURED ANIMAL REMAINS BELONGING TO THE ACADEMY.

In arranging the collection of Irish Antiquities belonging to the Academy, I found a great number of bones, chiefly the crania of carnivora, ruminants, and swine, presented to us at different times during the last nineteen years, and for the most part deposited in the crypts beneath the Library and Museum. This collection was commenced at the time of the discovery of the Dunshaughlin crannoge in 1840—when I deposited in the Academy many specimens of the various animal remains found in that vast bone heap. (See Proceedings, vols. iv. and vi.) Since then, some of our members have from time to time presented individual specimens, considering the Academy the most suitable receptacle for such objects. But a large proportion of the collection was presented by the Board of Works and the Shannon Commissioners, during the drainage operations carried on in different parts of the country from the year 1846 to 1853.

In presenting the Dunshaughlin bones, which were all found in connexion with the remains of man, my object was solely ethnological—the animals to which they belonged had in life been associated with man, had ministered to his wants, or were subservient to his amusements; several of them bear unmistakable evidence of having fallen by his hand; and all were found in connexion with those antiquities which illustrate his social history, from the mid period between the introduction of Christianity to the present time. Not so the great majority of those presented by the Board of Works, which were discovered in deepening the beds of rivers, or in land cuttings, totally unconnected with any vestiges of the human race, and several in situations where geologists believe they were deposited prior to man's occupation of this portion of the British isles. In our former premises in Grafton-street, the Dunshaughlin bones were displayed in the Museum or the Library. In the present house all those osseous specimens were stowed away among the lumber of the crypts, neglected, if not unknown—no attention having been bestowed upon them by our naturalists; and some had never been removed from the cases in which they had been forwarded to the Academy years ago.

Under these circumstances I have imposed upon myself the task of bringing them under the notice of the Academy, numbering, and arranging them, and of putting on record, when possible, the circumstances under which they were found, while yet we possess sufficient material of either a traditional or documentary nature to enable us to do so. As, however, one of the divisions under which I have arranged our Museum of Antiquities consists of "animal material," including objects of bone, horn, skin, wool, hair, and gut, used in the arts, and embracing leather and woollen fabrics, I have excluded all the specimens now under

consideration, and classed them under the head of Unmanufactured Animal Remains. As no other collection of this nature is known to exist in Ireland, and as it includes upwards of one hundred and eighty specimens, I take this opportunity of offering some observations upon the ancient Fauna of Ireland, as connected with the early history of the country. As yet we possess but imperfect knowledge upon the subject. (See the Journal of the Geological Society, vol. i., p. 224.) The remains of extinct animals are much fewer than in England; but then it must be remembered that our investigations have hitherto been very limited; even now the great bone cave, just discovered at Dungarvan, containing those invaluable remains lately described at a meeting of the Royal Dublin Society by Dr. Carte, shows what may be expected when accident or intended exploration shall have made a stricter investigation beneath the surface of our island.*

Many references to our ancient animals can be found scattered throughout the annals, bardic histories, and tribute lists in early times; but among the many legends, both mythical and founded on fact, relating to the animals proper to this country, and preserved in the vast collection of Irish MSS. belonging to the Academy and the Library of the University, there is none so curious as the following extract from a poem preserved in one of the manuscripts purchased by the Academy from Messrs. Hodges and Smith (S. 149, 2/36, p. 436) and for which every lover of Irish history is deeply indebted to Mr. Eugene Curry. This curious zoological and topographical poem, the original of which he believes to be as old as the ninth century, is certainly one of the most remarkable productions of its kind known in any language in Europe of the same date. The history of the poem is as follows:—Finn Mac Cumhaill was made prisoner by Cormac Mac Art, monarch of Erinn, who, however, consents to liberate him when a ransom of two of every wild animal in Ireland, a male and female, were brought before him on the green of Tara. Cailte Mac Ronain, the foster-brother and favourite of the celebrated Irish general (see "Annals of the Four Masters," under A.D. 286), having first performed many remarkable feats at Tara, in the King's palace, undertook, and succeeded in accomplishing his apparently hopeless task within a twelvemonth; and, in this poem, is said to have related to St. Patrick the result of his mission. There is, perhaps, no other example in the Irish language of the same extent, containing so many words—names of animals—of which the meaning is not known; and there are but few poems of so many lines requiring the same amount of topographical annotation. In this latter department I have been much assisted by Dr. O'Donovan. The names of several animals are, as stated, untranslatable; either the animals themselves have become extinct in this country, or they are now known by other names than those preserved in the MS. Many years ago, Mr. Curry kindly

* See the Journal of the Royal Dublin Society, No. XV., for October, 1859, pp. 44 and 351.

placed at my disposal a translation of this poem, which, in the March of the year 1854, I published in the "Dublin University Magazine;" but the Irish which he now presents has never been printed before.*

Very recently, Mr. Curry discovered a prose account of this tale in the Book of Lecain, which, in his opinion, tends to authenticate its great antiquity. The only difference between the poetic and the prose version is, that instead of the animals being required as a ransom for Finn, they were requested by Graine, the daughter of King Cormac (the lady who subsequently eloped with Diarmait), during the courtship of Mac Cumhaill.

To this poem have been added topographical notes, chiefly for the purpose of directing special attention to the places therein referred to, as likely habitats for certain animals, and in the hope that some of our Irish-speaking people in their vicinity may still remember the as yet, to us, unknown names. Until we learn what animals were understood by these, we cannot say, with any degree of certainty, what creatures are wanting in the list. It is, however, well worthy of note, that the localities specified are just such as naturalists would expect to furnish these particular animals—thus, the wild oxen were sought for in the then impassable districts of Clare; the otters beneath the overhanging rocks; the cranes and wagtails from the river's brink; the cuckoos and hawks from the green woods; the eagle from the tall cliff; the grouse from the wild heathery bog; the fox from the rocky mountain; the ducks and waterhens from the inland lake; the gull and the curlew from the sea-margin; the lark from the broad plain; the corncrake from the Shannon's bank; the bat out of the dark cave—and soforth, all showing accuracy of observation, as many of these places are still the most likely haunts for these very animals specified in this poem. There are a few apparent exceptions, such as that of the swans from the wood of Gowran, but that may yet be explained.

It is hoped that the present publication of this poem in the Irish language will add many more names to the translation. Cailte, it is said, thus addressed the Saint:—

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* The late Dr. Ball mentioned the circumstance of the existence of this poem to the Academy in 1844. See Proceedings, vol. ii., p. 541. "He stated that for one important addition he was indebted to Mr. Curry, who pointed out in a manuscript poem, ascribed to Caoltie, one of Finn Mac Cumhail's heroes, and which is certainly older than the year 1000, a portion in which the names of one hundred animals are recorded in a list of the ransom paid for the celebrated Finn Mac Cumhail when a prisoner. Some of the names mentioned have not yet been translated. Dr. Ball observed on the value of such a collection as a means of throwing light on the names of places in Ireland, and urged the interest that naturalists of other countries felt in preserving the names by which animals were known in their native places, as a sufficient reason for desiring to preserve those of Ireland. He stated his intention of having the collection he had made properly digested and arranged by a competent person, and that he would then offer it to the Academy for publication."

Téighim ann do shúr na níath,
Dus an bhfhuasceolainn mo thriath ;
Da éissin go Temraigh thailc,
Tucas liom coma Chormaic.

Tucasa leam in geilt garg,
Is in gribh ingneach imard,
Is dá fhiach Fheada an dá bheann ;
Dí lachain Locha Saileann.

Dá shinnach a Sliabh Cuilinn
Dá dhamh allaidh a Boirinn
Dá ghéis a Fídh Gabrain guill
Is dá chai Feadha fhordruim.

Dá thoghmall ó Chailltib craebh,
Do leath taebh dhá raen,
Is dá dhobran iarsain,
A carraic donnbhán Dobhair.

Dá fhailenn Thráighlí alle,
Dí ruiligh a Purt Láirge

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[1] *Geilt.*—According to O'Reilly, this word means, "a wild man or woman—one living in woods"—a maniac. It may, however, have been figuratively applied to some very fierce or untameable creature, either quadruped or bird, which inhabited the woods. But that the *simiæ*, or monkey tribe, were not likely to have at any time inhabited so cold a country, one would have seen, in the term, an exceedingly apt expression for "the wild man of the woods."

[2] *Grib.*—Swift, quick ; also applied to "the feathers on the feet of birds." The term occurs in Cormac's Glossary. But for the expressions—tall and with talons—employed in reference to this creature, it might be Anglicized into the Swift; but it is, in this poem, used in all probability to designate the Osprey, or sea-eagle. Cambrensis, in his "Topographia Hiberniæ," mentions among the birds of prey the eagle, osprey, hawk, falcon, and sparrow-hawk : and his observations on natural history and the habits and manners of animals are curious and interesting, and in many respects truthful and original. In some instances, however, he fell into the usual popular delusions of the day—as, for example, when describing the osprey in the chapter devoted to the consideration of birds of that description, he says it has one foot armed with talons wide open, and adapted to seizing its prey, while the other is of a more peaceful nature, and used for swimming.

[3] *Lough Sheelin.*—A well-known lake on the borders of Cavan, Longford, and Meath. From the expression in the text, one is induced to think that two particular ducks were specified—such as, perhaps, the ducks of St. Colman, of Shanboth, enumerated among the wonders of Ireland in Nennius, which could not be boiled, "although all the woods of the earth were burnt under that pot." There are many similar legends related even at this day. See Lover's legend of the Trout in Cong Cave.

[4] *Slieve Cuilinn*, or *Gullion.*—A mountain in the barony of Upper Orier, in the county of Armagh, which took its name from Cuileann, an artificer who lived here in the reign of Conchobar Mac Nessa, King of Ulster, and by whom the celebrated hero, Cúchulainn, was fostered. This mountain, which is also mentioned in MacPherson's "Ossian," may be seen from the northern railway between Dundalk and Newry.

[5] *Boirenn*, or *Burren.*—A wild district, in Thomond, county of Clare, in which herds of cattle were, very likely, common at the time referred to. In the "Leabhar na g-Ceart,"

I then went forth to search the lands,
To see if I could redeem my chief,
And soon returned to noble Tara
With the ransom that Cormac required.

I brought with me the fierce *Geilt*[1]
And the tall *Grib*[2] (Osprey?) with talons,
And the two Ravens of Fid-dá-Beann,
And the two Ducks of Loch Saileann.[3]

Two Foxes from Sliabh Cuilinn,[4]
Two wild Oxen from Burren,[5]
Two Swans from the dark wood of Gabhran,[6]
And two Cuckoos from the wood of Fordrum.

Two *Toghmalls* from Fidh-Gaibhle,[7]
Which is by the side of the two roads,
And two Otters[8] after them,
From the brown white rock of Dobhar.[9]

Two Gulls[10] from Tralee hither,
Two *Ruilechs* from Port Lairge,[11]

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we read of "ten hundred oxen" from Boirinn being part of the tributes of Cashel to the kings of Erin. This locality is also mentioned in Hardiman's Minstrelsy as one of the "three impassable places in Ireland—Brefny, Burren, and Bearra." Achadhbó, the "oxen field," is sometimes called "Campulus Bovis." See "Vita Sancti Kannichi," published and presented to the Kilkenny and South-east of Ireland Archæological Society by the late Marquis of Ormond.

[6] *Gabhran*, now Gowran, in the county of Kilkenny.

[7] *Fidh Gaibhle.*—The branching wood of Feegile, in the parish of Clonsast, near Portarlington, King's County. This was the celebrated wood of Leinster, sacred to St. Berchan, who states "that the wood derived its name from the River Gabhal, and that the river is called Gabhal from the Gabhal, or fork, which it forms at the junction of Cluain Sasta and Cluain Mor. The river is now called Fidh Gaible, though the wood has disappeared."—*Leabhar na g-Ceart, note by O'Donovan*, p. 214. What the *Toghmall* was we cannot yet say; the meaning of the word is, "the slow bird." It was, besides, capable of domestication, or being made a pet of; thus, it is related that, when Cuchulain slung a stone at Queen Meave, he killed the Toghmall which was resting on her shoulder.

[8] The *otter*, now called in Irish *madaidh uisce*, a water-dog, must have abounded in former times in Ireland, as we read of their skins being an article of commerce. In 1408 we find John, son of Dermod, charged with two otters' skins for his rent of Radon (Rathdown) for the same year; five otters' skins for the two years and a half preceding; and one hundred and sixty-two otters' skins for the arrears of this rent for many years then past, making a total of one hundred and sixty-nine otters' skins. This, which is the last entry accessible relative to the family of Gillamocholmog, is recorded in an unpublished Pipe Roll of 10th Hen. IV. See the "History of Dublin," by J. T. Gilbert, Esq., 1859. Peltry formed a large portion of the exports of Ireland in very early times.

[9] *Dobar.*—Probably Carrickdover, in the county of Wexford.

[10] *Gulls.*—In Zeuss and the Leyden Priscian *foilenn* glosses *alcedo*. Cf. Fr. *goëland*, in Welsh *gwylan*.

[11] *Port Lairge.*—Waterford—the Water Fiord.

Ceithre snoicc a Brosnadh báin,
Dí fheadóic cairrge dunáin.

Dí eachtaigh ó Echtge árd,
Dá smólach Leitre Lonngarg,
Dá dhrenn ó Dhún Aifte,
Dí chainche na Corraibthe.

Dí chuirr in Choruinn chladhaigh,
Dá errfhiach Mhoighe fabhuir,
Dá iolar Chairrge na clog
Dá sheabhac Feadha Connach.

Dá Pheasán ó Loch Meilge
Dá chirc uisce a Loch Eirne
Dá chirc fraich mónad Mafa,
Dí ghairg diana Dubhlacha.

Dá chrícharán a Chualainn
Dá mhiontán a Moigh Tualaing
Dá chaochán a Gleann Gaibhle
Dá ghealbainn na Sinainne.

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[12] *The River Brosna.*—In the King's County, a tributary of the Shannon. It rises to the south-west of Mullingar, and passes through Loch Belvedere, the ancient Loch Ennel. The term *snag* is translated by O'Reilly, woodpecker, and *snag-breac*, the magpie; but the former is not an Irish bird, and the latter is of comparatively recent introduction. Moreover, woodpeckers do not frequent rivers, but woods, whereas the heron is still called a snag, and the term is applied to a tall, ill-made man. Inis-Snag, near Thomastown, in the county of Kilkenny, is so named from this bird. In the west the crane is now styled in Irish *Cos crefog*—foot in the mud—a very apposite expression, as most of our native terms are—as, for instance, the curlew is called *Crithane*, from the manner in which it walks, with its shoulders humped or elevated; the woodcock *Creadbar*, or *Cullugh Caech*, on account of the uncertain, blind manner in which it first flies out of cover.

[13] *Dunan.*—Carrickdornan. The gray plover is still called the *feadog*, on account of its shrill whistle; and the lapwing, the *pillibeen*.

[14] *Eachtach* is explained by O'Molloy "*copiosus in valore.*" See note [15].

[15] *Echtge—Slieve Aughty*, on the borders of Clare and Galway, to the south of the town of Loughrea. From it rises the Abhainn-da-Loilgheach—i. e., the river of the two milch cows, now the Owendalulagh. "The name of this stream is accounted for by a legend in the Dinnseanchus, which states that Sliabh Echtghe, the mountain in which it rises, derived its name from Echtghe Uathach, the daughter of Ursothach, son of Tinde, one of the Tuatha de Danaan colony. She married Fergus Lusca Mac Rindi, who held this mountain in right of his office of cupbearer to the King of Olnegmacht. He had no stock, but she had; and she came to him with her cows, according to the law entitled *Slabhradh furiher fosadh*, and he gave up the mountain to her. On this occasion, according to the legend, two cows were brought there of remarkable lactiferousness, and equally fruitful; but on their removal hither, it turned out that one of them, which was placed to graze on the north side of the mountain, did not yield one-third as much milk as the one placed on the south side. This river forms the boundary between the fertile and barren regions of Sliabh Echtghe, alluded to in this legend."—*Annals of the Four Masters, note by O'Donovan.* From the foregoing legend it is not improbable that the Echtges of the poem were the peculiar cows or horned cattle of the vicinity.

Four *Snags* (Cranes?) from the River Brosna,[12]
Two *Feadógs* (Plovers) from the rock of Dunán.[13]

Two *Echtachs*[14] from the lofty Echtge,[15]
Two Thrushes from Letter Longaric,
Two *Drenns*[16] from Dun Aife,[17]
The two *Cainches* of Corraivte.

Two Herons from the hilly Corann,[18]
The two *Errfiachs* of Magh Fobhair,
The two Eagles of Carrick-na-Cloch,
Two Hawks from the wood of Caenach.

Two *Peasans* (Pheasants) from Loch Meilge,[19]
Two Water-Hens from Loch Eirne,
Two Heath-Hens (Grouse) from the bog of Mafa,[20]
Two swift *Gairgs* (Divers) from Dubh Loch.

Two *Cricharáns* from Cualann,[21]
Two *Miontáns*[22] from Magh Tualang,[23]
Two *Caechán*s (Choughs) from Gleann Gaibhle,[24]
Two Sparrows from the Shannon.

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[16] *Drenns.*—Probably wrens; the *droleen* is still a word applied to diminutive persons.

[17] *Dun Aife.*—Now Duneefy, in the county of Carlow.

[18] *Corann.*—Now Keshcorann, in the county of Sligo.

[19] *Loch Meilge.*—Now Lough Melvine, county of Fermanagh.

[20] *Mafa.*—Unknown. *Cearca-fraich*, the heath hen or grouse.

[21] *Cualann.*—Powerscourt and the adjacent country, in the counties of Dublin and Wicklow, including the Dargle, the Glen of the Downs, and extending even to Delgany, all of which beautiful region was probably well wooded in the time of Cailte. We cannot at present decide with any degree of certainty as to what the *cricharans* were: possibly they were squirrels, which, it is said, formerly abounded in that vicinity. K'Eogh, however, calls the squirrel the *Ira-rua.* The Marten, or *Madaidh Crainn*, the tree-dog, which is still extant in the south-west, may have been meant by this term.

[22] *Miontans.*—Titmice.

[23] *Magh Tualang.*—An ancient plain in Lower Ormond.

[24] *Gleann Gaibhle.*—Now Glengavlin, a wild valley in the barony of Tullyhaw, county of Cavan, in which the Shannon rises. See "Annals of Four Masters," A. D. 1390. It is a deep, circular hole, surrounded by rich alluvial soil, and called by the country people "The Shannon Pot." A very small stream proceeds from it, which, descending through the hills, soon widens into a considerable river that enters Lough Allen, near Dourais; passes obliquely through the lake, and leaves it at the Bridge of Ballintra, where it receives the Arigna River. Standing upon the side of Slieve An-Ierin mountain, or on any of the neighbouring elevations, one can, in particular states of the water and atmosphere, trace the stream of the Shannon passing through Loch Allen. Giraldus mentions a curious and what at first seems an incredible circumstance regarding this river—viz., that from its source it flows two ways, north and south—to Limerick on the one hand, and through Lough Erne to Ballyshannon on the other. If, however, one stands on the slight elevation which separates the Pot of the Shannon from the slopes above Swanlinbar, all the waters to the north of the ridge may be seen running to form the Erne water, and all those to the south-west passing towards the Shannon, so that, after all, the old Welshman was not so far astray as has been supposed.

Dá pheata odhra ó Ath Cliath,
Dí onchoin ó Chrotaibh Cliach,
Dá chabóicc ó Dhruim in Daimh
Dí riabóicc ó Leathan-mhaigh.

Dá choinín a Dhúmha duinn,
Dí mhuic nallta a Cnoghbha chuirr,
Dá pheatán Creite ruaidhe,
Dá thorc Temrach taebhuaine.

Dá choluim as an Ceas Chuirr,
Dá lon a leitribh Finnchuill
Dá dhuibhén thrágha Dhábhain
Dí earbóicc Luachra Deághaidh.

Dá fhainil a Sidh mBuidhe,
Dá iaroinn a Fidh Luadhraidhe,
Dí ghéseachtaigh on Maigh moill,
Dí spideóicc caemh a Cnámhchoill.

Dá fhereidhin Atha Lóich
Dí uisín a Monaidh móir
Dí ialltain a huaimh Chnoghbha
Dá phorc a crich Ollarbha.

Dá chreabhar ón cCoillidh ruaidh,
Dá fhaidirclinn Léana huair,
Dá bhruacharán Shléibhe dá én,
Dá chadhan Thurlaig Bhruidhéil.

Dá naescain a Dún Daighre,
Dí bhuideóicc a bhruach Bairne,
Dí spireóicc sonna a Sliabh cleath
Dá lochaidh liatha a Luimneach.

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[25] *Ath Cliath.*—Now Dublin; in the bay and river of which, especially on the strand of Moynalty, cormorants were probably common in former times. *Odharog* is a scrat, or young cormorant.

[26] *Onchus.*—*Loch nan onchon*, the lake of the otters. See "The Irish Nennius," p. 198.

[27] *Crotta Cliach.*—The Galtee Mountains, county of Tipperary. In the dictionaries *Ormchre* is the term for a leopard, but that animal did not exist in Ireland. Mr. Curry believes that it was the old term for a boar-hound.

[28] *Riabhoges.*—The little bird which is the usual attendant of the cuckoo, and called "the cuckoo's waiting-maid," is so styled. This is still a living word in the west.

[29] *Cnoghbha.*—The well-known mound of Knowth, on the Boyne, near Newgrange.

[30] *Ceis Corann.*—Kesh-corran, county of Sligo.

[31] *Luachair Deaghaidh.*—Slieve Lougher, in Kerry.

[32] *Cnamh Choill.*—Now Cneam Choill, a townland close to the town of Tipperary. It is curious to find the interest attaching to the robin extending so far back as the date of this poem.

[33] *Ath Loich.*—At Dunlow, near Killarney, Kerry. The *Fereidhin* is mentioned in the account of the death of Dermod Mac Cerchail, monarch of Erin, in A. D. 590.

Two *Peata-Odhras* (Cormorants) from Ath Cliath,[26]
Two *Onchus*[26] from Crotta Cliach,[27]
Two *Caboges* (Jackdaws) from Druim Damh,
Two *Riabhoges*[28] (bog Larks) from Leathan Mhaigh.

Two Rabbits from Dumho Duinn,
Two Wild Hogs from circular Cnoghbha,[29]
Two *Peatans* (Leverets?) from Creat Roe,
Two Wild Boars from green-sided Tara.

Two Pigeons out of Ceis Corann,[30]
Two *Lons* (Blackbirds) out of Leitir Finnchoill,
Two Black-birds from the strand of Dabhan,
Two *Earbógs* (Roebucks) from Luachair Deaghaidh.[31]

Two *Faenels* (Swallows) out of Sidh Buidhe,
Two *Iaronns* from the wood of Luadraidh,
Two *Geisechtachs* (Screamers, Peacocks) from Magh Mall,
Two charming Robins from *Cnamh Choill.*[32]

Two *Fereidhins* from Ath Loich,[33]
Two *Uisins* (Fawns) from Moin mor,
Two *Ialltans* (Bats) out of the cave of Cnoghbha,[34]
Two Pigs from the lands of *Ollarbha.*[35]

Two Woodcocks from Coillruadh,
Two *Faidhirclis* (Crows) from Lenn Uar,[36]
Two *Bruacharans* from *Sliabh-da-Ean,*[37]
Two *Cadhans*[38] (Barnacles) from Turloch Bruigheoil

Two *Naescans* (Snipes?) from Dun Daighre,[39]
Two *Buidheógs* (Yellow-hammers) from the brink of Bairne,
Two *Spireógs* (Sparrowhawks?) from *Sliabh Cleath,*[40]
Two gray Mice from Luimneach (Limerick).

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[34] *Cnogbha.*—From this it would appear that the cave under the mound of Knowth was open at the time of Cormac Mac Art; probably it had not been closed up after the rifling by the Danes. The modern Irish name for the bat is *Ialtog* or *Sciathan-leathair*, leather-wing.

[35] *Ollarbha.*—Now Larne Water, a river in the county of Antrim.

[36] *Lenn Uar.*—The vale of the Uar, near Elphin, county of Roscommon.

[37] *Sliabh-da-Ean.* Slieve-Daen, in the county of Sligo.

[38] *Cadhans.*—This is still a living word, and is applied to the barnacle, which migrates to this country from Shetland about the 15th October, which was formerly so abundant at Wexford, Tralee, and along the coast of Kerry. The true barnacle, or *Anas erythropus*, is seldom seen at either of these places; but the brent goose, or *Anas bernicla*, is still common. The locality here mentioned, Turloch Bruigheoil, which is very celebrated in Irish history, is the small lake of Bree-oile, in the barony of Athlone, county of Roscommon. Turlochs, or collections of water which become nearly dry in summer, abounded in that county—such as the Turloch of Carrokeel, the Turloch of Castleplunket, and that of Turlochmore, &c.

[39] *Dun Daighre.*—Now Duniry, in the S. E. of the Co. Galway, a seat of the MacEgans.

[40] *Sliabh Cleath.*—Now Slieve-Glah, a hill near the town of Cavan. The term

Dá thraghna a srothaibh Sinna,
Dí ghlaiseóicc a bhruachaib Birra,
Dá chrotach a chuan nGailbhe,
Dí screchóicc a Mhuirtheimhne.

Dí gheilt glinne Ghleanna Smóil
Dí bhaidbh Atha Mogha móir,
Dá onchoinn luatha a Loch Con,
Dí chait a huaimh Chruachon.

Dá chadhla a Sith Gabhrain gil,
Di mhuic do mhucaibh Mic Lir,
Reithe is caera chorcra chas,
Do radas liom ó Aonghas.

Tucas liom each agus láir
Do ghroigh mhaisigh Mhanannáin,
Tarbh is bán bhó a Druim Caín
Fuaras féin ó Mhuirn Mhunchain.

Spireog is still a living word in the very locality here referred to, and signifies the sparrow-hawk. Giraldus Cambrensis has a chapter upon birds in his "Topographia Hibernia," which, although abounding in the absurdities of writers upon Natural History at that period, and presenting in an especial manner the peculiar prejudices of this writer, is, nevertheless, not devoid of interest. "This kingdom produces," he says, "in greater abundance than other countries, hawks, falcons, and ospreys, to which nature has given, for the pleasure of the nobles (in hawking), courageous breasts, crooked and sharp beaks, and feet armed with talons." He also remarks upon the circumstance of the nests of birds of prey not increasing, although the animals themselves reproduce annually. "The number of eagles seen here is," he says, "no less than that of kites seen in other countries." Cranes, he says, collected in his time in such numbers, that one hundred might frequently be seen together. This, probably, refers to the true crane then common in Ireland, and now replaced by the heron. As a specimen of the credulity of the period, may be mentioned the following notice of the crane from this quaint writer:—"These birds keep watch by night, each one a night in its turn, for the common safety, resting on one foot, and having the other foot under its wing, with a stone in it, that by its fall, if asleep, perchance, crept on it, the bird being roused, may immediately return to its office of watch-holding."

[41] *Birra.*—Now Birr, or Parsonstown, a large town in the King's County, adjoining the county of Tipperary.

[42] *Muirtheimhne.*—A level plain along the sea, in the county of Louth, comprising Dundalk, &c.

[43] *Glenn-a-Smoil.*—The Glen of the Thrush, beyond Rathfarnham, in the county of Dublin, near the source of the River Dodder. For *Geilt Glinne*, the maniac of the woods, see *Geilt*, p. 185.

[44] *Badhbh*, the gray or scald crow.

[45] *Ath Mogha.*—Now Ballymoe, upon the River Suck, county of Galway, on the borders of Roscommon, near Castlereagh. There are many legends relating to this glen.

[46] *Loch Con.*—One of the great chain of the Mayo lakes, stretching between Galway Bay and Killala, still celebrated as a locality for the otter.

[47] *Cruachain.*—The cave of Rathcroghan, now Rawcroghan, the site of the ancient palace of the Kings of Connaught, near Castlereagh, county of Roscommon. The stone passage here alluded to still exists, and is the scene of many legends, both ancient and modern. I remember, when a boy, being warned by one of the old people against enter-

Two Corncrakes from the banks of Shannon,
Two *Glaiseógs* (Wagtails) from the brinks of Birra,[41]
Two *Crotachs* (Curlews) from the harbour of Galway,
Two *Sgreachógs* (Screech-Owls or Jays?) from Muirtheimhne.[42]

Two *Geilt Glinnes* from Glenn-a-Smoil,[43]
Two *Badhbhs*[44] from great Ath Mogha,[45]
Two fleet *Onchus* (Otters) from Loch Con,[46]
Two Cats out of the cave of Cruachain.[47]

Two *Cadhlas* (Goats) from Sith Gabhran,
Two Pigs of the Pigs of Mac Lir,[48]
A Ram and Ewe both round and red,
I brought with me from Aengus.[49]

I brought with me a Stallion and a Mare,
From the beautiful stud of Manannan,
A Bull and a white Cow from Druim Cain,[50]
Which were presented to myself by Muirn Munchain.[51]

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ing it, because it was said to have been inhabited by wild cats, and other venomous creatures of that description.

[48] *Mac Lir.*—Manannan Mac Lir, the Neptune, or sea-god, of the old Tuatha dé Danann. See an account of this personage in the biography of Sir Robert M'Clure, the discoverer of the north-west passage, in the "Dublin University Magazine," for March, 1854, p. 358.

[49] *Aengus.*—The great Tuatha dé Danann magician of Brugh na Boinne. This name is sometimes applied to Angus in Scotland, where Cailte may have sojourned before he arrived in Ireland.—J. O'D.

[50] *Druim Cain.*—A hill near Tara, county Meath; but there are many places of the name in Ireland.

[51] *Muirn Munchain.*—The mother of Finn Mac Cumhail.

Note I.—A friend has kindly furnished me with the following Irish names of animals, extracted from the oldest copy of Cormac's Glossary: *ag allaid*, cervus, a deer; *bairene, catt boinenn*, a she cat; luathither *lochaid* fri *forgarmain*, "swifter than a *cat* after a *mouse*;" *banb, mát, muc*, a pig; *orc muice, cumlachtaid*, a sucking pig; *nér, torc allaid*, a wild boar; *triath, torc*, a boar; *brocc*, a badger; *capall, ech, pell, fell*, a horse; *gabur* or *gobur*, a steed; *tarb*, a bull; *bó, ferb*, a cow; *lóig bó*, a calf; *fithal*, a calf (Latin *vitulus*); *gámnach, clithar-shét, rig-shét, sét gabla, colpach, samaisc, dam timchill arathair, laulgach*, different kinds of kine; *cúfodoirne, dobarchú*, an otter; *glademain, maic thire*, wolves; *oss allaid, seg*, a wild deer (*oss* seems cognate with *ox*); *ness*, a weasel; *ói* (Latin, *ovis*; English, *ewe*), *cáira*, a sheep; *óisc*, a dry ewe; *cú*, a dog (genitive *con* = *canis, hound-d*); *banchú*, a bitch; *milchú*, a greyhound; *oircne*, a lapdog; *cuilén*, a pup (*cuaine*, a litter of pups); *patu*, a hare; *rob, rop, beist* (bestia), *anmann*, names for *animals* generally; *fiach, bran*, a raven; *crufechta, bádb*, or *bódb*, a carrion crow; *corr*, a crane; *ela, gall*, a swan; *géd*, a goose; *seig*, a hawk; *coilech lachenn*, a mallard? *essine*, a featherless bird; *én*, a bird; *cupar*, an old bird; *elta*, a flock of birds; *iasc*, a fish; *leithech*, a kind of flat fish; *orc, brutan*, a salmon; *parn, bloach mara*, a whale; *cailech*, a cock; *legam*, a moth?

Note II.—*Faidhireli* (*suprà*, p. 188) may be identified with *adirclis* (gl. cornix) Zeuss, "Grammatica Celtica," p. 726. The *f* is merely prosthetic.

Silvester Gerald Barry, the learned chaplain of John, King of England, and popularly known by the name of "Giraldus Cambrensis," owing to the circumstance of his Welsh origin, has enumerated in his "Topographia Hiberniæ" the different animals common to this country; but as he did not give the Irish names, we find some difficulty in using his description as a commentary upon the foregoing poem. The Rev. John K'Eogh, author of the "Botanologia Universalis Hiberniæ," also published, in 1739, "Zoologia Medicalis Hiberniæ," in which he has given in the English character, and as they were pronounced by him, the Irish names of the "birds, beasts, fishes, reptiles, and insects which are commonly known and propagated in this kingdom;" but it is extremely defective as a list of animals, and far below the state of biological knowledge which then existed—being a mere enumeration of the various supposed cures and superstitious virtues attributed by old women, and old writers also, to the different parts and products of animals.

Among the animals of extinct Irish Fauna which possibly existed contemporaneously with man, but which have no representatives in the present day, was the bear, in Irish *Mathghamhain* (probably *Ursus Arctos*, or the fen bear), unmistakable evidence thereof having been already brought before the Academy by the late Dr. Ball,* and three casts of such bears' crania being now, with the other unmanufactured animal remains, in our Museum. Of these, it is said that two were found in a cut-away bog, about seven feet from the original surface, near Ballymahon, on the borders of Longford and Westmeath counties; but the hearsay or traditional evidence obtained by collectors of specimens, either of natural history or antiquity, as to the precise positions or strata in which such articles have been found by the peasantry, must be received with caution.

Fig. 1.

The fine specimen of cranium here figured, one-sixth the natural size, is 13¼ inches from the alveolar process to the end of the occipital spine, and was probably that of the European Ursus, or black bear. Dr. Carte considers it that of the Pyrenean species. It was found in the townland of Kilrathmurry, barony of Carbury, and county of Kildare, in cutting the new channel for the River Boyne, above Leinster Bridge,

* For notices of the Irish Bear, see "Proceedings," vol. iv., p. 416.

"about four feet under the surface," but in what description of soil is not mentioned. "The place where it was discovered had been a complete marsh, and scarcely accessible in summer. A large quantity of bones were found with the skull, which were broken up by the men" employed upon the work. It was presented to the Academy by the Board of Works. See "Proceedings," vol. v., Appendix, p. 54. Besides these two, we had in very early times the great cave bear, or *Ursus spelæus.**

When the bear became extinct in Ireland we have no precise means of determining. Bede says the only ravenous animals in Ireland were the wolf and fox. St. Donatus, who died in A.D. 840, states, that in his time it was not a native; and Gerald Barry (Cambrensis) does not enumerate it among the beasts known in Ireland at the period of his visit, in the twelfth century. In addition to the circumstance of the heads of several bears having been discovered, the fact of there being an Irish name for the animal in one of our old glossaries in the Library of Trinity College (M.S., H. 2, 13), strengthens the idea that it existed here contemporaneously with man. The late William Thompson—decidedly our first Irish naturalist—wrote thus, in his Report on the Fauna of Ireland, to the British Association, in 1840:—"I am not aware of any written evidence tending to show that the bear was ever indigenous in Ireland, but a tradition exists of its having been so; and it is associated with the wolf, as a native animal, in the stories handed down through several generations to the present time." History is, however, silent respecting it. According to Pennant, the brown bear infested the mountainous parts of Scotland up to the year 1057; and Professor Owen, in his "History of British Fossil Mammals and Birds," says, the most recent formations in England contain "remains which can scarcely be regarded as fossil, and which, if not perfectly identical with, indicate only a variety of the same species which is still common in many parts of the European continent."

The wolf, *Canis lupus* (the *Cú-allaidh*, or wild hound; and sometimes called *Mac-Tire, filius terræ*, the son of the land), is so frequently referred to in modern Irish history, and existed so recently (up to 1710), that it is unnecessary to enter upon its description at any length; moreover, its bones and crania are so identical with those of the dog of a similar size, that it is scarcely possible to distinguish the one from the other; even the observant Cuvier acknowledges that the difference between two dogs or two wolves of the same size were often more marked than between dog and wolf.† In the vast collection of animal remains found on the site of the crannoge at Lagore (or *Loch-Gabhar*, the lake of the steeds), near Dunshaughlin, county of Meath, described at page 222 of the "Catalogue of Antiquities," were found some heads of canine animals, either wolf or hound, of the largest of which the accom-

* See Journal of the Royal Dublin Society, No. 15, p. 352.

† See the account of the last wolf in Connaught, p. 143 of the Catalogue of Antiquities, R. I. A. In the Brehon Laws, printed by Vallancey, pet wolves, pet hawks, pet deer, pet hogs, are mentioned.

panying cuts, from No. 1, give a faithful representation. It is nearly 11 in. in length, measured from the end of the occipital ridge to the alveolar process at the roots of the upper incisors, and is principally characterized by the magnitude of the crest. The profile view of the outline and the prolonged muzzle rather tends to the belief of its having belonged to the true Irish wolf-dog, or large rough-coated hound, of an iron-gray colour, of former times, examples of which may still be seen in Scotland and the Hebrides. The Irish hound (*Canis Hibernicus*), or *Milchú*, so loudly extolled by our writers, is now nearly, if not altogether, extinct in this country.

Fig. 2.

Fig. 3.

There are five dogs' heads in the collection. Nos. 1, 2, and 3 are each about the same size, viz., 11 in., measured round the surface of the bone, as stated above. No. 3 had during life disease of the bone between the orbits, possibly the result of accident. Nos. 4 and 5 are small heads of the same variety, possibly those of females. They measure about 9 inches over the same line as in the foregoing. In No. 5 the occipital crest is proportionably not so large. The lower jaws are wanting in all. These five crania were found in the Dunshaughlin crannoge, and were presented by me in 1842.

Among the remaining carnivora still existing, and likely to have occupied the attention of man, were the fox (*Vulpes vulgaris*), the *Sinnach, nech is sine do conaib*, the longest-lived of dogs,* or *Madaidh ruadh*, the red dog; also the badger (*Meles vulgaris*, or *M. taxus*), and in the native tongue *Broce*;† and the otter (*Lutra vulgaris*), the *Madaidh uisce*, or *Dobharchú*, the water-dog, or water-hound. In this list might also with propriety be included the seal (*Phoca vitulina*, and *P. halichœrus*),‡ called in Irish *Rón*. This latter gives names to many localities, such as *Rinn Róin*, the point or promontory of the seal; *Carrig na Rón*, the seal's rock, now called "The Beeves," in the mouth of the Shannon, &c. &c.

The marten (*Martinus abietum*) formerly abounded in our woods, and a few still exist in some localities where portions of the ancient forests remain, among which I may specify Ballykyne, near Cong, in the county of Mayo, and Kylemore, Connemara, county of Galway. It affords an ornamental fur, not without its value even at the present day.§ Like

* See the copy of Cormac's Glossary, in H. 2. 16, col. 82, in Library T. C. D.

† The badger is called *broc* in old Saxon also, and *barsuk* in the Russian. See "The Tale of Deirdre," where this Irish beauty talks of feeding on badger's flesh.—Transactions of the Gaelic Society, vol. i.

‡ See Dr. Ball's Paper in Trans., R. I. A., vol. xviii.

§ Peter Lombard enumerates martens' skins among the exports from Ireland in the sixteenth century. See "Anthologia Hibernica," vol. i. p. 121; also p. 45, of this paper.

all the small carnivora, it was called in the native tongue, a dog, *Madaidh crainn*, "the tree dog," or *cat crainn*, "the tree cat." The stoat and the weasel (*mustela erminea*), called in Irish *Planaid* or *Easóg*, still remain, although under the game and vermin laws they are yearly decreasing.*

Of the cervine race Ireland boasts the most magnificent example, in either a fossil or recent state, which the world has yet produced—the gigantic Irish deer or fossil elk (*Cervus megaceros Hibernicus*); but whether that noble animal, which formerly traversed our plains and feeding pastures, coexisted with man, is questionable; most naturalists affirming that it did not, while the opinion of antiquarians rather tends the other way. The argument adopted by the former is, that the strata of calcareous tufa and shell marl in which the bones are almost invariably found are pre-Adamite, or were formed anterior to man's occupation of this island. But if the discoveries lately said to be made in the gravel drifts at Abbeville in France should prove true, this theory respecting our Irish fossil deer is untenable; moreover, these investigations show either that man is much older, or several fossils much younger than is usually supposed. It is, however, remarkable that as yet we have not discovered any Irish name for it. If the animal was here a contemporary of man, it certainly had become extinct long before the Irish had a knowledge of letters. In the collection of crude animal remains belonging to the Academy will be found the crania of no less than sixteen specimens of our greatest cervine animal, besides many detached fragments of skeletons. They are said by the district engineers to the Board of Works to have been found in the counties of Fermanagh, Cavan, Leitrim, Monaghan, and Roscommon; but under what precise circumstances discovered, and whether in peat, clay, or marl, has been stated in only a few instances. Others were found in the Shannon, but where, was not specified. Most of them were presented by the Shannon Commissioners or the Board of Works.

The following is a catalogue of these remains now belonging to the Academy, amounting altogether to upwards of 50 specimens, complete or fragmentary.

No. 1. A head and a portion of the horns in tolerable preservation, but wanting several of the tines of the latter; brow antlers deficient. The label attached to it states that "it was found six feet below the land surface, imbedded in blue marl, eighteen inches beneath the overlying peat at a quick turn of the River Erne, below Cloggy Bridge, in the county of Cavan; in the excavation of the channel made under the direction of the Drainage Department of the Board of Works, December, 1851."

No. 2. A head and part of the horns, the latter tolerably perfect, but the former wanting a portion of the superior maxillary bone on the right side; one brow antler remaining. Breadth of the palm only nine

* *Es* is the ancient word, of which *easóg* is a derivative. See O'Flaherty's Iar Connaught, p. 10.

inches, this was apparently a young animal, and "found in the Shannon," but where is not specified. There was no label attached.

No. 3. A head and imperfect horns; with the label, "No. 10," and appearing to have been that presented by the Board of Works, under the following circumstances:—"Found in the bed of the River Dee, between Nobler and Whitewood, county of Meath" (Proceedings, vol. vi., p. 180). This specimen appears more recent than any other in the collection.

No. 4. A complete head, but horns imperfect, brow antlers wanting; in the left horn-blade there is an oblong indentation, about $1\frac{1}{2}$ inch in extent, and $\frac{1}{4}$ broad, into which might be fitted a long narrow bronze celt, similar to some in the Museum. Both head and antlers are covered with aquatic lichen. It is marked "No. 25," and was probably presented by the Drainage Commissioners.

No. 5. The head and horn-beams of what appears to be the remains of one of the oldest animals of the Irish fossil elk yet recorded. The superior maxillary bone is imperfect; the infra-orbital apertures are very oblique, only $2\frac{1}{2}$ inches beneath the burr or crown, and the approaching edges of the burr are but three inches asunder; while in No. 3 that space

Fig. 4.

is $4\frac{3}{4}$ inches wide, and in No. 9 it is still larger, so that these distances may, with other circumstances, be taken as indications of age. The breadth between the orbits is $9\frac{1}{2}$ inches. The right palm only remains, and is deeply grooved for the large arterial network which ramified on its surface. The circumference of the basal ridge or burr is 15 inches,

being the largest yet recorded, except that Irish specimen at Knowle Manor House, in Kent, mentioned by Professor Owen. The brow antlers, although the largest at their bases, of any yet described, are unfortunately imperfect towards their extremities; where they spring from the base of the beam, they are deeply grooved, and the anterior and outer surfaces of the horn-beam itself also present deep indentations, which spread upwards and outwards along its edge into the antler; the teeth are worn to the crown, and several of the alveoli have been absorbed. Taking all the circumstances of this very old head, figured on the opposite page, into consideration, I think the approach of the pedestals and horn crowns to each other, the obliquity and the distance of the orbital holes from the base of the horns, and especially the grooving of the horn-beam upwards and outwards from the brow antler, may be taken as indications of extreme age in this animal. This specimen, as also No. 10, was presented by Algernon Preston, Esq., who has lately written to me to say "they were found at Chapelizod, near this city; but I am unable to give the particulars."

No. 6. A good head, but wanting the horn altogether on the right, and partially so on the left side; very dark in colour. Label: "Found in the townland of Kilnagross, parish of Kiltoghert, barony and county of Leitrim, district of Eslin: Thomas J. Mulvany, district engineer; John Coghlan, resident engineer." Presented by the Drainage Commissioners.

No. 7. A head of rather a large size; apparently of an old animal, although the teeth are very little worn; fragments of both horn stems remaining. The bone is much affected by either weather or water, and the interstices of the skull are filled with clay. Marked with the name "Donahoe;" it probably came from one of the Strokestown Loughs.

No. 8. A very perfect, large head, measuring, from the occipital crest at top to the end of the mouth bone, 22 inches. The head is rather narrower than usual; a portion of each stem and both brow antlers are perfect. The palm of the brow antler is seven inches across; there is some irregularity in the crown of the left beam, as if from exuberant growth; a small tit-like projection, apparently the commencement of a third horn, springs from the bone beneath the base of the beam on this side. The colour of the whole is very dark, but both the bone and horn are in a fine state of preservation; it is heavier than any of the other specimens: and was "found in the parish of Cloone, barony of Mohill, county of Leitrim. This head was in the possession of a labourer, who said he found it in the river, under the village of Cloone. As he could not point out the precise locality where it was found, it could not be ascertained if there were any other bones." Presented by the Board of Works. (Proceedings, Appendix, vol. v., p. 60.)

No. 9. A fragmentary head and beam of left horn, apparently belonging to a young animal. The bone is very smooth. Label, "found eleven feet beneath the land surface, embedded in plastic blue clay, below the bed of the River Erne near Cloggy Bridge, in the county of Cavan, in the excavation of the channel, in December, 1852." Presented by the Board of Works.

No. 10. A fragment of the upper portion of the head and left horn, apparently very much affected by either weather or water, the burr being worn off on both sides. Presented, along with No. 5, by Mr. Algernon Preston.

No. 11. A fragment of a small head and both horn-beams, but wanting the palms and brow antlers. This specimen presents some peculiarities differing slightly from all the others. The crowns on which the horns are set are very much longer and narrower—even compared with their size—than in any other specimen in the Academy. The circumference of the beam a little above the brow antler is but $5\frac{1}{4}$ inches. The antlers appear to rise higher, and not to spread so wide laterally as in all the others. It was presented by the Shannon Commissioners, and was "found in excavations in the lock pit at the new works, Rooskey, *in bog*, ten feet beneath the surface of ground, 11th March, 1847." The infra-orbital holes are $3\frac{1}{2}$ inches from the horn-crowns, and in most of the other heads scarcely more than $2\frac{1}{2}$ inches. The older the animal, the smaller and more oblique do these holes appear to become (see Nos. 1 and 5). This remarkable specimen, as shown in the subjoined woodcut, is either a different variety, a very young animal, or a degenerate race; and of

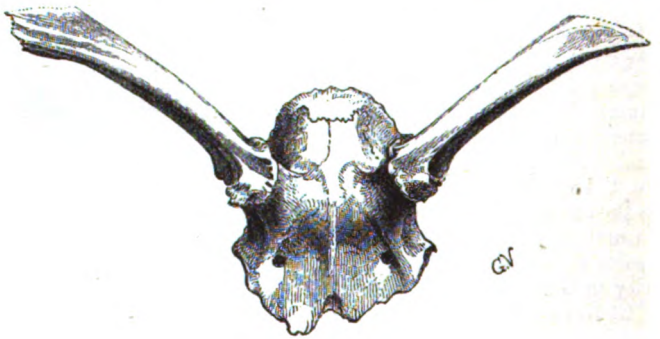

Fig. 5.

these three suggestions the first seems the most probable; and the fact of *finding it in a bog*, above either the blue clay or marl, shows that it existed in times more recent than the foregoing and larger animals.

No. 12. A small fragment of the frontal bone, with a portion of the left horn and brow antler, of a large and apparently old animal, found with several other bones of *C. megaceros*, "in a solid bank, 17 feet under the surface of sandy clay and peat," in the townland of Bumlin, Strokestown drainage district, county of Roscommon. Presented by the Board of Works.

No. 13. The beam of a right horn, with a small portion of the skull attached; very heavy and dark-coloured, as if by immersion in bog. No number or label attached.

No. 14. The upper portion of the head and horn-beam of a small animal, and somewhat resembling No. 11. It has been much acted on by water; was found in the Shannon, at Drumsna Bridge, between the counties of Leitrim and Roscommon, on the 19th June, 1846, and was presented by the Shannon Commissioners.

No. 15. A shed horn, with the brow antler attached; "found in digging at Lisduff, county Cavan," in 1848, and presented by Lord Farnham.

No. 16. The beam and a portion of the palm of a left horn. No register, number, or label.

No. 17. A portion of the skull and the beam and palm of the left horn of a full-grown animal. Presented to the Academy by W. R. Wilde, Esq., on the 23rd May, 1859.

No. 18. A large horn-blade. No register, but evidently not belonging to any of the foregoing.

No. 19. A large piece of a horn palm, marked "No. 4, found in the present main channel [of the river] four feet below the original bottom, and about midway between Ballyconnell Mill and Island, in the Ballinamore and Ballyconnell districts."

No. 20. A large piece of horn-palm, with one side removed, showing the beautiful cancelli of the bone.

21. A large piece of horn-palm broken off at the expansion of the beam.

No. 22. Fragments of a beam and palm.

No. 23. A brow antler covered with marl, and filled internally with crystals of protophosphate of iron; a substance discovered and described in these bones, by Dr. Aldridge, some years ago.

No. 24. The fragment of a beam and palm.

No. 25. Two fragments; pieces of a palm.

No. 26. A large tine, apparently found in clay, and filled with crystals, like No. 23.

Nos. 27, 28, 29, 30, 31, 32, 33, and 34, are fragments of horns; so far as can be judged from their present condition, not belonging to any of the foregoing specimens.

No. 35. An inferior maxilla, perfect; also fragments of seven other lower jaws, four right and three left; numbered from 36 to 42. The bony structure of the teeth and the edges of the alveoli are completely filled with the blue crystals of iron already alluded to.

Nos. 43 to 47 are vertebræ, evidently of different animals. No. 47 is a sacrum, with a portion of the coccyx. No. 48, two scapulæ, found with Nos. 15 and 17. No. 49, four ribs. No. 50, two pelvic bones, much discoloured, and the interstices filled with blue matter. No. 51 includes 19 bones, of which 6 appear to have belonged to the same animal, viz., 2 femora, 2 tibiæ, and 2 tarsal bones, and all marked with the same deep blue colour as the pelvic bones, No. 51, to which they appear to belong. These bones are all very light and friable, and the blue colouring matter has permeated their interior to a considerable distance. It does not here exist in the shape of crystals, like that in the horn-palms of No. 23, and in some of the teeth. No. 52 is a femur, marked

"No. 10," and was found in the Derryholmes River during the excavations for underpinning the bridge. Besides the foregoing, there are two portions of iliac crests, also stained blue, and apparently belonging to the same animal as No. 51. No. 53 is a portion of a humerus. Presented by the Drainage Commissioners. (See "Proceedings," vol. v., Appendix, p. 62.)

The whole collection of heads, horns, perfect bones, and fragments of *C. megaceros* at present exhibited in the Academy amounts to seventy-two.

In the foregoing list, the majority and the most important specimens have been identified; but some others referred to in the Proceedings and Presentation Book cannot now with accuracy be determined.

The remains of the reindeer (*Cervus tarandus*), or caraboe, have been discovered in the Dublin mountains, and may be seen in the Museum of the Royal Dublin Society; in the Mansion House there is a very fine specimen, said to have been found in Ireland; and some bones of that animal were lately found in Shandon cave.*

The horn of *Cervus alces*, or the true elk, was found in the county of Tyrone, and described by Thompson in 1837.† The circumstance of the remains of these two animals, the reindeer and the elk, being found in Ireland, affords the philosopher food for speculation as to the probable state of our climate when they existed here.

The red deer (*Cervus elephas*), called in the native tongue *Fiadh Ruadh*, still roams through its native woods of Kerry, and was known in parts of Galway, especially among the Twelve Pins, and in Erris, in the county of Mayo, within the memory of the last generation. This, above all others, was the wild animal most noted in early Irish history, and the antlers of which were apparently most frequently used in the arts in former times. We possess a large collection of red deers' horns, and several perfect specimens are still attached to the crania. Of these, the number of tines on each antler varies from 6 to 10; the latter is shown in the accompanying magnificent set of horns, No. 3, which were found about 7 feet under the surface, in deepening the bed of the river between the townlands of Ballymore and Ballinafad, county of Roscommon. Fig. 6, No. 2, had originally seven tines on the right, and has now eight on the left side. It was found at Ballinderry, county of Westmeath, and was presented by Barkley Clibborn, Esq. With this exception, all the remains of red deer in the Academy's collection were procured during the drainage operations in different parts of Ireland, and were presented either by the Shannon Commissioners or the Board of Works.

Other animals of the cervine species, the fallow deer (*Cervus dama*), and the roebuck, may have also existed in early times, probably introduced; and afforded to our ancestors food, clothing, and amusement, although not known in the time of Bede, and undescribed by Gerald Barry, and not found, like the remains of red deer, in our bogs. But in

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* See Professor Oldham's paper on this subject in the "Journal of the Geological Society," for 1847, and Dr. Carte's communication in the "Journal of the Royal Dublin Society," No. XV.

† See Proceedings of the London Zoological Society for 1837, p. 53.

a very old translation of the scriptural "Book of Kings," contained in the "Leabhar Breac," we find the fallow deer called *Bugul;* the hart, *Fiadh-oige;* and the roebuck, *Gabur;* which latter, however, also signifies a goat.

Gerald Barry, in his "Topographia Hiberniæ," when speaking of the exceeding fatness of our stags, adds:—"By so much as they are smaller in the size of their bodies, by so much are they the more surprisingly set off by their heads and horns." But this evidently refers to the red deer. Besides the heads of red deer presented by the Board of Public Works to the Academy, great quantities of the remains both of deer and oxen have from time to time been discovered upon the borders of our inland lakes, as their waters have been lowered, either naturally or artificially, during the last few years; and their accumulation in these localities receives an elucidation from the following tales, extracted from the "Book of Lismore," and furnished me by Mr. Curry.

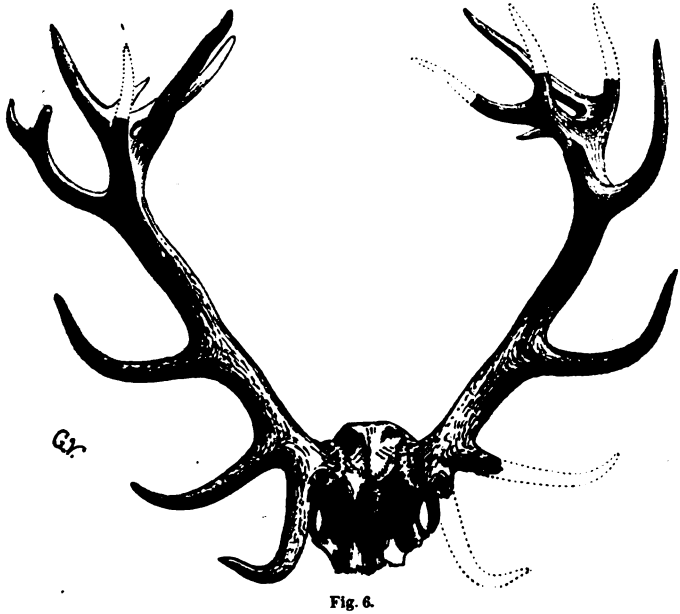

Fig. 6.

"Bran Mac Derg, son of the King of Munster, hearing that Cailte, one of Finn Mac Cumhaill's champions, to whom allusion has already been made, was still living, at a great age, as related by the Finian writers, repaired to him to learn the best method of hunting the deer with which Finn and his warriors had been acquainted of old. 'How do you order your hunting?' said Cailte to him. 'We,' said the young prince, 'surround the hill, the cairn, or the wood in which the deer may be at the time, and sometimes we succeed in killing some,

and at other times none, for a whole day.' Cailte, it is said, shed tears at hearing this statement, and the whole party then moved forward to the hill of Ceannabrat, near the present Ardfinan, on the borders of the counties of Limerick and Cork; and here they came to the confluence of three glens within the mountains of Slieve Keen, with a lake between them, called Loch Bo, or the Lake of the Cow, a locality still recognisable. Here they sat on the hill which lay to the east of the lake, called the Cnoc Maine, where, as Cailte told them, the greatest and most wary stag in Ireland formerly dwelt. This rogue of a buck was called *Laith-na-tri-mbeam*, or the gray buck with the three antlers, and, continued Cailte, 'he was killed at last by one of Finn Mac Cumhaill's warriors, after escaping all our efforts for seven and twenty years; and I was the man that killed him.' Cailte then went forth and posted his people around the lake, east, south, and north, and then he raised his hunting whoop, and gave three terrible shouts, so that there was not within hearing of him a deer, in plain, bog, mountain, or wood, that did not come careering at full speed to the lake, and sprang into it, as well to cool themselves as to escape the dreaded enemy. The men then closed in upon the lake, and not one of the animals escaped unslaughtered. Among them were wild oxen, red deer, and wild boars, and their number amounted to eight hundred. On another occasion St. Patrick and his retinue, with Cailte, came to the house of a rich landholder who lived in the southern part of the present county of Kildare, near the River Slaney. The farmer complained to Cailte that although he planted a great quantity of corn every year, it yielded him no profit, on account of a huge wild deer which every year came across the Slaney from the west, when the corn was ripe for cutting, and, rushing through it in all directions, trampled it down under his feet. Cailte undertook to relieve him, and he sent into Munster for his seven deer-nets, which arrived in due time. He then went out and placed his men and his hounds in the paths through which the great deer was accustomed to pass, and he set his deer-nets upon the cliffs, passes, and rivers around, and when he saw the animal coming to the ford of the red deer on the River Slaney, he took his spear and cast a fortunate throw at him, driving it the length of a man's arm out through the opposite side, and 'The Red Ford of the Great Deer' is the name of that pass on the Slaney ever since, and they brought his back to Drom Lethan, or the Broad Hill, which is called 'The Broad Hill of the Great Wild Deer.'"

With respect to the deer with the three horns, alluded to above, it is curious to find that in the manuscript minutes of the Committee of Antiquities for the year 1796, Mr. Ralph Ousley presented to the Academy "an account of a triple-horned moose deer found in the county of Limerick," and a fine specimen of the head of *Cervus megaceros*, with a small third horn, was lately offered for sale in Dublin.

From the earliest period deer have entered largely into the domestic history of every nation where they existed, not merely as an article of food, or a subject on which the poet could draw for the simile of grace, swiftness, and agility, but one with which have been linked many curious

myths, and which frequently lends a pictorial colouring to historic events. According to the Annals of the Four Masters, even before the Christian era, A. M. 4357, Eochaidh, joint sovereign of Ireland, was surnamed Fiadhmuine, or Eochy the Huntsman—"*Quod illi cognomen Fiadhmuine fecit Fiadh nimirum cervum interpretatur et Muin silvam;*" and another Pagan king, Niel Sedamin, was so called because "the cows and the does were alike milked" in his reign,—*fiadh* meaning a hind or doe. This art of taming deer and converting them into domestic cattle is said to have been received from Flidisia, the king's mother. King Daire of old had a magical fawn as a familiar, of which some wonderful tales are related. The deer tribe occupy a high place in Irish hagiology, and were, it is said, the subjects of many miracles. Pet deer were frequent attendants upon some of our early saints. St. Etchen, who conferred the order of priesthood upon Columbkille, yoked a stag to the plough; St. Attaracta, of Killaraght, near Boyle, yoked stags to cars to carry timber, the animals having first licked her feet in token of obedience. Two stags, obeying the sound of the bell of St. Fintan, came and carried his satchel. A stag carried the satchel of St. Berach, or Barry, of Kilbarry, on the Shannon. Stags, it is stated, carried stones and wood for St. Codocus, to build his monastery. St. Kieran, of Seirkieran, in the King's County, had at his monastery a fox, a badger, a wolf, and a stag, so tame that they were called his monks. A doe licked the hands and feet of St. Cuanna, and remained with him during the saint's life. A doe obeyed St. Gerald, of Mayo, and remained with him during its life. A wild doe came daily to St. Errina to be milked; others of the deer tribe obeyed the voice of St. Molagga. St. Patrick is said to have found a deer suckling a fawn in the spot where the Cathedral of Armagh stands, and upon his taking up the fawn, the dam followed him. A wild fawn obeyed the commands of St. Cairnuth, and was the cause of the death of King Leurig. Deer were said to have been employed to carry timber to build the castle of the King of Connaught, and were used for other domestic purposes; and, it is said, a deer found the books of St. Columbkille, which were lost.

The stag with the branching horns was celebrated among our ancient Irish poems, and venison formed a portion of the feast of our early Irish kings. Among the perogatives of the kings of Tara referred to in the "Book of Rights," we find the "venison of Nas and the swift deer of Luibneach."

Among the circumstances corroborative of the number of red deer in Ireland in former times, may be mentioned the discovery of immense quantities of the tips of stags' horns, both in the great crannoge of Dunshaughlin, and also, within the last few years, in sinking a sewer through High-street, in Dublin. These bits of bone, which are from three to five inches in length, were sawn off from the remainder of the horn, which was, in all probability, manufactured into sword and knife-handles. Bone bodkins, fibulæ, also combs, spindle-heads, dagger-hafts, and other weapons, tools, and ornaments, &c., formed from the hard bones of mammals, abound in our antiquarian collection; and the antlers of the stag

formed celt handles, and were also sharpened, and used as spears and as points for making holes, and for several other purposes.

O'Flaherty, in his "Iar-Connaught," written in 1684, says, speaking of the Joyce Country mountains, "Next Mam-en are the mountains of Corcoga, on the confines of Balynahynsy, Ross, and Moycullin countreys, where the fat deere is frequently hunted: whereof no high mountain in the barony of Ballynahynsy, or half barony of Rosse is destitute." Mr. Hardiman, the learned editor and commentator of O'Flaherty's work, says that he "heard from an old native of the barony of Ross, in Iar-Connaught, that in his youth large red deer were common there; that he frequently saw them grazing among the black cattle on the hills." And Molyneux, writing in 1715, has left on record the following remarkable passage:—"And here I cannot but observe, that the red deer in these our days is much more rare with us in Ireland than it has been formerly, even in the memory of man. And though I take it to be a creature naturally more peculiar to this country than to England, yet, unless there be some care to preserve it, I believe, in process of time, this kind may be lost also like the other sorts we are now speaking of,"—that is, the gigantic extinct deer, the loss of which he attributed to some great pestilence. Pococke said the mountains of Erris were "full of red deer, which are very indifferent food, being never fat. However, the hunting of them affords good diversion to those who traverse mountains on foot, but they frequently escape the dogs."

The following is a list of the remains of red deer:—

No. 1. A head and horns, complete, with 8 tines on each antler; it measures 34 inches across the extreme breadth of the widest part of the antlers; it was "found in the townland of Ballymore, barony of Ballintubber, South, county of Roscommon," and presented by the Drainage Commissioners.

No. 2. Head and antlers, 33 inches across, with 6 tines on right, and 8 on left horn; "found 8 feet below the surface of the water in Ballinderry Lough, near Moate, county Westmeath, on 3rd May, 1849." See p. 200.

No. 3. Head and horns, the latter slightly imperfect, but showing that there were originally 10 tines on each side; it is 31 inches across the widest part. See engraving, Fig. 6, p. 201.

No. 4. A head and antlers very perfect, with 7 tines on each side.

No. 5. Head and antlers, with 7 tines on right horn, the left imperfect; found in the townland of Clonfree, county of Roscommon, in an old river-course at the mouth of Lough Flaskey, Strokestown district.

No. 6. A head and horns, the antlers imperfect at their tops.

No. 7. A head and antlers, the right imperfect, 9 tines on the left; found in deepening an old river-course in the townland of Foxborough, near Elphin, county of Roscommon.

No. 8. A right horn, with 8 tines, "found in 1847, in excavating in alluvial soil and mossy peat, about 4 feet under the surface, adjacent to the River Clare, in the townland of Lehid, parish of Kilbannon, barony of Dunmore, and county of Galway."

No. 9. A right horn, imperfect.

No. 10. A left horn of 6 tines, and No. 11, a left horn of 7 tines, found in Ardakillan Lough, near Strokestown, county of Roscommon.

No. 12. A right horn of 7 tines. No. 13. Part of cranium, and right horn with 6 tines. No. 14. A left horn with 7 tines. No. 15. Part of cranium of a small animal. No. 16. A shed left horn of 7 tines. No. 17. A left horn with 7 tines. No. 18. Part of a head and left horn. No. 19. A shed left horn, with 6 tines. No. 20. Fragment of a shed left horn. No. 21. Upper part of cranium, wanting the horns; found in the river's bank, near Ballycumber bridge, King's County. No. 22. Upper part of cranium, wanting horns. No. 23. A fragment of right horn. Nos. 24 and 25. Ditto. No. 26. The fragment of a small left horn. No. 27. An imperfect left horn, sawn off below the crown. No. 28. Fragment of a right horn. No. 29. Ditto, much worn, as if by attrition in water. No. 30. A right horn. No. 31. Fragment of an antler top, with 4 tines. No. 32. A fine-shaped right horn, with 9 tines. No. 33. A left horn and fragment of skull. No. 34. A portion of left shed horn. No. 35. Fragment of right horn. No. 36. Fragment of cranium, and portion of left horn. No. 37. A fragment of shed left horn, found in the River Shannon, at Grosse's Island, near Carrick-on-Shannon, July, 1847. No. 38. A small imperfect left shed horn. No. 39. Fragment of a right shed horn. No. 40. Fragment of small left shed horn. No. 41. Upper fragment of left shed horn. No. 42. Upper fragment of horn, with 5 tines. No. 43. Ditto. All the foregoing were presented by the Board of Public Works. No. 44. Pelvis of a deer, marked "No. 8," with the inscription, "Found in the river between Annagossin and Castlebellingham." No. 45 is a small shed horn, apparently of the roebuck, presented by Joshua Ferguson, Esq.

There is some difficulty in distinguishing the cranium of the goat from that of the horned sheep, especially in mutilated specimens, and therefore the remains of both animals have been arranged and registered together. In the sheep, however, as has been well remarked by Owen, "the greatest diameter of the horn is across the longitudinal axis of the head; in the goat it runs parallel with it."

The Goat, *Gabhur*, the *Capra hircus*, has in all probability existed in Ireland from the earliest period of its inhabitation, and the head, horns, and other bones of this animal, have been found not only in crannoges, but in artificial caves, and in the stone passages and vaulted chambers in ancient raths, as well as in the clay which composes the ramparts of some of these moats. As the goat always gives way to the sheep in the progress of civilization, except in those regions which, from their peculiarly mountainous and rocky nature, must remain its natural habitat, we find this animal gradually disappearing in many localities, formerly celebrated for it in Ireland. It is seldom alluded to in Irish writings of antiquity, and is not enumerated among the animals which were given as tributes to the kings of Erinn. Among the sheep's and goats' heads discovered in our crannoges were several specimens of the four-horned

variety (see Fig. 9, below). The two other figures (Figs. 7 and 8) are of the ordinary goat: both are from Dunshaughlin.

Fig. 7.

Fig. 8.

Fig. 9.

The old Irish goat was small, in some instances white, but more usually of an iron-gray colour. Many localities throughout the country, hills, rocks, and mountains, derive their names from goats, such as *Keam-a-gower*, the goat's path, in the west of the county of Cork; *Lisnangabhar*, the goat's fort, in the county of Monaghan; and the celebrated pass in Achill Island, called the *Minaun*, or kid's path.

St. Patrick had two buck-goats, which he employed for carrying water. An account of them will be found in Colgan's "Trias Thaumaturga." They were stolen by three thieves, of the Ui-Torra, in the territory of Hy-Meith-tire, in the now county of Monaghan; but the saint received information which enabled him to detect the thieves, who declared that they had not stolen the goats. Patrick, however, it is stated, worked a miracle on the occasion, and caused the animals, which they had killed and eaten, to bleat from their bellies, and he prayed that the descendants of the thieves should, throughout all time, be distinguished by producing and wearing on their chins beards similar to those of buck-goats. "*Ad cujus miraculi augmentum et continuam memoriam accessit, quod imprecante Patricio tota posteritas istorum furum velut avitâ hereditate semper* barbas, *caprinis subsimiles habeant.*"—p. 150, c. 10.

Sheep, *Cuira*, or *Caeiri*. Although the Irish histories do not refer to sheep at so early a date as horned cattle are alluded to, still there is evidence to show that they existed prior to our Christian era; for in the "Leabhar-na-gCeart," or Book of the Rights and Privileges of the Kings of Erin, they are thus mentioned in the Tribute of Cashel: "Sixty smooth-wethers;" also, "seven hundred wethers, not hornless;" again, "a thousand fine sheep," and "a thousand rams swelled out with wool," with many similar references to sheep, all showing that there were great numbers as well as different breeds thereof in Ireland at a very early period.

All the crania of sheep in the Academy's collection are horned, and, with the true goat's heads, already alluded to, amount to twenty-two

specimens, more or less perfect, and exhibiting great variety in size, shape and direction of horn-cores; they also show great difference in age. Among the specimens most worthy of note are Nos. 17 and 18, figured below, which are good examples of the *Ovis polycoratus* of Linnæus.

Fig. 10.

Fig. 11.

In the illustration from No. 16, Fig. 9, there are four horns, the left supplemental one being but rudimentary. No. 17, Fig. 10, is a good specimen of the head of the four-horned sheep of the ordinary character. It is drawn from the occipital aspect. No. 18, Fig. 11, affords a posterior view of the cranium of a small specimen of five-horned sheep, three on the left and two on the right side: the face part is wanting; it is only six inches across between the extremities of the horn-cores; the horns were all curved forwards over the face and orbits. No. 17 partakes of the same character, although in a slighter degree. According to Buffon, the many-horned sheep prevail in the North, and they probably came to us from that direction. In Iceland they have sometimes as many as eight horns, while in warm countries the hornless variety is less frequently found. With a plurality of horns is generally associated a coarser description of wool. In the cold parts of the Himalayan range we also find the four-horned variety, like No. 17.

In Nos. 1 to 7 inclusive, the face part is wanting. This latter was found at Dunshaughlin, and presented by the author. No. 12 was found at Ballinderry, county of Westmeath, and presented by Dr. Lentaigne. Nos. 14 and 15 are the most perfect specimens in the collection. In several of these heads it is difficult to draw a distinction between them. To the naturalist as well as the historian these remains of ovine animals are of much interest.

When the horse (*Cappul*) and the ass (*Assul*) were first introduced into Ireland, is unknown, but we read of the "deacon of the ass" in the days of St. Patrick. There are five horses' heads in the Academy's bone collection, but two of them are very recent.* The bones of the horse

* Dr. O'Donovan has afforded the following note upon this subject.—"I do not think we have had the ass long. *Asal* was the name of a man at a very early period; but it does not mean *asinus*.

were, however, found in the great bone cave at Shandon, along with those of the elephant.

The hare, the *Lepus Hibernicus* of Thomson, called in Irish *gearr fiadh* (the short deer), usually pronounced *gearreadh*, and in some places *miol-muirghe* (the animal of the plain), and the rabbit, *conneen* (the little hound), are both, in all probability, contemporaneous with man. There is reason to believe that we had the squirrel in abundance in our native woods in former times; it has been reintroduced latterly.

Swine (*Sus scrofa*, in Irish *Muc*) no doubt existed in Ireland in a wild and domesticated state from the very earliest times, and have ever since contributed largely to the wealth of the people. The wild hog (*Torc fiadhain*) abounded in the woods, which formerly covered so large a portion of the surface of the country, and fed upon the acorns and beech-mast; hence the frequent mention in our ancient annals of the failures of these crops, as well as the years in which they abounded. Yet it is remarkable that among the copious entries respecting epizootics affecting other animals, a mortality of swine is only mentioned four times anterior to the present century, viz., A.D. 1040, 1088, 1133, and 1741. Pigs were given as tribute to the King of Emania, as stated in the "Leabhar-na g-Ceart," where we read of "1000 hogs from their territories;" also "hogs not fit for journeying from their fatness;" "hogs of broad sides," and "bull-like hogs," with "sows for the sty," &c. Giraldus Cambrensis says, in his "Topographia Hiberniæ:"—"In no part of the world have I seen such an abundance of boars and forest hogs. They are, however, small, misshapen, wary, no less degenerated by their ferocity and venomousness than by the formation of their bodies." Among the restrictions put upon one of the kings of Ulster, in the Book of Rights, so frequently alluded to, was, that he was not to go into the "wild boar's hunt, or to be seen to attack it alone." Very many places in Ireland are called after pigs, such as *Sliabh-na-muice*, in Tipperary; *Gleann-na-muice-duibhe*, near Newry; *Ceann-tuirc*, in the county of Cork. The names *Muckross* and *Torc*, at Killarney, are derived from the same root. The name *Muckalagh* enters largely into Irish topographical names, and signifies a place where pigs fed,—probably on acorns.

The Irish pig, such as it existed thirty years ago, has become almost extinct, having been replaced by imported breeds of a more profitable character.* Several heads of swine have been found in peat-bogs, also in the great Dunshaughlin bone-heap, and in different other crannoges, as well as in the deepening of rivers, &c. But the anatomical resemblance between the wild boar and an aged domesticated animal of the ancient breed is so great, that it is difficult to distinguish the one from the other. Compared with veritable specimens of the ancient wild boar of Northern Europe, as found in the peat-mosses of Scandinavia, especially in Zeeland, ours appears to have been a very diminutive animal.

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* See the author's dissertation on the Pig in the "Dublin University Magazine" for March, 1854.

In the accompanying illustrations we have a good specimen of the cranium and of a part of the lower jaw and tusks of our ancient Irish pig, but whether from domesticated animals cannot now be determined. This

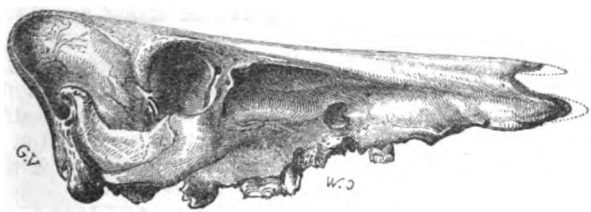

Fig. 12.

head, which measures only 11½ inches, was found under the bed of the River Brosna, above Ballycumber Bridge, King's County, and was presented by the Board of Works; the lower jaw was procured from Lough Gurr, county of Limerick, and is of a yellowish-brown colour, such as all the bones found in that locality present.

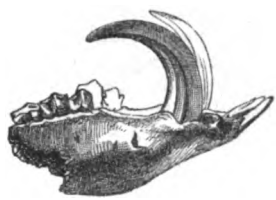

Fig. 13.

There are the remains of nine pigs in the Academy's collection, besides several tusks. No. 1, figured above; No. 2, from the Ballinderry lake, is a little longer, and was presented by Dr. Lentaigne; Nos. 3 and 4 are crania of swine, slightly imperfect, procured from the Dunshaughlin crannoge, and were deposited in the Academy by the author. No. 5, ditto; locality unknown. Nos. 6 and 7, anterior portions of lower jaws, procured from Lough Gurr. Nos. 8 and 9, fragments of lower jaws.

Oxen.—Having already described in the Proceedings for June 14, 1858, the varieties of horned cattle which formerly existed in Ireland, I have now but to put on record the registration of that great collection, amounting to forty specimens at present in the Academy, and to revise some of the opinions which I put forward in my former publication upon this subject.

From a recent inspection of all the zoological museums of note in Scandinavia and Northern Germany, I am led to entertain the views advanced by Professor Nilsson, of Lund, that the modern Auroch preserved in the Lithuanian Forests is a Bison, similar in character to that of America, and is not identical with the great extinct Urus of the ancients, or *Bos primigenius* of Owen, of which Nilsson possesses the largest and finest collection in Europe. It would also appear from Nilsson's investigations, that very many of the ox-heads in our collection belong to his variety of *Bos frontosus* in which the "ridge of the occiput rises high in the centre, convex; horns short, somewhat depressed at the root, directed outwards and backwards, then bent forward." The figure I have given at page 70 of this volume of the Proceedings is

from an undoubted specimen of that class; and there are many examples in our collection quite similar to other drawings in Nilsson's book, especially Figs. 3 and 5, published in the notice of that work, in the "Annals and Magazine of Natural History," vol. iv., 2nd series, p. 349.

The following is a list of the fifty-five ox crania now in the Academy:—

No. 1. The head of a fine bull, of the short curved horn variety, marked No. 22, and bearing the label, F. 702, with the following inscription:—"Young head, supposed to have been sacrificed." It was procured at Lough Gurr, county of Limerick, together with Nos. 2, 8, and 11. It is 23½ inches long, and 8 across the forehead, and is figured at p. 72 of this volume.

No. 2. A cow's head, of the same variety or breed, 19 inches long, and only 6½ across the forehead below the horns. See woodcut, p. 73, vol. v., marked F. 705 in old registry of Museum.

No. 3. A Cow's head, 18 inches long, of same breed as foregoing. No. 4. A specimen of the same breed, imperfect at the muzzle. Nos. 5, 6, and 7 possess the same characters. These four last were found at Dunshaughlin, and, with Nos. 10 and 19, were presented by the author.

No. 8. Ditto, marked No. 23, F. 703, in Museum registry. No. 9. An imperfect head of same breed. No. 10. From Dunshaughlin; deposited by the author. No. 11. Ditto; marked 24; F. 704. No. 12. Ditto; marked S. 7.

No. 13. Fragment of an ox-head, "found in a rath in the townland of Callanagh, parish of Ballyrowan, Queen's County, and presented by Joshua Ferguson, Esq."

No. 14. A long, narrow head. No. 15. A fragment, with left horn.

Nos. 16, 17, and 18. Ox-heads, wanting the horn-slugs. The last specimen appears to have been struck in the forehead by a blunt instrument, possibly in slaughtering.

No. 19. The head of a young ox; horns curved rather more than usual; found in Dunshaughlin. No. 20. A cranium and horn-cores, found at Ballinderry; presented by Dr. Lentaigne. No. 21. The head and horn-cores of a small, young animal. No. 22. A fragment of a large head, with left horn-core; probably of a bull.

Nos. 23, 24, and 25 present the same characters as the foregoing, but the slugs are rather flatter, and curved more inwards, like those of the old Irish cow of forty years ago. All these were found in Dunshaughlin, and deposited by the author. They may be classed under the long-headed curved horned breed of which No. 1 is the type.

No. 26 is a fine bull-head of the straight short-horned breed, 18 inches long, discovered at Dunshaughlin, in 1840, figured at page 71 of this volume, and is the finest specimen of the domesticated descendant of the *Bos longifrons* which has yet been found in Ireland. Under this head are classed the following:—No. 27. A large ox-head, with a cut in the forehead, into which can be fitted several of our narrow bronze celts. No. 28. Head and horn-cores. No. 29 would appear from its colour, compared with the others, to be quite recent; it is a very good specimen

of *Bos longifrons*, and was "found in the trough chamber at Dowth."* No. 30 is the upper fragment of a head and horn-cores; figured at p. 73. No. 31. Portion of head and horn-cores. No. 32. Ditto, of a young animal; horns very straight. No. 33. Ditto. No. 34. A long head and horn-cores. No. 35. Head of a small, young animal. No. 36. A large head, wanting horn-cores. No. 37. A good head, resembling the *Bos longifrons*. No. 38. Upper fragment of head, and slugs. No. 39. A small long head, like those of the breed typified by No. 1. Nos. 40, 41, 42, 43, and 44. Crania and horn-cores, more or less perfect, chiefly small animals.

No. 45 is the upper portion of a head and horn cores, the latter rather retreating, and the former rising into a high projection. This head is figured at p. 70 of the Proceedings, and resembles more than any other in the Collection the new variety styled *Bos frontosus* of Nilsson, at least so far as the very high crest between the horns is a sufficient characteristic. No. 46 is of the same breed, but being that of a young animal, the protuberance is not well developed. No. 47 is a large head; the cores wanting; the mark where this beast was slaughtered by a blow on the forehead is very manifest.

Nos. 48 to 55 are eight hornless or *maohl* varieties, and all, except the two first, present a very remarkable protuberance, or frontal crest, but this is especially marked in Nos. 50 and 53. As the *maohl* ox would appear to have abounded in Ireland more than in any other part of Europe, I subjoin the accompanying illustration of this hornless variety, which may be taken as affording a good idea of its general characters. It was accidentally omitted in my communication upon the Ancient and Modern Races of Oxen in Ireland, at page 64.

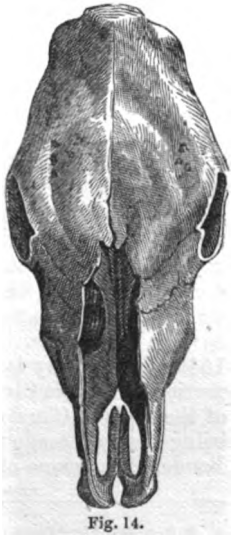

Fig. 14.

With the exception of Nos. 1, 2, 3, 8, 11, 13, 20, 28, 29, 30, 32, and 39, all these heads were found at Dunshaughlin, and either presented or deposited in the Academy by myself. Besides the foregoing list of the osseous remains of extinct and existing mammals, derived for the most part from our lakes, bogs, and crannoges, and now forming one of the largest known collection of its kind, there are many fragments and isolated bones not enumerated. It now remains for the Academy to decide on their ultimate destination; and on that subject I have addressed a letter to the Council.

An interesting discussion ensued, in which the Chairman, Professor Wright, Mr. Curry, and other members took part.

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* See "The Beauties of the Boyne," p. 208.

Mr. Wilde exhibited a remarkable antique brooch, recently found at Rathmore, county of Cavan, and purchased by Mr. West, College-green, by whose permission he brought it under the notice of the Academy. It is of bronze, but was originally plated, and was also beautifully ornamented in front with enamel, portions of which still remain, and show that Irish artists had attained considerable skill in that description of decoration. What adds considerably to the interest of this object is its having four spiral rings, or helices, each of three turns, wound round one side of the circle. One of these spiral rings is encircled within a smaller one.

Mr. Wilde presented a portion of the head and antlers of a fossil elk, and also a good specimen of the head and horn-cores of a goat, the latter found in Dunshaughlin crannoge, several years ago.

The thanks of the Academy were voted to the donor, after which the Academy adjourned.

MONDAY, NOVEMBER 14, 1859.

James Henthorn Todd, D. D., President, in the Chair.

On the recommendation of Council, it was—

Resolved—That the sum of Fifty Pounds be placed in the hands of the Council to enable them to purchase antique articles for the Academy Museum.

The Rev. Dr. Reeves read—

AN ACCOUNT OF THE CRANNOGE OF INISHRUSH, AND ITS ANCIENT OCCUPANTS.

That part of Ulster known in the sixteenth century as *Brian Carragh's Country* consisted of a tract on either side of the Bann, of which Portglenone may be taken as the centre. The portion on the Antrim side of the river, which consisted of the adjacent part of the parish of Ahoghill, was held, by inheritance, under O'Neill, of Clanaboy; while the Londonderry portion, which consisted of the south-east part of Tamlaghtocrilly parish, was wrested by force of arms from O'Cahan, and held in adverse possession. In Marshal Bagenal's "Description of Ulster," 1586, the territory is thus noticed:—"Brian Caraghe's countrey was a portion of Northe Clandeboy, won from it by a bastard kinde of Scottes, of the septs of Clandonells, who entered the same, and do yet holde it, being a very stronge piece of lande lienge uppon the North side of the Bande. The name of the nowe Capten thereof is Brian Caraghe,* who

* A very interesting document from the State Paper Office has been printed by Herbert F. Hore, Esq., in the Ulster Journal of Archæology, vol. vii. p. 61. It is a letter from Allister McConeill to Captain Piers, dated 10th of December, 1566, in which he says: "als mony as we myt drywe and dreaf ower y^e^ Ban all y^e^ carycht y^t^ Brean Karriche hade. . . . . , and ane *innyse* [i. e., island, namely, Innisrush] y^t^ Brean Karriche hade of befair and Oneiles servand tuk yt, and now we have gotten y^t^ *innys* agane, and that harchips I behuffit to sla yame to be meit to my arme."

possessethe likewise another pece of a countrey of Tyron side upon the Band, for which hé doth contribute to Onele, and for his landes on the North side to them of Clandeboye; by reason of the fastnes and strengthe of his countrey, havinge succour and frendes on each side the Band, it is very hard to harme him, which maketh him so obstinate and careles as he never yet wolde appeare before any Deputie, but yeldethe still what relife he can to the Scottes. His force in people is very smale; he standethe onelie upon the strength of his countrey, which in dede is the fastest grownde of Ireland."* The substance of this statement is transferred by John Dymmok into his "Treatice of Ireland," circ. 1600, who corrupts the chieftain's name to *Bryan Mac Carvugh*.† In his "Particuler of the Rebells Forces," April 28, 1599, we find under Ulster, "Shane mac Bryan Carragh, and his cuntry joynyng on the Bansyde—50 foot, 10 horse."‡ In Francis Jobson's Maps of Ulster, preserved among the manuscripts of Trinity College, *Bryan Carrogh's Country* is laid down on either side of the Bann, and a little south-east on the Antrim side, somewhere in the parish of Ahoghill, *Temple Brian Carrogh* is also marked.§ With these agree the engraved maps of Baptista Boazio,‖ Speed,** Jannson,†† and Blaeu.‡‡ John Norden's map, prefixed to the printed State Papers of Ireland, places Brian Carogh only on the county of Londonderry side, north-west of Forte Tuom, now Toome Bridge.§§ Local tradition circumscribes his territory still more, bounding it on the north by Wolf Island; north-west by Drumlane March; on the east by Tyanee Burn; on the south-east by Cut of the Hill, near Bellaghy; and on the south by the Clady River.

This Brian, who bore the common epithet of *Carrach*, or "Scabbed,"‖‖ was an O'Neill, and great-grandson of Domhnall Donn, or "Donnell

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* Printed from the original record in the State Paper Office, dated December 20, 1586, by Herbert F. Hore, Esq., in the "Ulster Journal of Archæology," vol. ii., p. 154. The county of Antrim part of this document had previously been printed, with a few verbal inaccuracies, from a copy in Dean Dobbs' collection, by the Rev. John Dubourdieu, in his "Statistical Survey of Antrim," vol. ii., p. 620.

† "Tracts relating to Ireland," vol. ii., p. 23 (Irish Archæological Soc. Publications).

‡ Ibid., p. 29.

§ The second map of Ulster in the Trin. Coll. collection of Irish maps and charts is a large coarsely coloured survey of Ulster, on vellum, by Francis Jobson, dated 1590. The third, which is smaller, and on paper, is also by Jobson, and marks *Brian Carrugh* on both sides of the Bann. Map 4 of Ulster, also by Jobson, on vellum, places *Brian Caroth* entirely on the east side of the river.

‖ This rudely executed and coloured map, which is extremely rare, was "graven by Renolde Elstrack," and published in the latter part of Queen Elizabeth's reign, and sold "in the Pope's head alley by Mr. Sudbury." It places *Brian Caroch* on the west side, but has his name to the south-east, lower down, near the Fevagh.

** Speed's Theatre; the Province of Ulster, between pp. 145, 146 (1614).

†† "Le Nouvel Atlas ou Theatre du Monde," tom. iv., Irlande, between pp. 41, 42 (1647).

‡‡ Blaeu, "Geographia Hiberniæ," between pp. 27, 28 (1654).

§§ With this agrees the copy of Norden's map of Ulster, on vellum, in the Trin. Coll. collection, where it is No. 1 of Ulster. It is of the date 1609–1611.

‖‖ Carrach was in very common use. Thus, we find an earlier Brian Carrach O'Neill, in the "Annals of the Four Masters" at 1387; an Art Carrach at 1486; a

the Brown," whose father, Brian, was brother of Con, eldest son of Hugh Boy the Second, the ancestor of the noble house of Shane's Castle, now, alas! extinct in the male line. Domhnall Donn became possessed of the district on the Antrim side of the Bann, and founded a sept called the Clann Domnaill Duinn na bana,* "Descendants of Donnell Donn of the Bann." Hence arose among the English the familiar appellation of *Clandonnells*, as employed by Bagenal and Dymmok in the passages above cited. Camden, however, erroneously supposed them to be the same as the Mac Donnells, familiarly called M'Connells; and, speaking of the Earl of Essex's failure in reducing Ulster, he adds, that he "left this country to the *O'Neals*, and *Brian Carragh* of the family of the MacConnells, who have since cut one another's throats in their disputes for sovereignty."† The name Clandonnell, no doubt, was often applied to the MacDonnells,‡ especially O'Neill's gallowglasses, but in the present instance it was borrowed from *Donnell* Donn O'Neill.

The epithet, "a bastard kind of Scotts," is, probably, derived from a mistaken notion that Brian Carragh's men were MacDonnells; or it may have reference to Scotch mercenaries employed by the chief of the district, who settled and intermarried therein. In confirmation of this view, there is the local tradition that the Mac Erleans, who abound in the district, were a Scotch clan, whose name was originally Mac Clean,§ and that they were invited over from the west coast of Argyle and planted here by Brian Carrach, where they became his best supporters against O'Cahan.

Brian Carrach flourished in the middle of the sixteenth century,‖ and died about 1586. A son of his was slain, according to the Four Masters, in 1577. Another son, Shane Boy, who was captain of the district in 1599, is the last of that line noticed in Mac Firbis's Genealogy of the O'Neills, but the old family pedigree, copies of which belonging to the families of Shanescastle and Bannvale, have been examined by me, gives another generation in Cormac, son of Shane Boy. Anne, daughter of Brian Carrach, was second wife of Shane O'Neill, of Shanescastle,** son of the Brian O'Neill, whom the Earl of Essex caused to be apprehended near Carrickfergus in 1574.††

Neale Carrach at 1488; a Rory Carrach at 1523, all O'Neills. Mr. Hoare, supposing Carrach to be a surname, in a note on *Brian Carrach* cites a statement about *Alexander Carrach;* but he was a Mac Donnell. His name appears in the family pedigree, and in the "Four Masters," at 1542, 1577. This Alexander Carrach died in 1634. See note to O'Donovan's "Four Masters," 1590 (p. 1895).

* Mac Firbis, Geneal. MS. (Library, Royal Irish Academy), p. 121 *a*.

† Britannia, vol. iv., p. 431. (Gibson's translation, ed. Gough, London.)

‡ See Miscellany of the Celtic Society, p. 192; Iar Connacht, p. 331.

§ That is *Mac Gilla Eoin*. See "Four Masters," at 1523, 1559, 1577.

‖ The learned editor of the "Four Masters" makes a slight mistake in identifying Brian Carrach of 1387 (p. 709) with the present individual noticed at 1577 (p. 1692).

** O'Neill Pedigree.

†† Camden, Annales Elizabethæ, anno 1573 (p. 246, ed. 1573). Devereux's Lives and Letters of the Earls of Essex, vol. i. pp. 19, 34, 37–39, 66, 69, 89, 90. O'Donovan's "Four Masters," 1573 (p. 1664), 1574 (p. 1676).

The following Table, commencing with the founder of the noble house of Clannaboy, shows the collateral descent of the Edenduffcarrick and Bann-side lines.

AEDH BUIDHE, *or* HUGH BOY I.
Appears in the "Four Mast." at 1259, 1260, 1261, 1262, 1281. Slain in 1283.

BRIAN O'NEILL
Inaugurated 1291; slain 1295.

HENRY O'NEILL.

MUIRCERTACH CENNFADA O'NEILL.

BRIAN BALLAGH O'NEILL.
His sons adults in 1426.

AODH BUIDE, HUGH BOY II., O'NEILL.
Slain May 2, 1444.

CON O'NEILL.
Flor. 1465, 1468, 1471, 1472, 1475, 1481; ob. 1482.

NIALL MOR O'NEILL.
Ob. April 11, 1512.

PHELIM BACACH O'NEILL.

BRIAN O'NEILL.
Flor. 1573, apprehended by Earl of Essex, 1574.

JOHN O'NEILL = ANNE, d. of Brian Carrach.
Flor. 1586; ob. 1617.

PHELIM DUBH O'NEILL.
Ob. 1677.

BRIAN O'NEILL.
Ob. 1669.

JOHN O'NEILL.
Ob. 1738.

CHARLES O'NEILL.
Ob. 1769.

JOHN O'NEILL.
First Vis. O'Neill; killed 1798.

CHARLES HENRY ST. JOHN.
Earl O'Neill. Ob. Mar. 25, 1841, æt. 62.

JOHN RICHARD BRUCE.
Third Viscount O'Neill.
Ob. Feb. 12, 1855, æt. 74.

BRIAN O'NEILL.
Died of small-pox, 1488.

DOMHNALL DONN.
Founder of *Clann Domhnaill Duinn na Bana.*

SHANE DUBH O'NEILL.

CORMAC O'NEILL.

BRIAN CARRACH O'NEILL.
Ob. circ. 1586.

.....
"The son of Brian Carrach, son of Corbmac, was slain by the army of O'Neill, 1577" (Four Mast.).

SHANE BOY O'NEILL.
Alive in 1599.

CORMAC.

ANNE.
Second wife of John O'Neill of Shane's Castle.

The place which is traditionally pointed out as the site of Brian's abode is a small island, in the middle of a marshy basin at Inishrush, called the Green Lough.* This spot was really the Inip puip, "Island of the Wood;" and though it has long since ceased to bear this name *par excellence*, it comes in for a share as part of the townland of Inishrush, as adjacent to the hamlet so called, and as included in the Perpetual Cure of Inishrush. And the reason why this inconsiderable speck gave name to the surrounding district, was its importance in the sixteenth century as the seat of the chieftain's fortress: just as Inip Ua Flomn, the now obliterated crannoge near Desertmartin, gave the name of Loch Inip Ua Fhlomn, first, to the small lake it existed on, and then, in the form of *Loughinsholin*, to one of the largest baronies in Ulster.†

The Green Lough was drained some years ago by the father of Hugh MacLoughlin, the present tenant. Previously to that it was a sheet of water, about half a mile in circumference, and used to receive the surplus water of the Black Lough; but, by means of a deep cut, its contents were carried into the Clady River, and it was completely drained. About the middle, in the position shown on the Ordnance map, was a circular eminence artificially formed of clay and gravel, the edge of which sloped down to the water. Inside this marginal embankment was a circle of oak piles, most of which still remain, about seven perches in circumference. In the upper ends were mortised horizontal beams of oak, and upon this framework, as a foundation, rested a wooden house, which was securely connected with the supporting timbers. Such was the edifice which tradition describes as the residence of Brian Carrach O'Neill. The approach was from the western margin of the lough, where an artificial causeway was formed, which came within a short distance of the island. I expected to hear of many articles of antiquity being found during the process of draining, but the only one which was remembered was a piece of iron chain-mail. At present, owing to neglect of the drain, the basin containing the island has been to some extent again submerged, so that, on the 18th of October last, an effort which I made to reach the island failed, as I sank above the knees before I had taken many steps. However, the island, though considerably impaired in outline, still remains prominent and green, and produces a cock of hay every year. The apple-trees which are growing on the top were planted there a few years ago.

The road to Tamlaght skirts the Green Lough on the south, and on

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* As distinguished from the larger sheet of water called the *Black Lough*, which lies a little to the north-west, but which has no island.—Ordnance Survey of Londonderry, sheet 33.

In the fourth Ulster map in the Trin. Coll. collection, *Brian Caroth* is placed on the Antrim side; but on the Derry side of his territory, south of the *Slut Donogh*, is the mark of a very small lake, with a diminutive island, no doubt intended for the one in question. Speed, Jannson, and Blaeu, mark the Clady River, which they call the *Skinne flu.*, and on the north side of it they correctly place the little lake with its island, which they call *Lo. Rush.*

† See my communication in the Proceedings, p. 359, *supra*.

the other side of it rises one of the escars which abound in the parish. The highest part of this is called the *Gallows Hill*, and the marks of three graves are shown near the spot where the gallows stood. They are said to contain the remains of three warriors slain by Brian Carrach. Living, as this chieftain did, in a district which was wrested from a rival tribe, his life was naturally marked by vigilance, and his acts by decision and severity. The inaccessible nature of his territory enabled him to bid defiance to the English, but the emissaries of the O'Cahans were ever ready to take advantage of his difficulties; and tradition says that the two sons whom he left were assassinated by the Logans and Mac Shanes at a christening party near Skeg-na-holiagh. Certainly the stories which are told of him do not impress the mind with a notion of his gentleness. The following, which was related to Dr. O'Donovan, when in this part of the country in 1834, and was communicated by him to the Ordnance Survey Office,* presents a fair specimen of the local estimate for this chief's memory:—"Many stories are related of Brian Carrach O'Neill, who encroached upon O'Kane, and possessed the south-east portion of the county. Brian would never hang one man alone, and if he found a man guilty of swinging by his law, he would give him a long day, until he could find another to dance along with him. One time he found a man guilty, and a long time passed over, but no companion could be found for him. At last a stranger came to visit the friars of a monastery within the territory, and Brian, riding out one day, viewed him, and they allow that he sent word to the abbot, requesting of him to *lend* him that man, and that he would send him one in return as soon as possible. The abbot, fearing to disobey, sent him the man, and Brian caused him to be hanged along with the convict. Soon after this, he found two others guilty, one of whom attracted his notice as being remarkably comely. Brian spoke to him, saying, 'I shall forgive you if you will marry a daughter that I have.' 'Let's see her,' says the convict. Brian sends for the daughter; but as soon as the comely youth beheld her, he cried out, Suas liom, suas liom: 'Up with me, up with me.' 'By the powers,' says Brian, 'I will not up with you, but she must go up.' Upon which he hanged his own daughter for her ugliness, and gave the comely youth up to the abbot, in payment of the man he had borrowed from him to make up the even number."†

The monastery above mentioned was, probably, the small friary which tradition reports to have existed in the little village of Tamlaght, about two miles distant, on the north-west.

The Rev. Samuel Haughton stated his views respecting the tidal currents in the Arctic Archipelago. In his opinion the Atlantic and

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* Londonderry Letters, dated Newtownlimavady, August 16, 1834.

† A story very similar is recorded by Dr. Fitzgerald, in Mason's "Parochial Survey," of Henry Avrey O'Neill, whose castle was in the parish of Ardstraw.—Vol. i, p. 116. The Ardstraw youth said, *Cur suas me, cur suas me.*

Pacific tides meet along a line of comparatively still water, on which the ice accumulates so as to form an impassable barrier. This line passes through the following points:—North of Renslœr Harbour; North of Wellington Channel; Banks's Strait; North of Prince of Wales's Strait.

A general sketch of this theory was published, in April, 1858, in the "Natural History Review," and communicated by Mr. Haughton to Captain M'Clintock in the summer of 1857. The practical conclusion deduced from this theory was, that no ship could pass from the Atlantic to the Pacific, or *vice versâ*. Mr. Haughton stated that the discoveries of Captain M'Clintock respecting the "Erebus" and "Terror" confirmed this theory.

The Rev. Robert Carmichael read the first part of a paper—

ON CERTAIN METHODS IN THE CALCULUS OF FINITE DIFFERENCES.

Sect. I.—*On the Solution of Systems of Simultaneous Equations in the Calculus of Finite Differences.*

There are many questions in physics, more especially in the departments of magnetism, heat, meteorology, and astronomy, in which the conditions for solution are given by observations made at periods separated by finite intervals, and the unknown quantities enter in certain linear combinations. It would seem to be obvious that, in some of these cases, the phenomena would admit, as their possible analytical expression, and in some cases would require as their only suitable expression, systems of simultaneous equations in finite differences.

For instance, it seems evident that there are certain classes of physical problems which are only susceptible of exposition by such a system as,—if u_t, v_t, w_t, &c., are unknown functions of t to be determined, a_1, b_1, c_1, &c., constants, and f_1, f_2, f_3, &c., functions of known form,—

$$\left.\begin{aligned} \Delta.u_t &= a_1u_t + b_1v_t + c_1w_t + \ldots + f_1(t) \\ \Delta.v_t &= a_2u_t + b_2v_t + c_2w_t + \ldots + f_2(t) \\ \Delta.w_t &= a_3u_t + b_3v_t + c_3w_t + \ldots + f_3(t) \\ &\text{\&c.} \end{aligned}\right\},$$

or,

$$\left.\begin{aligned} u_{t+n} &= a_1u_t + b_1v_t + c_1w_t + \ldots + f_1(t) \\ v_{t+n} &= a_2u_t + b_2v_t + c_2w_t + \ldots + f_2(t) \\ w_{t+n} &= a_3u_t + b_3v_t + c_3w_t + \ldots + f_3(t) \\ &\text{\&c.} \end{aligned}\right\},$$

So far as I am aware, no general method has been given for the solution of such systems of equations. In the following pages an attempt is made to supply the desideratum.

1. Let it be proposed to solve the system of equations in finite differences, of the first order, exhibiting n unknown functions,

$$\left.\begin{aligned} u_{x+1} &= a_1 u_x + b_1 v_x + c_1 w_x + \ldots \\ v_{x+1} &= a_2 u_x + b_2 v_x + c_2 w_x + \ldots \\ w_{x+1} &= a_3 u_x + b_3 v_x + c_3 w_x + \ldots \\ &\text{\&c.} \end{aligned}\right\},$$

the auxiliary known functions f_1, f_2, f_3, &c., being, for the present, omitted.

Multiply the first equation by λ, the second by μ, the third by ν, &c.; then, adding all together, we get

$$e^{D_x}(\lambda u_x + \mu v_x + \nu w_x + \ldots) = \left\{\begin{aligned} &(a_1\lambda + a_2\mu + a_3\nu + \ldots)\, u_x \\ &\qquad + \\ &(b_1\lambda + b_2\mu + b_3\nu + \ldots)\, v_x \\ &\qquad + \\ &(c_1\lambda + c_2\mu + c_3\nu + \ldots)\, w_x \\ &\qquad + \text{\&c.} \end{aligned}\right.$$

Now, as we have introduced n arbitrary constants, we are at liberty to subject them to n conditions, which we may suppose to be—

$$\begin{aligned} a_1\lambda + a_2\mu + a_3\nu + \ldots &= k\lambda, \\ b_1\lambda + b_2\mu + b_3\nu + \ldots &= k\mu, \\ c_1\lambda + c_2\mu + c_3\nu + \ldots &= k\nu, \\ &\text{\&c.}, \end{aligned}$$

k being a new constant.

The preceding equation is thus reduced to the form

$$e^{D_x}(\lambda u_x + \mu v_x + \nu w_x + \ldots) = k(\lambda u_x + \mu v_x + \nu w_x + \ldots),$$

the solution of which is, at once,

$$\lambda u_x + \mu v_x + \nu w_x + \ldots = Ck^x,$$

where C is any arbitrary constant.

Now, with regard to the quantity k, it is to be observed that if $(n-1)$ of the quantities λ, μ, ν, &c., be eliminated between the assumed equations of connexion, the n^{th} quantity will of course disappear of itself, and we obtain an equation of the n^{th} degree in k, and the known quantities a_1, b_1, c_1, &c., namely, the determinant,

$$\left|\begin{matrix} a_1 - k, & a_2, & a_3, & \text{\&c.} \\ b_1, & b_2 - k, & b_3, & \text{\&c.} \\ c_1, & c_2, & c_3 - k, & \text{\&c.} \\ & \text{\&c., \&c.} & & \end{matrix}\right| = 0:$$

consequently, in the above solution, k may be supposed to have any one of n known values.

Hence, writing down the series of solutions corresponding to the several roots k_1, k_2, k_3, &c., it is obvious that the general solution of the given system of simultaneous equations in finite differences is exponible in the form—

$$\left.\begin{aligned} u_x &= C_1k_1^x + C_2k_2^x + C_3k_3^x + \ldots + C_nk_n^x \\ v_x &= D_1k_1^x + D_2k_2^x + D_3k_3^x + \ldots + D_nk_n^x \\ w_x &= E_1k_1^x + E_2k_2^x + E_3k_3^x + \ldots + E_nk_n^x \\ &\text{\&c.} \end{aligned}\right\},$$

where, of the constants C_1, D_1, E_1, &c., n only are arbitrary.

When some of the roots k_1, k_2, k_3, &c., are equal, or when there are pairs of imaginary roots, modifications sufficiently evident must be introduced in the general form of solution.

Thus, in the case of r equal roots, whose common value is k_1, the general form of solution becomes

$$\left.\begin{aligned} u_x &= k_1^x(C_{r-1}x^{r-1} + C_{r-2}x^{r-2} + \ldots + C_1x + C_0) + \ldots + C_nk_n^x \\ v_x &= k_1^x(D_{r-1}x^{r-1} + D_{r-2}x^{r-2} + \ldots + D_1x + D_0) + \ldots + D_nk_n^x \\ w_x &= k_1^x(E_{r-1}x^{r-1} + E_{r-2}x^{r-2} + \ldots + E_1x + E_0) + \ldots + E_nk_n^x \\ &\text{\&c.} \end{aligned}\right\},$$

Lastly, in the case of a pair of imaginary roots, the general form of solution becomes—

$$\left.\begin{aligned} u_x &= C_1(k_1 + k_2\sqrt{-1})^x + C_2(k_1 - k_2\sqrt{-1})^x + C_3k_3^x + \ldots + C_nk_n^x \\ v_x &= D_1(k_1 + k_2\sqrt{-1})^x + D_2(k_1 - k_2\sqrt{-1})^x + D_3k_3^x + \ldots + D_nk_n^x \\ w_x &= E_1(k_1 + k_2\sqrt{-1})^x + E_2(k_1 - k_2\sqrt{-1})^x + E_3k_3^x + \ldots + E_nk_n \\ &\text{\&c.} \end{aligned}\right\},$$

which may obviously be reduced to the simpler form—

$$\left.\begin{aligned} u_x &= (k_1^2 + k_2^2)^{\frac{x}{2}}\ C'_1\cos\left\{x\tan^{-1}\left(\frac{k_2}{k_1}\right) + C'_2\right\} + C_3k_3^x + \ldots + C_nk_n^x \\ v_x &= (k_1^2 + k_2^2)^{\frac{x}{2}}\ D'_1\cos\left\{x\tan^{-1}\left(\frac{k_2}{k_1}\right) + D'_2\right\} + D_3k_3^x + \ldots + D_nk_n^x \\ w_x &= (k_1^2 + k_2^2)^{\frac{x}{2}}\ E'_1\cos\left\{x\tan^{-1}\left(\frac{k_2}{k_1}\right) + E'_2\right\} + E_3k_3^x + \ldots + E_nk_n^x \\ &\text{\&c.} \end{aligned}\right\},$$

EXAMPLES.

(1.) Let it be proposed to solve the system of two simultaneous equations—

$$\left.\begin{aligned} u_{x+1} &= a_1 u_x + b_1 v_x \\ v_{x+1} &= a_2 u_x + b_2 v_x \end{aligned}\right\}.$$

The solution is at once—

$$u_x = C_1 k_1^x + C_2 k_2^x,$$

$$v_x = C_1 \left(\frac{k_1 - a_1}{b_1}\right) k_1^x + C_2 \left(\frac{k_2 - a_1}{b_1}\right) k_2^x,$$

where k_1, k_2 are the roots of the equation

$$(k - a_1)(k - b_2) = b_1 a_2.$$

(2.) Let it be proposed to solve the system of three simultaneous equations—

$$\left.\begin{aligned} u_{x+1} &= b_1 v_x + c_1 w_x \\ v_{x+1} &= a_2 u_x + c_2 w_x \\ w_{x+1} &= a_3 u_x + b_3 v_x \end{aligned}\right\},$$

The solution is at once

$$\left.\begin{aligned} u_x &= C_1 k_1^x + C_2 k_2^x + C_3 k_3^x \\ v_x &= D_1 k_1^x + D_2 k_2^x + D_3 k_3^x \\ w_x &= E_1 k_1^x + E_2 k_2^x + E_3 k_3^x \end{aligned}\right\},$$

where

$$D_1 = C_1 \frac{a_3 k_1 + c_2 a_3}{k_1^2 - c_2 b_3}, \qquad E_1 = C_1 \frac{a_3 k_1 + b_3 a_2}{k_1^2 - c_2 b_3},$$

$$D_2 = C_2 \frac{a_3 k_2 + c_2 a_3}{k_2^2 - c_2 b_3}, \qquad E_2 = C_2 \frac{a_3 k_2 + b_3 a_2}{k_2^2 - c_2 b_3},$$

$$D_3 = C_3 \frac{a_3 k_3 + c_2 a_3}{k_3^2 - c_2 b_3}, \qquad E_3 = C_3 \frac{a_3 k_3 + b_3 a_2}{k_3^2 - c_2 b_3},$$

and where k_1, k_2, k_3 are the roots of the cubic equation obtained by the elimination of λ, μ, ν between the equations

$$\left.\begin{aligned} a_2\mu + a_3\nu &= k\lambda \\ b_1\lambda + b_3\nu &= k\mu \\ c_1\lambda + c_2\mu &= k\nu \end{aligned}\right\}, \quad \text{or} \quad \begin{vmatrix} -k, & a_2, & a_3 \\ b_1, & -k, & b_3 \\ c_1, & c_2, & -k \end{vmatrix} = 0,$$

or,

$$k^3 - (b_1 a_2 + c_1 a_3 + c_2 b_3)\, k - (c_2 b_1 a_3 + c_1 a_2 b_3) = 0.$$

As regards the determination of the arbitrary constants C_1, C_2, C_3, we are supposed to be given the values of u_x, v_x, w_x, corresponding to a particular value of x. Let it be supposed, for example, that the values of

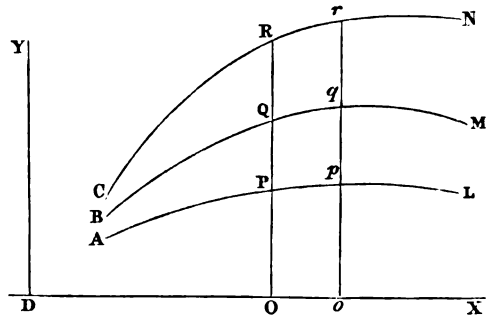
these quantities, corresponding to $x = 0$, are respectively, α, β, γ; then we shall have, for the determination required,

$$\left.\begin{aligned} \alpha &= C_1 + C_2 + C_3 \\ \beta &= D_1 + D_2 + D_3 \\ \gamma &= E_1 + E_2 + E_3 \end{aligned}\right\},$$

writing, for simplicity, the constants D_1, E_1, &c., in their primitive form.

The following is the geometrical problem, of which the given system of simultaneous equations of finite differences is the analytical statement.

To find *three* curves AL, BM, CN, such that,



taking $OD = x$ and Oo as the unit-increment of the abscissa,

$$\begin{aligned} OP &= u_x, & & op = u_{x+1}, \\ OQ &= v_x, & \text{whence} \quad & oq = v_{x+1}, \\ OR &= w_x, & & or = w_{x+1}, \end{aligned}$$

we may have

$$\left.\begin{aligned} op &= b_1 . OQ + c_1 . OR \\ oq &= a_2 . OP + c_2 . OR \\ or &= a_3 . OP + b_3 . OQ \end{aligned}\right\},$$

2. In the preceding article, the solution of the system

$$\left.\begin{aligned} u_{x+1} &= a_1 u_x + b_1 v_x + c_1 w_x + \ . \ . \ . \\ v_{x+1} &= a_2 u_x + b_2 v_x + c_2 w_x + \ . \ . \ . \\ w_{x+1} &= a_3 u_x + b_3 v_x + c_3 w_x + \ . \ . \ . \\ &\text{\&c.} \end{aligned}\right\},$$

was found by the aid of indeterminate constants. The following is, perhaps, a simpler and more elegant method.

Writing these equations in the form

$$\left.\begin{array}{l}(a_1 - e^D)\,u_x + b_1 v_x + c_1 w_x + \ldots = 0 \\ a_2 u_x + (b_2 - e^D)\,v_x + c_2 w_x + \ldots = 0 \\ a_3 u_x + b_3 v_x + (c_3 - e^D)\,w_x + \ldots = 0 \\ \text{\&c.}\end{array}\right\},$$

and remembering that the symbol e^D is commutative with constants, we get as the result for u_x, the determinant

$$\left\{\begin{array}{llll} a_1 - e^D, & b_1, & c_1, & \text{\&c.} \\ a_2, & b_2 - e^D, & c_2, & \text{\&c.} \\ a_3, & b_3, & c_3 - e^D, & \text{\&c.} \\ \multicolumn{4}{c}{\text{\&c., \&c.}}\end{array}\right\} . u_x = 0,$$

the first term of which is, of course,

$$(a_1 - e^D)\,(b_2 - e^D)\,(c_3 - e^D) \ldots u_x.$$

Consequently, the result is an equation of the form

$$u_{x+n} + \alpha u_{x+n-1} + \beta u_{x+n-2} + \text{\&c.} + \sigma u_x = 0,$$

where α, β, γ, &c., σ, are constants; and if the roots of the correspondent symbolic equation be, as before, k_1, k_2, k_3, &c., the value of u_x is, as stated,

$$u_x = C_1 k_1^x + C_2 k_2^x + C_3 k_3^x + \text{\&c.}$$

3. If the system of equations to be solved had been

$$\left.\begin{array}{l}\Delta . u_x = a_1 u_x + b_1 v_x + c_1 w_x + \ldots \\ \Delta . v_x = a_2 u_x + b_2 v_x + c_2 w_x + \ldots \\ \Delta . w_x = a_3 u_x + b_3 v_x + c_3 w_x + \ldots \\ \text{\&c.}\end{array}\right\},$$

it is evident that the solution required will be had by simply substituting in the results of the previous article $(a_1 + 1)$, $(b_2 + 1)$, $(c_3 + 1)$, &c., for a_1, b_2, c_3, &c., respectively.

EXAMPLES.

(1.) Thus, if it be required to solve the system of two equations

$$\left.\begin{array}{l}\Delta . u_x = a_1 u_x + b_1 v_x \\ \Delta . v_x = a_2 u_x + b_2 v_x\end{array}\right\},$$

we have, at once,

$$u_x = C_1 m_1^x + C_2 m_2^x,$$

$$v_x = C_1 \left(\frac{m_1 - a_1 - 1}{b_1}\right) m_1^x + C_2 \left(\frac{m_2 - a_1 - 1}{b_1}\right) m_2^x,$$

where m_1, m_2 are the roots of the equation

$$(m - a_1 - 1)(m - b_2 - 1) = b_1 a_2.$$

(2.) Again, if it be required to solve the system of three simultaneous equations

$$\left.\begin{aligned} \Delta . u_x &= b_1 v_x + c_1 w_x \\ \Delta . v_x &= a_2 u_x + c_2 w_x \\ \Delta . w_x &= a_3 u_x + b_3 v_x \end{aligned}\right\},$$

we have for the result sought

$$\left.\begin{aligned} u_x &= C_1 m_1^x + C_2 m_2^x + C_3 m_3^x \\ v_x &= D_1 m_1^x + D_2 m_2^x + D_3 m_3^x \\ w_x &= E_1 m_1^x + E_2 m_2^x + E_3 m_3^x \end{aligned}\right\},$$

where m_1, m_2, m_3 are the roots of the cubic equation obtained by the elimination of λ, μ, ν, between the equations

$$\left.\begin{aligned} a_2\mu + a_3\nu &= (m-1)\lambda \\ b_1\lambda + b_3\nu &= (m-1)\mu \\ c_1\lambda + c_2\mu &= (m-1)\nu \end{aligned}\right\},$$

or,

$$(m-1)^3 - (b_1a_2 + c_1a_3 + c_2b_3)(m-1) - (c_2b_1a_3 + c_1a_2b_3) = 0.$$

It will be observed that the form in which, in the correlative example, D_1, E_1, &c., are expressed in terms of C_1, C_2, C_3, remains unaffected, as it should.

4. It is plain that we may employ a method similar to that just given, for the solution of the system of simultaneous equations in finite differences of the n^{th} order,

$$\left.\begin{aligned} u_{x+n} &= a_1 u_x + b_1 v_x + c_1 w_x + \ldots \\ v_{x+n} &= a_2 u_x + b_2 v_x + c_2 w_x + \ldots \\ w_{x+n} &= a_3 u_x + b_3 v_x + c_3 w_x + \ldots \\ &\text{\&c.} \end{aligned}\right\},$$

The reduct equation is, in this case,

$$e^{nD} . (\lambda u_x + \mu v_x + \nu w_x + \ldots) = k^n (\lambda u_x + \mu v_x + \nu w_x + \ldots),$$

the equations of condition being

$$\left.\begin{aligned} a_1\lambda + a_2\mu + a_3\nu + \ldots &= k^n\lambda \\ b_1\lambda + b_2\mu + b_3\nu + \ldots &= k^n\mu \\ c_1\lambda + c_2\mu + c_3\nu + \ldots &= k^n\nu \\ &\text{\&c.} \end{aligned}\right\},$$

and the solution of the reduct equation is, if α, α', α'', &c., be the n several roots of unity,

$$\lambda u_x + \mu v_x + \nu w_x + \ldots = C(\alpha k)^x + C'(\alpha' k)^x + C''(\alpha'' k)^x \ldots$$

5. In the same manner, if the system of equations to be solved had been

$$\left.\begin{aligned} \Delta^n . u_x &= a_1 u_x + b_1 v_x + c_1 w_x + \ldots \\ \Delta^n . v_x &= a_2 u_x + b_2 v_x + c_2 w_x + \ldots \\ \Delta^n . w_x &= a_3 u_x + b_3 v_x + c_3 w_x + \ldots \\ &\text{\&c.} \end{aligned}\right\},$$

we should have for the reduct equation

$$\Delta^n . (\lambda u_x + \mu v_x + \nu w_x + \ldots) = k^n (\lambda u_x + \mu v_x + \nu w_x + \ldots),$$

the solution of which is, α, α', α'', &c., being, as before, the n several roots of unity,

$$\lambda u_x + \mu v_x + \nu w_x + \ldots = C(\alpha k + 1)^x + C'(\alpha' k + 1)^x + C''(\alpha'' k + 1)^x + \ldots$$

EXAMPLES.

(1.) Let it be proposed to solve the system of the second order

$$\left.\begin{aligned} u_{x+2} &= b_1 v_x + c_1 w_x \\ v_{x+2} &= a_2 u_x + c_2 w_x \\ w_{x+2} &= a_3 u_x + b_3 v_x \end{aligned}\right\}.$$

The equations of condition in this case are

$$\left.\begin{aligned} a_2\mu + a_3\nu &= k^2\lambda \\ b_1\lambda + b_3\nu &= k^2\mu \\ c_1\lambda + c_2\mu &= k^2\nu \end{aligned}\right\};$$

the reduct equation

$$e^{\partial D} . (\lambda u_x + \mu v_x + \nu w_x) = k^2 (\lambda u_x + \mu v_x + \nu w_x);$$

the solution of this equation,

$$\lambda u_x + \mu v_x + \nu w_x = Ck^x + C'(-k)^x;$$

while the equation to determine k is

$$k^6 - (b_1 a_2 + c_1 a_3 + c_2 b_3) k^2 - (c_2 b_1 a_3 + c_1 a_2 b_3) = 0.$$

(2.) If it be proposed to solve the system

$$\left.\begin{aligned} \Delta^2 . u_x &= b_1 v_x + c_1 w_x \\ \Delta^2 . v_x &= a_2 u_x + c_2 w_x \\ \Delta_2 . w_x &= a_3 u_x + b_3 v_x \end{aligned}\right\},$$

we have, for the reduct equation,

$$\Delta^2 . (\lambda u_x + \mu v_x + \nu w_x) = k^2 (\lambda u_x + \mu v_x + \nu w_x);$$

for the solution of this equation

$$\lambda u_x + \mu v_x + \nu w_x = C(1+k)^x + C'(1-k)^x;$$

while k is determined by the same equation as in the last example.

As this equation is of the sixth degree, it might be supposed that the complete solution of the problem should consist of six equations, each involving two arbitrary constants. It will be observed, however, that since the roots of the equation in k are of the form

$$\pm k_1, \qquad \pm k_2, \qquad \pm k_3,$$

and λ, μ, ν depend only on k^2, these six equations, each of which is of the shape, in the former case

$$\lambda u_x + \mu v_x + \nu w_x = Ck^x + C'(-k)^x,$$

and in the latter case,

$$\lambda u_x + \mu v_x + \nu w_x = C(1+k)^x + C'(1-k)^x,$$

are reducible to three, and there are not virtually more than six arbitrary constants. These constants are, in general, to be determined by given values of u_x, v_x, w_x, u_{x+1}, v_{x+1}, w_{x+1}, corresponding to a given value of x.

6. If the system of simultaneous equations, proposed for solution, were given in the form,

$$\left.\begin{aligned} a_1 u_{x+n} + b_1 v_{x+n} + c_1 w_{x+n} + \ldots &= u_x \\ a_2 u_{x+n} + b_2 v_{x+n} + c_2 w_{x+n} + \ldots &= v_x \\ a_3 u_{x+n} + b_3 v_{x+n} + c_3 w_{x+n} + \ldots &= w_x \\ \&c. \end{aligned}\right\},$$

or, in the correlative form,

$$\left.\begin{aligned} a_1 \Delta^n u_x + b_1 \Delta^n v_x + c_1 \Delta^n w_x + \ldots &= u_x \\ a_2 \Delta^n u_x + b_2 \Delta^n v_x + c_2 \Delta^n w_x + \ldots &= v_x \\ a_3 \Delta^n u_x + b_3 \Delta^n v_x + c_3 \Delta^n w_x + \ldots &= w_x \\ \&c. \end{aligned}\right\},$$

the first equation being multiplied by λ, the second by μ, the third by ν, &c., and all being added together, subject to the conditions

$$\left.\begin{aligned} a_1\lambda + a_2\mu + a_3\nu + \ldots &= \frac{\lambda}{k^n} \\ b_1\lambda + b_2\mu + b_3\nu + \ldots &= \frac{\mu}{k^n} \\ c_1\lambda + c_2\mu + c_3\nu + \ldots &= k^n \\ \&c. & \end{aligned}\right\},$$

we get for the reduct equation, in the former case,

$$e^{nD}.(\lambda u_x + \mu v_x + \nu w_x + \ldots) = k^n(\lambda u_x + \mu v_x + \nu w_x + \ldots),$$

and, in the latter case,

$$\Delta^n.(\lambda u_x + \mu v_x + \nu w_x + \ldots) = k^n(\lambda u_x + \mu v_x + \nu w_x + \ldots);$$

the corresponding solutions being, in the former case,

$$\lambda u_x + \mu v_x + \nu w_x + \ldots = C(\alpha k)^x + C'(\alpha' k)^x + C''(\alpha'' k)^x + \ldots,$$

and, in the latter case,

$$\lambda u_x + \mu v_x + \nu w_x + \ldots = C(\alpha k + 1)^x + C'(\alpha' k + 1)^x + C''(\alpha'' k + 1)^x + \ldots$$

It should be noticed that the values of the constants and of the several roots of the equation in k are, of course, wholly different from those occurring in the previous article, in which a notation similar to that just used was employed.

7. If the system of equations to be solved were of the form

$$\left.\begin{aligned} \Delta.u_x &= a_1u_x + b_1v_x + c_1w_x + \ldots + f_1(x) \\ \Delta.v_x &= a_2u_x + b_2v_x + c_2w_x + \ldots + f_2(x) \\ \Delta.w_x &= a_3u_x + b_3v_x + c_3w_x + \ldots + f_3(x) \\ &\&c. \end{aligned}\right\},$$

where f_1, f_2, f_3, &c., are given algebraic functions,—proceeding as before, and with the same system of conditions, we obtain the equation

$$\Delta(\lambda u_x + \mu v_x + \&c.) = k(\lambda u_x + \mu v_x + \&c.) + (\lambda f_1 + \mu f_2 + \&c.),$$

or

$$(\Delta - k).(\lambda u_x + \mu v_x + \nu w_x + \&c.) = \lambda f_1 + \mu f_2 + \nu f_3 + \&c. = F(x),$$

the solution of which is, in its primary symbolic form,

$$\lambda u_x + \mu v_x + \nu w_x + \&c. = (\Delta - k)^{-1}.F(x) + (\Delta - k)^{-1}.0,$$

or, in its semi-evaluated form, supposing, for simplicity, that F only contains positive integer values of x,

$$\lambda u_x + \mu v_x + \nu w_x + \&c. = -\frac{1}{k}\left(1 + \frac{\Delta}{k} + \frac{\Delta^2}{k^2} + \&c.\right) . F(x) + Ck^x.$$

The operations indicated by the symbols Δ, Δ^2, &c., being performed, the complete solution, in its primary type, is obtained, it being observed that λ, μ, ν, &c., enter linearly in the right-hand member.

A corresponding method of solution, of course, will apply to such a system of equations as

$$\left.\begin{aligned} u_{x+1} &= a_1 u_x + b_1 v_x + c_1 w_x + \ldots + f_1(x) \\ v_{x+1} &= a_2 u_x + b_2 v_x + c_2 w_x + \ldots + f_2(x) \\ w_{x+1} &= a_3 u_x + b_3 v_x + c_3 w_x + \ldots + f_3(x) \\ &\&c. \end{aligned}\right\},$$

or we may, in some cases with advantage, employ an extension of the method stated in the second article.

8. If the system of equations proposed for solution were of the form

$$\left.\begin{aligned} \Phi(\Delta) . u_x + \Psi(\Delta) . v_x &= F_1(x) \\ \Phi(\Delta) . v_x - \Psi(\Delta) . u_x &= F_2(x) \end{aligned}\right\},$$

where F_1 and F_2 are given functions of x, we may proceed in the following manner.

Operating upon the first equation with $\Phi(\Delta)$, and making substitution from the second equation, we get

$$\Phi(\Delta)^2 . u_x + \Psi(\Delta)^2 . u_x = \Phi(\Delta) . F_1(x) - \Psi(\Delta) . F_2(x).$$

The operations susceptible of execution being performed, this equation is obviously reducible to the form

$$\{\Phi(\Delta)^2 . + \Psi(\Delta)^2 .\} u_x = F_3(x),$$

in which there is now but a single unknown function.

This last equation, in general, admits of solution, and the value of u_x being found, that of v_x is obtained by substitution in either of the given equations.

A mode of solution precisely similar will apply to the system correlative to the above, namely,

$$\left.\begin{aligned} (a_0 u_x + a_1 u_{x+1} + a_2 u_{x+2} + \ldots + a_n u_{x+n}) + (b_0 v_x + b_1 v_{x+1} + b_2 v_{x+2} + \ldots + b_m v_{x+m}) &= F_1(x) \\ (a_0 v_x + a_1 v_{x+1} + a_2 v_{x+2} + \ldots + a_n v_{x+n}) - (b_0 u_x + b_1 u_{x+1} + b_2 u_{x+2} + \ldots + b_m u_{x+m}) &= F_2(x) \end{aligned}\right\}$$

or

$$\left.\begin{aligned} \Phi(e^D) . u_x + \Psi(e^D) . v_x &= F_1(x) \\ \Phi(e^D) . v_x - \Psi(e^D) . u_x &= F_2(x) \end{aligned}\right\},$$

the equations being written in their condensed symbolic form.

EXAMPLES.

(1.) Let the system proposed for solution be

$$\left.\begin{aligned}(a_0u_x + a_2u_{x+2} + a_4u_{x+4}) + (a_1v_{x+1} + a_3v_{x+3}) &= m\alpha^x\\ (a_0v_x + a_2v_{x+2} + a_4v_{x+4}) - (a_1u_{x+1} + a_3u_{x+3}) &= n\beta^x\end{aligned}\right\}.$$

The reduct equation is in this case

$$(a_0 + a_2e^{2D} + a_4e^{4D})^2 . u_x + (a_1e^D + a_3e^{3D})^2 . u_x = m\left(a_0 + a_2\alpha^2 + a_4\alpha^4\right)\alpha^x - n\left(a_1\beta + a_3\beta^3\right)\beta^x,$$

which, as is readily seen, may be written in the shape

$$\mathrm{F}\left(e^{2D}\right) . u_x = A\alpha^x - B\beta^x,$$

where F is a biquadratic of given form, in which the coefficient of the highest term has been reduced to unity.

The solution of this equation is, omitting the arbitrary portion,

$$u_x = \frac{A}{\mathrm{F}(\alpha^2)} . \alpha^x - \frac{B}{\mathrm{F}(\beta^2)} . \beta^x,$$

and the arbitrary portion of the solution, itself, is

$$\begin{aligned}&C_1k_1^x + C'_1(-k_1)^x + C_2k_2^x + C'_2(-k_2)^x\\ &\qquad +\\ &C_3k_3^x + C'_3(-k_3)^x + C_4k_4^x + C'_4(-k_4)^x,\end{aligned}$$

if the roots of the biquadratic $\mathrm{F}(k^2) = 0$ be supposed to be

$$k_1^2, \qquad k_2^2, \qquad k_3^2, \qquad k_4^2.$$

The value of u_x being thus found, the value of v_x is had by simple substitution in either of the given equations, and the mode of determination of the arbitrary constants may be easily deduced from the previous articles.

(2.) If the system of equations proposed for solution were

$$\left.\begin{aligned}(a_0u_x + a_2\Delta^2u_x + a_4\Delta^4u_x) + (a_1\Delta v_x + a_3\Delta^3v_x) &= m\alpha^x\\ (a_0v_x + a_2\Delta^2v_x + a_4\Delta^4v_x) - (a_1\Delta u_x + a_3\Delta^3u_x) &= n\beta^x\end{aligned}\right\},$$

we should have for the reduct equation

$$\mathrm{F}\left(\Delta^2\right) u_x = A'\alpha^x - B'\beta^x,$$

the solution of which is, omitting as before the arbitrary portion,

$$u_x = \frac{A'}{\mathrm{F}\{(\alpha-1)^2\}}\alpha^x - \frac{B'}{\mathrm{F}\{(\beta-1)^2\}}\beta^x,$$

and the arbitrary portion is

$$C_1(1+k_1)^x + C'_1(1-k_1)^x + C_2(1+k_2)^x + C'_2(1-k_2)^x + C_3(1+k_3)^x + C'_3(1-k_3)^x + C_4(1+k_4)^x + C'_4(1-k_4)^x.$$

9. Let the system proposed for solution be

$$\left.\begin{aligned} u_{x+2} &= a_1 u_x + b_1 v_x + c_1 \\ v_{x+2} &= a_2 u_x + b_2 v_x + c_2 \end{aligned}\right\}.$$

Proceeding as above, we obtain

$$\theta^{2D}.(\lambda u_x + \mu v_x) = k^2(\lambda u_x + \mu v_x) + \lambda c_1 + \mu c_2,$$

whence, at once, result the two equations for the determination of u_x and v_x, namely,

$$\left.\begin{aligned} \lambda u_x + \mu v_x &= C_1 k_1^x + C'_1(-k_1)^x + \frac{\lambda c_1 + \mu c_2}{1-k_1^2} \\ \lambda' u_x + \mu' v_x &= C_2 k_2^x + C'_2(-k_2)^x + \frac{\lambda' c_1 + \mu' c_2}{1-k_2^2} \end{aligned}\right\}$$

the equation in k being, as before,

$$(k^2 - a_1)(k^2 - b_2) = b_1 a_2.$$

Hence,

$$u_x = \frac{c_1(1-b_2) + b_1 c_2}{(1-a_1)(1-b_2) - b_1 a_2} + D_1 k_1^x + D'_1(-k_1)^x + D_2 k_2^x + D'_2(-k_2)^x,$$

$$v_x = \frac{c_2(1-a_1) + a_2 c_1}{1-a_1.1-b_1-b_1 a_2} + \frac{k_1^2 - a_1}{b_1}\{D_1 k_1^x + D'_1(-k_1)^x\} + \frac{k_2^2 - a_1}{b_1}\{D_2 k_2^x + D'_2(-k_2)^x\}.$$

10. As the values of the constants a_1, b_1, c_1, &c., are supposed to be given by observation, and are therefore liable to certain small errors, it may be worth while to consider what corrections should be introduced, if these constants should become, respectively, $a_1 + \delta a_1$, $b_1 + \delta b_1$, $c_1 + \delta c_1$, &c.

It is obvious that, as the roots of the equation in k depend on the values of the constants stated, these roots will receive certain increments, which may be, for convenience, respectively denominated by the expressions δk_1, δk_2, δk_3, &c.

Thus in the second example, quoted under the first article, the value of u_x will become

$$u_x = C_1(k_1 + \delta k_1)^x + C_2(k_2 + \delta k_2)^x + C_3(k_3 + \delta k_3)^x,$$

or, since δk_1, δk_2, δk_3, are very small quantities,

$$u_x = C_1(k_1^x + xk_1^{x-1}\delta k_1) + C_2(k_2 + xk_2^{x-1}\delta k_2) + C_3(k_3 + xk_3^{x-1}\delta k_3),$$

or,

$$u_x = (C_1k_1^x + C_2k_2^x + C_3k_3^x) + x(C_1k_1^{x-1}\delta k_1 + C_2k_2^{x-1}\delta k_2 + C_3k_3^{x-1}\delta k_3).$$

There is no difficulty in determining the corresponding corrections to be made on the values of v_x and w_x.

As regards the method exhibited in this section, it may be allowed to state that it is precisely similar to that employed for the solution of systems of simultaneous differential equations, and, as I believe, for the first time published in a treatise on the "Calculus of Operations," in the year 1855.

Postscript.—Upon communicating some of the results contained in this section to the Rev. Dr. Lloyd, with a view to the suggestion by him of some physical applications, if such existed, I received from him a statement of his views, which it is right to lay before the Academy. He points out how, in the present position of physics, the conditions of the problems discussed are, in general, first treated with respect to some one predominant element, and then the other elements taken up and dealt with as residual phenomena, or disturbing causes. Dr. Lloyd states his belief that any attempt to apply a more rigorous method (in which all the elements are simultaneously taken into account) would fail, in consequence of the large errors, which the errors of the observed results would entail, in the process of elimination. Professor Haughton has expressed his coincidence in this view. As a matter of course, I defer to the opinions expressed by physicists so justly distinguished as these gentlemen, and put forward the methods contained in this paper simply for their mathematical value, whatever that may be. One remark only I would venture to offer. Is it not possible that we may yet be enabled to state, by such systems of equations, the conditions of phenomena which depend on the simultaneous action of heterogeneous laws: for instance, those of heat, electric action, and chemical affinity, supposing for a moment the division of these agencies to be logically just? The geometrical illustration proposed in the first article would possibly give some reason to hope that this calculus of finite differences may yet be made more ancillary to physical research than it hitherto has been.

The Secretary read the following letter from the Right Hon. Edward Cardwell, addressed to the President:—

"*Dublin Castle, 22nd October*, 1859.

"Sir,—In reference to your letter of the 17th ultimo, I am directed by the Lord Lieutenant to acquaint you, that the Lords Commissioners of Her Majesty's Treasury have been pleased to sanction a grant of two hundred pounds in aid of the completion of a Catalogue of the Museum of the Royal Irish Academy.

"Their Lordships have given the necessary authority to the Paymaster of Civil Services for the issue of the above-mentioned sum.

"I am, Sir, your obedient servant,

(Signed) "EDWARD CARDWELL.

"*Rev. James Henthorn Todd, D. D.,*
"*President of the Royal Irish Academy.*"

Moved by the Rev. Charles Graves, D. D., seconded by the Rev. J. Carson, D. D., and—

RESOLVED,—That the President of the Academy be requested to convey to His Excellency the Lord Lieutenant the marked thanks of the Academy, for having thus exerted his influence in its favour with the Lords Commissioners of Her Majesty's Treasury.

STATED MEETING, WEDNESDAY, NOVEMBER 30, 1859.

JAMES HENTHORN TODD, D. D., President, in the Chair.

The Rev. ROBERT CARMICHAEL, F. T. C. D., read the second part of a paper—

ON CERTAIN METHODS IN THE CALCULUS OF FINITE DIFFERENCES.

SECT. II.—*On the Application of the Calculus of Finite Differences to the Symbolical Reduction of certain Definite Integrals.*

THE theorems principally employed for the deductions of the results contained in the following section are two, fundamental in their character as regards the Calculus of Finite Differences, and easily proved, namely—

$$\mathrm{F}(e^{D_x}) \cdot m^x = \mathrm{F}(m) \cdot m^x, \qquad \text{(I.)}$$

and

$$\mathrm{F}(\Delta) \cdot m^x = \mathrm{F}(m-1) \cdot m^x, \qquad \text{(II.)}$$

where F is any algebraic function of the quantity it contains, m any constant, and Δ the ordinary symbol of this Calculus.

1. By the first theorem, if we were required to determine the value of any definite integral of the form

$$\int_{x_1}^{x_2} \mathrm{F}(x)\, x^a dx,$$

we see that this integral is instantly reducible to the symbolic shape

$$\int_{x_1}^{x_2} \mathrm{F}(e^{D_a})\, x^a dx;$$

and if the quantity a be supposed to be independent of the limits of the integral x_1, x_2, transferring, as is legitimate, the symbolic operator outside the sign of integration, we have, as the symbolic result, simply

$$\mathrm{F}(e^{D_a}) \cdot \left(\frac{x_2^{a+1} - x_1^{a+1}}{a+1} \right),$$

the further evaluation of which will depend upon the particular form of the given function F. The result now obtained admits of ready verification by the substitution for $\mathrm{F}(x)$, $\mathrm{F}(e^{D_a})$, of their equivalents, derived from the formula

$$\mathrm{F}(u) = \mathrm{F}(0) + \mathrm{F}'(0) \cdot \frac{u}{1} + \mathrm{F}''(0) \cdot \frac{u^2}{1.2} + \mathrm{F}'''(0) \cdot \frac{u^3}{1.2.3} + \&c.,$$

and its value consists in the circumstance that the question proposed has now become reduced to the mechanical working out of the product of a known operation, upon a simple known subject, that operation proceeding according to a known and practical method.

2. Similarly, if we were required to determine the value of a definite integral of the form,

$$\int_{x_1}^{x_2} \mathrm{F}(x-1)\, x^a dx,$$

the value of a being, as before, independent of the limits of the integral, we have, as our symbolic result, in the first instance,

$$\mathrm{F}(\Delta_a) \cdot \left(\frac{x_2^{a+1} - x_1^{a+1}}{a+1} \right)$$

(the suffix to the symbol Δ being employed to denote that this symbol is understood to operate only upon a), and the further evaluation, as before, simply depends upon the particular form of the given function F.

3. More generally, if we were required to determine the value of any definite integral of the form

$$\int_{x_1}^{x_2} \int_{y_1}^{y_2} \mathrm{F}_1(x)\, \mathrm{F}_2(y)\, x^a y^\beta dx\, dy,$$

wherein the quantities a, β, are supposed to be independent of the limits and of each other, we see that this integral is equivalent to

$$\mathrm{F}_1(e^{D_a})\, \mathrm{F}_2(e^{D_\beta}) \cdot \int_{x_1}^{x_2} \int_{y_1}^{y_2} x^a y^\beta dx\, dy,$$

or

$$\mathrm{F}_1(e^{D_a})\, \mathrm{F}_2(e^{D_\beta}) \cdot \frac{1}{\beta+1} \int_{x_1}^{x_2} x^a \left(y_2^{\beta+1} - y_1^{\beta+1} \right) dx :$$

and if, for simplicity, the equations of the *limiting curves* be written in the form

$$y_2^{\beta+1} = f_2(x), \qquad y_1^{\beta+1} = f_1(x),$$

the final symbolical value of the given integral is

$$\mathrm{F}_1(e^{D_a})\, \mathrm{F}_2(e^{D_\beta}) \cdot \frac{1}{\beta+1} \left\{ f_2(e^{D_a}) - f_1(e^{D_a}) \right\} \cdot \left(\frac{x_2^{a+1} - x_1^{a+1}}{a+1} \right),$$

and the complete evaluation now depends, in general, solely on the particular values of the given functions F_1, F_2, f_1, f_2.

4. Similarly, if it were proposed to determine the value of a definite integral of the form

$$\int_{x_1}^{x_2} \int_{y_1}^{y_2} \mathrm{F}_1(x-1)\, \mathrm{F}_2(y-1)\, x^a y^\beta dx dy,$$

wherein the quantities a, β, are supposed to be independent of the limits and of each other, we see that this integral is equivalent to

$$\mathrm{F}_1(\Delta_a) \cdot \mathrm{F}_2(\Delta_\beta) \cdot \int_{x_1}^{x_2} \int_{y_1}^{y_2} x^a y^\beta dx dy,$$

or, with the same limiting curves as before,

$$\mathrm{F}_1(\Delta_a)\, \mathrm{F}_2(\Delta_\beta) \cdot \frac{1}{\beta+1} \left\{ f_2(e^{D_a}) - f_1(e^{D_a}) \right\} \cdot \left(\frac{x_2^{a+1} - x_1^{a+1}}{a+1} \right);$$

and, as before, the complete evaluation of this symbolic form depends, in general, solely on the particular values of the given functions, F_1, F_2, f_1, f_2.

5. The results obtained in the preceding articles may be still further generalized. In fact, if the quantities α, β, γ, &c., be supposed to be independent of the limits and of each other, it is evident that we may write the multiple definite integral

$$\int_{x_1}^{x_2}\int_{y_1}^{y_2}\int_{z_1}^{z_2} \ldots F_1(x)\, F_2(y)\, F_3(z) \ldots x^\alpha y^\beta z^\gamma \ldots dx\, dy\, dz \ldots$$

in the form

$$F_1(e^{D_\alpha})\, F_2(e^{D_\beta})\, F_3(e^{D_\gamma}) \ldots \int_{x_1}^{x_2}\int_{y_1}^{y_2}\int_{z_1}^{z_2} x^\alpha y^\beta z^\gamma \ldots dx\, dy\, dz \ldots,$$

and then, solving the simpler integral, proceed to evaluate this result when operated upon by the symbolic factor to the left hand of the expression just obtained.

In the same manner, the multiple definite integral

$$\int_{x_1}^{x_2}\int_{y_1}^{y_2}\int_{z_1}^{z_2} \ldots F_1(x-1)\, F_2(y-1)\, F_3(z-1) \ldots x^\alpha y^\beta z^\gamma \ldots dx\, dy\, dz \ldots$$

is seen to be equivalent to

$$F_1(\Delta_\alpha)\, F_2(\Delta_\beta)\, F_3(\Delta_\gamma) \ldots \int_{x_1}^{x_2}\int_{y_1}^{y_2}\int_{z_1}^{z_2} \ldots x^\alpha y^\beta z^\gamma \ldots dx\, dy\, dz \ldots,$$

and the proposed question is reduced, as before, to the determination of the value of a simpler integral, and the deduction of the expression resulting from the operation upon this value, by the symbolic factor to the left hand of the formula last written down.

6. Since, as is easily seen,

$$e^{D_x + D_y} \cdot m^x n^y = mn \cdot m^x n^y,$$

we have, by successive operation,

$$e^{p(D_x + D_y)} \cdot m^x n^y = (mn)^p \cdot m^x n^y.$$

Hence, in general, if F be any algebraic function,

$$F(e^{D_x + D_y}) \cdot m^x n^y = F(mn) \cdot m^x n^y.$$

By the aid of this theorem, we see that we are readily furnished with means for the reduction and simplification of certain other species of definite integrals.

Thus the same suppositions as before being made with respect to α, β, it appears that the definite integral

$$\int_{x_1}^{x_2}\int_{y_1}^{y_2} F(xy)\, x^\alpha y^\beta\, dx\, dy = F(e^{D_\alpha + D_\beta}) \cdot \int_{x_1}^{x_2}\int_{y_1}^{y_2} x^\alpha y^\beta\, dx\, dy,$$

and, again, the definite integral

$$\int_{x_1}^{x_2}\int_{y_1}^{y_2} \mathrm{F}\,(\overline{x-1}\,.\,\overline{y-1})\,x^{\alpha}y^{\beta}\,dx\,dy = \mathrm{F}\,(\Delta_{\alpha}.\Delta_{\beta})\int_{x_1}^{x_2}\int_{y_1}^{y_2} x^{\alpha}y^{\beta}\,dx\,dy:$$

or, more generally, that the multiple definite integrals

$$\int_{x_1}^{x_2}\int_{y_1}^{y_2}\int_{z_1}^{z_2}\ldots \mathrm{F}\,(xyz\ldots)\,.\,x^{\alpha}y^{\beta}z^{\gamma}\ldots\,dx\,dy\,dz\ldots$$

and

$$\int_{x_1}^{x_2}\int_{y_1}^{y_2}\int_{z_1}^{z_2}\ldots \mathrm{F}\,(\overline{x-1}\,.\,\overline{y-1}\,.\,\overline{z-1}\ldots.)\,.\,x^{\alpha}y^{\beta}z^{\gamma}\ldots\,dx\,dy\,dz\ldots$$

may be reduced, respectively, to the simpler symbolic forms

$$\mathrm{F}\,(e^{D_{\alpha}+D_{\beta}+D_{\gamma}+\cdots})\,.\int_{x_1}^{x_2}\int_{y_1}^{y_2}\int_{z_1}^{z_2}\ldots x^{\alpha}y^{\beta}z^{\gamma}\ldots\,dx\,dy\,dz\ldots$$

and

$$\mathrm{F}\,(\Delta_{\alpha}\,.\,\Delta_{\beta}\,.\,\Delta_{\gamma}\ldots)\int_{x_1}^{x_2}\int_{y_1}^{y_2}\int_{z_1}^{z_2}\ldots x^{\alpha}y^{\beta}z^{\gamma}\ldots\,dx\,dy\,dz\ldots$$

7. Again, it appears from considerations suggested in the last article, that the definite integral

$$\int_{x_1}^{x_2}\int_{y_1}^{y_2}\mathrm{F}\left(\frac{x}{y}\right).\,x^{\alpha}y^{\beta}\,dx\,dy = \mathrm{F}\,(e^{D_{\alpha}-D_{\beta}})\,.\int_{x_1}^{x_2}\int_{y_1}^{y_2}x^{\alpha}y^{\beta}\,dx\,dy,$$

and the definite integral

$$\int_{x_1}^{x_2}\int_{y_1}^{y_2}\mathrm{F}\left(\frac{x-1}{y-1}\right).\,x^{\alpha}y^{\beta}\,dx\,dy = \mathrm{F}\left(\frac{\Delta_{\alpha}}{\Delta_{\beta}}\right).\int_{x_1}^{x_2}\int_{y_1}^{y_2}x^{\alpha}y^{\beta}\,dx\,dy;$$

or, more generally, that the definite integral of the fourth order

$$\int_{x_1}^{x_2}\int_{y_1}^{y_2}\int_{z_1}^{z_2}\int_{w_1}^{w_2}\mathrm{F}\left(\frac{xz}{yw}\right)x^{\alpha}y^{\beta}z^{\gamma}w^{\delta}\,dx\,dy\,dz\,dw$$

may be reduced to the symbolic form

$$\mathrm{F}\,(e^{D_{\alpha}+D_{\gamma}-(D_{\beta}+D_{\delta})})\,.\int_{x_1}^{x_2}\int_{y_1}^{y_2}\int_{z_1}^{z_2}\int_{w_1}^{w_2}x^{\alpha}y^{\beta}z^{\gamma}w^{\delta}\,dx\,dy\,dz\,dw,$$

and the corresponding definite integral

$$\int_{x_1}^{x_2}\int_{y_1}^{y_2}\int_{z}^{z_2}\int_{w_1}^{w_2}\mathrm{F}\left(\frac{x-1\,.\,z-1}{y-1\,.\,w-1}\right).\,x^{\alpha}y^{\beta}z^{\gamma}w^{\delta}\,dx\,dy\,dz\,dw$$

to the symbolic form

$$\mathrm{F}\left(\frac{\Delta_{\alpha}\,.\,\Delta_{\gamma}}{\Delta_{\beta}\,.\,\Delta_{\delta}}\right)\cdot\int_{x_1}^{x_2}\int_{y_1}^{y_2}\int_{z_1}^{z_2}\int_{w_1}^{w_2}x^{\alpha}y^{\beta}z^{\gamma}w^{\delta}\,dx\,dy\,dz\,dw.$$

EXAMPLES.

(1.)

$$\int_{x_1}^{x_2} (\log x)^n \cdot x^{a-1}\,dx = (D_a)^n \cdot \frac{x_2^a - x_1^a}{a}.$$

Hence, as a special case,

$$\int_0^1 (\log x)^n \cdot x^{a-1}dx = (D_a)^n \cdot \left(\frac{1}{a}\right).$$

(2.)

$$\int_{x_1}^{x_2} \frac{x^{a-1}dx}{(x-1)^n} = \Delta_a{}^{-n} \cdot \frac{x_2^a - x_1^a}{a} = \Sigma_a{}^n \cdot \frac{x_2^a - x_1^a}{a}.$$

Hence, as a special case,

$$\int_0^1 \frac{x^{a-1}dx}{(x-1)^n} = \Sigma_a{}^n \cdot \left(\frac{1}{a}\right).$$

(3.)

$$\int_{x_1}^{x_2} x^{p-1}(1-x)^{q-1}\,dx = (-1)^{q-1} \cdot \Delta_p{}^{q-1} \cdot \frac{x_2^p - x_1^p}{p}.$$

Hence, as a special case,

$$\int_0^1 x^{p-1}(1-x)^{q-1}\,dx = \mathbf{F}(p, q) = (-1)^{q-1} \cdot \Delta_p{}^{q-1} \cdot \left(\frac{1}{p}\right),$$

and, if q be any positive integer, we very easily derive for the value of the first Eulerian Integral, in this case,

$$\mathbf{F}(p,q) = \frac{1 \cdot 2 \cdot 3 \ldots (q-1)}{p(p+1)(p+2)\ldots(p+q-1)}.$$

(4.) Let it be proposed to reduce the integral, first discussed by Binet,

$$\int_0^1 \{(1+x)^{p-1}(1-x)^{q-1} + (1+x)^{q-1}(1-x)^{p-1}\}\,dx.$$

If, in our second fundamental theorem, we substitute $m+1$ for m, we obtain the theorem

$$\mathbf{F}(\Delta_a) \cdot (1+x)^a = \mathbf{F}(x) \cdot (1+x)^a,$$

a result, indeed, which could readily have been deduced directly.

Hence, it is easily seen that the integral proposed is equivalent to

$$(1-\Delta_p)^{q-1} \cdot \int_0^1 (1+x)^{p-1}\,dx + (1-\Delta_q)^{p-1} \cdot \int_0^1 (1+x)^{q-1}dx$$

or, finally,

$$(1-\Delta_p)^{q-1}\cdot\left(\frac{2^p-1}{p}\right)+(1-\Delta_q)^{p-1}\cdot\left(\frac{2^q-1}{q}\right).$$

For the evaluated result, Binet has obtained the very simple form

$$2^{p+q-1}\cdot \mathbf{F}\,(p,\,q).$$

(5.) To evaluate the integral

$$\int_0^1 (x^a-1)\,(1-x)^b dx$$

quoted by Haan from Lobatchewsky, *Mém. Kasan.* 1835.

It is obviously equivalent to

$$(-1)^b\Delta\,{}_a{}^b\cdot\left(\frac{1}{a+1}\right)+\int_0^1 (1-x)^b d\,(1-x),$$

or, at once, by a previous example,

$$\frac{1\,.\,2\,.\,3\,.\,.\,.\,.\,.\,\,b}{(a+1)\,(a+2)\,\ldots\,(a+b)}-\frac{1}{b+1}.$$

The form in which the value of this integral is given by Haan is, in the notation of Kramp,

$$1^{b/1}\left\{\frac{1^{a/1}}{2^{a+b/1}}-\frac{1}{2^{b/1}}\right\};$$

the law of this notation being expressed by the formula

$$x^{m/h}=x\,(x+n)\,(x+2n)\,.\,.\,.\,.\,(x+\overline{m-1}n).$$

(6.) It is a well-known theorem, due to M. Dirichlet, that if the variables x, y, z, &c., be connected by the condition

$$x+y+z+\&c.\,\angle 1,$$

then will the multiple definite integral

$$\iiint\ldots x^{l-1}y^{m-1}z^{n-1}\ldots dx\,dy\,dz\ldots=\frac{\Gamma(l)\,\Gamma(m)\,\Gamma(n)\ldots}{\Gamma(1+l+m+n+\ldots)}.$$

Hence it follows that, if Φ be any algebraic function, the symbolic reduct form of the result of the evaluation of the multiple definite integral (proposed for discussion, Moigno, *Leçons de Cal. Diff. et Int.*, tome ii., p. 265),

$$\iiint\ldots\Phi\,(x+y+z+\&c.)\cdot x^{l-1}y^{m-1}z^{n-1}\ldots dx\,dy\,dz\ldots$$

is simply

$$\Phi\,(e^{D_l}+e^{D_m}+e^{D_n}+\&c.)\cdot\frac{\Gamma(l)\,\Gamma(m)\,\Gamma(n)\ldots}{\Gamma(1+l+m+n+\ldots)}.$$

As a simple case, if the variables x and y be connected by the condition

$$x+y \angle 1$$

then will

$$\iint \Phi(x+y)x^{l-1}y^{m-1}\,dx\,dy = \Phi\left(e^{D_l}+e^{D_m}\right)\cdot\frac{\Gamma(l)\,.\,\Gamma(m)}{\Gamma(1+l+m)}.$$

It is obvious that, if the variables be connected by the same condition as before, and their number be p, we shall have for the result of the evaluation of the multiple definite integral

$$\iiint\ldots\Phi(x+y+z+\ldots-p)\,x^{l-1}y^{m-1}z^{n-1}\ldots dx\,dy\,dz\ldots,$$

in its symbolic reduct form, simply

$$\Phi(\Delta_l+\Delta_m+\Delta_n+\&c.)\cdot\frac{\Gamma(l)\,\Gamma(m)\,\Gamma(n)\ldots}{\Gamma(1+l+m+n+\ldots)}.$$

As a case of this last theorem, it appears that if the variables x and y be connected by the condition

$$x+y \angle 1,$$

then will

$$\iint \Phi(x+y-2)\,x^{l-1}y^{m-1}\,dx\,dy = \Phi(\Delta_l+\Delta_m)\cdot\frac{\Gamma(l)\,.\,\Gamma(m)}{\Gamma(1+l+m)}.$$

There is no difficulty in extending these results to the more complicated case in which the variables are connected by the condition

$$\left(\frac{x}{a}\right)^p+\left(\frac{y}{\beta}\right)^q+\left(\frac{z}{\gamma}\right)^r+\&c. \leqq 1.$$

(7.) It may readily be proved by the assumption $x^2=z$, that

$$\int_0^1 (1-x^2)^q x^{2a-1}\,dx = \tfrac{1}{2}\cdot\frac{1\,.\,2\,.\,3\,\ldots\,.\,q}{a\,(a+1)\,(a+2)\ldots(a+q)},$$

or, in the notation of Kramp,

$$\tfrac{1}{2}\cdot\frac{1^{q/1}\,.\,1^{a/1}}{a\,.\,1^{a+q/1}}.$$

In the same manner it may be proved that

$$\int_0^1 (1-x^2)^q x^{2a}\,dx = \frac{2\,.\,4\,.\,6\,\ldots\,.\,(2q)}{(2a+1)\,(2a+3)\ldots(2a+1+2q)}.$$

or, in the notation of Kramp,

$$\frac{2^{q/2}}{(2a+1)^{q+1/2}}.$$

SECT. III.—*On certain Analogous Theorems in the Differential Calculus and the Calculus of Finite Differences.*

1. It is a well-known theorem in the operational or symbolic department of the Differential Calculus, that if Φ be any algebraic function of the symbol it contains, and u any subject,

$$e^{-mx} \cdot \Phi(D) \cdot e^{mx} u = \Phi(D+m)\, u.$$

By the aid of this principle, Dr. Boole has established his very remarkable theorem, that *the equation*

$$u + p_1 \Phi(D)\, e^x u + p_2 \Phi(D)\, \Phi(D-1)\, e^{2x} u + \ldots + p_n \Phi(D)\, \Phi(D-1) \ldots \Phi(D-n+1)\, e^{nx} u = U$$

may be resolved into a system of equations of the form

$$u - q\, \Phi(D)\, e^x u = U,$$

the values of q being determined by the equation

$$q^n + p_1 q^{n-1} + p_2 q^{n-2} + \ldots + p_n = 0.$$

2. Similarly, in the Calculus of Finite Differences, we have the correlative primary theorems

$$a^{-x} \cdot \mathrm{F}(e^D) \cdot a^x u_x = \mathrm{F}(ae^D) \cdot u_x,$$

and

$$a^{-x} \cdot \mathrm{F}(\Delta) \cdot a^x u_x = \mathrm{F}(a\Delta + \overline{a-1}) \cdot u_x;$$

or, more generally,

$$a^{-mx} \cdot \mathrm{F}(e^D) \cdot a^{mx} u_x = \mathrm{F}(a^m e^D) \cdot u_x,$$

and

$$a^{-mx} \cdot \mathrm{F}(\Delta) \cdot a^{mx} u_x = \mathrm{F}\{a^m e^D + (a^m - 1)\} \cdot u_x;$$

each of which may be readily established inductively, and either of which may be deduced from the other.

The theorem in Finite Differences corresponding to that stated by Dr. Boole, and above quoted, is the following—(the reader being pleased to observe that the short symbolic general mode for writing an equation in Finite Differences, with constant coefficients, is

$$\Psi(e^D) \cdot u_x = U) —$$

The equation

$$u_x + p_1 \Phi(e^D)\, a^{mx} u_x + p_2 \Phi(e^D)\, \Phi(a^m e^D)\, a^{2mx} u_x + \ldots + p_n \Phi(e^D)\, \Phi(a^m e^D) \ldots \Phi(a^{-(n-1)m} e^D)\, a^{nmx} u_x = U$$

may be resolved into a system of equations of the form

$$u_x - q\,\Phi(e^D)\,a^{mx}u_x = U,$$

the values of q being determined, as before, by the equation

$$q^n + p_1 q^{n-1} + p_2 q^{n-2} + \ldots + p_n = 0.$$

3. Again, as regards solution by series, if a differential equation, given to be solved, admitted of reduction to the typical form

$$\mathrm{F}_o(xD)\,y + \mathrm{F}_n(xD)\,x^n y = \Sigma \mathrm{A} x^\alpha, \qquad (1)$$

where F_o, F_n are algebraic functions, and the order of the symbol xD is at least not lower in F_o than it is in F_n, we may proceed in the following manner.

Operating with the symbol $\mathrm{F}_o(xD)^{-1}$ upon both sides, we get

$$y + \frac{\mathrm{F}_n(xD)}{\mathrm{F}_o(xD)} \cdot x^n y = \Sigma \frac{\mathrm{A}x^\alpha}{\mathrm{F}_o(\alpha)} + \frac{1}{\mathrm{F}_o(xD)} \cdot 0;$$

or, if the roots of the equation $\mathrm{F}_o(p) = 0$ be supposed all real and unequal, and designated by α_1, α_2, α_3, &c.,

$$\left(1 + \frac{\mathrm{F}_n(xD)}{\mathrm{F}_o(xD)} x^n\right) y = \Sigma \frac{Ax^\alpha}{\mathrm{F}_o(\alpha)} + \Sigma \mathrm{C} x^\alpha.$$

Hence, at once,

$$y = \begin{cases} \Sigma \dfrac{\mathrm{A}}{\mathrm{F}_o(\alpha)} \left\{1 - \dfrac{\mathrm{F}_n(xD)}{\mathrm{F}_o(xD)} x^n + \dfrac{\mathrm{F}_n(xD)}{\mathrm{F}_o(xD)} x^n \cdot \dfrac{\mathrm{F}_n(xD)}{\mathrm{F}_o(xD)} x^n - \&c.\right\} x^\alpha \\ \qquad + \qquad (2 \\ \Sigma \mathrm{C} \left\{1 - \dfrac{\mathrm{F}_n(xD)}{\mathrm{F}_o(xD)} x^n + \dfrac{\mathrm{F}_n(xD)}{\mathrm{F}_o(xD)} x^n \cdot \dfrac{\mathrm{F}_n(xD)}{\mathrm{F}_o(xD)} x^n - \&c.\right\} x^\alpha; \end{cases}$$

or, finally,

$$y = \begin{cases} \Sigma \dfrac{\mathrm{A}x^\alpha}{\mathrm{F}_o(\alpha)} \left\{1 - \dfrac{\mathrm{F}_n(n+\alpha)}{\mathrm{F}_o(n+\alpha)} x^n + \dfrac{\mathrm{F}_n(2n+\alpha)}{\mathrm{F}_o(2n+\alpha)} \cdot \dfrac{\mathrm{F}_n(n+\alpha)}{\mathrm{F}_o(n+\alpha)} x^{2n} - \&c.\right\} \\ \qquad + \qquad (3) \\ \Sigma \mathrm{C} x^\alpha \left\{1 - \dfrac{\mathrm{F}_n(n+\alpha)}{\mathrm{F}_o(n+\alpha)} x^n + \dfrac{\mathrm{F}_n(2n+\alpha)}{\mathrm{F}_o(2n+\alpha)} \cdot \dfrac{\mathrm{F}_n(n+\alpha)}{\mathrm{F}_o(n+\alpha)} x^{2n} - \&c.\right\}. \end{cases}$$

Let the roots of the equation $\mathrm{F}_o(p) = 0$, be, as before,

$$a_1, a_2, a_3, \&c.,$$

and the roots of the equation $F_n(p) = 0$, be

$$\beta_1, \beta_2, \beta_3, \&c.$$

Then it is evident that if any one of the following relations, namely,

$$\begin{gathered} n + a = a_1, a_2, a_3, \&c., \\ 2n + a = a_1, a_2, a_3, \&c., \\ 3n + a = a_1, a_2, a_3, \&c., \\ \&c. \end{gathered}$$

should hold; or any one of the following,

$$\begin{gathered} n + a_1 = a_2, a_3, a_4, \&c.; \quad n + a_2 = a_1, a_3, \&c., \\ 2n + a_1 = a_2, a_3, a_4, \&c.; \quad 2n + a_2 = a_1, a_3, \&c., \\ 3n + a_1 = a_2, a_3, a_4, \&c.; \quad 3n + a_2 = a_1, a_3, \&c., \\ \&c., \end{gathered}$$

—in any of these cases, some of the terms in the above solution by series, become infinite, and therefore the corresponding equation ceases to be soluble by this method, if soluble at all.

On the other hand, if any one of the following relations, namely

$$\begin{gathered} n + a = \beta_1, \beta_2, \beta_3, \&c., \\ 2n + a = \beta_1, \beta_2, \beta_3, \&c., \\ 3n + a = \beta_1, \beta_2, \beta_3, \&c., \\ \&c., \end{gathered}$$

should hold; or any of the following:

$$\begin{gathered} n + a_1 = \beta_1, \beta_2, \beta_3, \&c.; \quad n + a_2 = \beta_1, \&c., \\ 2n + a_1 = \beta_1, \beta_2, \beta_3, \&c.; \quad 2n + a_2 = \beta_1, \&c., \\ 3n + a_1 = \beta_1, \beta_2, \beta_3, \&c.; \quad 3n + a_2 = \beta_1, \&c., \\ \&c., \qquad\qquad \&c.; \end{gathered}$$

then, in the former case, the series included within the first pair of brackets would become, in so far as the corresponding constituents are concerned, *terminate* (if the word may be employed in its participial sense); in the latter case, the series included within the second pair of brackets would become, to a like extent, terminate. It may be noticed here that when an equation is said to be integrable 'in finite terms,' the expression, as it stands, is somewhat ambiguous, but is intended to convey that the solution may be expressed in a determinate number of terms, as in contrast to an indefinite, though even converging series, or a series possibly reducible, but not yet reduced.

EXAMPLES.

By this method may be treated the equation first proposed for solution by Euler, but, since his time, more completely identified with the name of another German mathematician. The equation alluded to is that known as Pfaff's differential equation, recently discussed by Dr. Boole in his valuable work on Differential Equations, and which, as remarked by this latter distinguished author, includes all examples of the second order, which are susceptible of reduction to the binomial type. It is of the form

$$(a + a'x^n)\, x^2 D^2 u + (b + b'x^n)\, xDu + (c + c'x^n)\, u = X.$$

By the same method may be treated the still higher equation of the third order

$$(a + a'x^n)\, x^3 D^3 u + (b + b'x^n)\, x^2 D^2 u + (c + c'x^n)\, xDu + (d + d'x^n)\, u = X,$$

or, more generally, the differential equation of the r^{th} order,

$$(a + a'x^n)\, x^r D^r u + (b + b'x^n)\, x^{r-1} D^{r-1} u + \&c. + (k + k'x^n)\, u = X,$$

as is plain from observing that this last equation may be reduced to the form

$$(ax^r D^r + bx^{r-1} D^{r-1} + \&c. + k)\, u + x^n (a'x^r D^r + b'x^{r-1} D^{r-1} + \&c. + k')\, u = X,$$

or, transferring x^n to the right-hand side of the second operator,

$$\left.\begin{aligned} &\{axD(xD-1)\ldots(xD-r+1) + bxD(xD-1)\ldots(xD-r+2) + \&c.\}\, u \\ &\{a'(xD-n)(xD-n-1)\ldots(xD-\overline{n+r-1}) + b'(xD-n) \\ &\qquad \ldots(xD-\overline{n+r-2}) + \&c.\}\, x^n u \end{aligned}\right\} = X,$$

which is obviously of the required form.

It will suffice to exhibit the application of the method to Pfaff's equation. This plainly can be reduced to the form

$$(xD-\alpha_1)(xD-\alpha_2)\, u + k(xD-\beta_1)(xD-\beta_2)\, x^n u = \Sigma M x^m.$$

Hence at once we get

$$u + k\frac{(xD-\beta_1)(xD-\beta_2)}{(xD-\alpha_1)(xD-\alpha_2)}\, x^n u = \Sigma \frac{Mx^m}{(m-\alpha_1)(m-\alpha_2)} + A_1 x^{\alpha_1} + A_2 x^{\alpha_2},$$

or, finally, in full,

$$u = \left\{ \begin{array}{l} \Sigma \dfrac{Mx^m}{(m-a_1)(m-a_2)} \left\{ 1 - k \dfrac{(m+n-\beta_1)(m+n-\beta_2)}{(m+n-a_1)(m+n-a_2)} x^n \right. \\ \qquad \left. + k^2 \dfrac{(m+2n-\beta_1)(m+2n-\beta_2)(m+n-\beta_1)(m+n-\beta_2)}{(m+2n-a_1)(m+2n-a_2)(m+n-a_1)(m+n-a_2)} x^{2n} - \&c \right\} \\ \qquad + \\ A_1 x^{a_1} \left\{ 1 - k \dfrac{(a_1+n-\beta_1)(a_1+n-\beta_2)}{n(n+a_1-a_2)} x^n \right. \\ \qquad \left. + k^2 \dfrac{(a_1+2n-\beta_2)(a_1+2n-\beta_2)(a_1+n-\beta_1)(a_1+n-\beta_2)}{2n^2(2n+a_1-a_2)(n+a_1-a_2)} x^{2n} - \&c. \right\} \\ \qquad + \\ A_2 x^{a_2} \left\{ 1 - k \dfrac{(a_2+n-\beta_1)(a_2+n-\beta_2)}{n(n+a_2-a_1)} x^n \right. \\ \qquad \left. + k^2 \dfrac{(a_2+2n-\beta_1)(a^2+2n-\beta_2)(a_2+n-\beta_1)(a_2+n-\beta_2)}{2n^2(2n+a_2-a_1)(n+a_2-a_1)} x^{2n} - \&c. \right\} \end{array} \right.$$

It may be remarked that the same method of solution, precisely, applies to partial differential equations of the type

$$\mathrm{F}_o (xD_x + yD_y + zD_z + \&c.)\, u + \mathrm{F}_n (xD_x + yD_y + \&c.)\, \Theta_n u = \Sigma \Theta_m$$

where Θ_n, Θ_m are given homogeneous functions in the independent variables of the degrees n, m, respectively; or to the reducible type

$$\mathrm{F}_o (axD_x + byD_y + \&c.)\, u + \mathrm{F}_n (axD_x + byD_y + \&c.)\, \Theta_n u = \Sigma \Theta_m,$$

and that the partial differential equation, corresponding to the total differential equation discussed by Pfaff, namely

$$(a + a'\Theta_n)(x^2 D^2_x + 2xyD_xD_y + y^2 D^2_y)\, u + (b + b'\Theta_n)(xD_x + yD_y)\, u + (c + c'\Theta_n)\, u = \Sigma \Theta_m,$$

where Θ_n is a given homogeneous function in x and y, admits of easy solution by a process similar to that already exhibited.

4. A similar method of solution will apply to the class of equations in Finite Differences represented by the typical form

$$\mathrm{F}_o (\Delta)\, u_x + \mathrm{F}_n (\Delta)\, e^{nx}\, u_x = \Sigma M e^{mx},$$

where, as before, F_o and F_n represent algebraic functions of the symbol Δ, and the degree of Δ in F_n is supposed to be at least not higher than in F_o. In fact, since

$$f(\Delta)\, Ca^r = f(a-1)\, Ca^r,$$

we have

$$u_x + \frac{F_n(\Delta)}{F_o(\Delta)} e^{nx} u_x = \Sigma \frac{Me^{mx}}{F_o(e^m - 1)} + \frac{1}{F_o(\Delta)} 0;$$

or, if a_1, a_2, a_3, &c., be, as before, the roots of $F_o(p) = 0$,

$$u_x + \frac{F_n(\Delta)}{F_o(\Delta)} e^{nx} u_x = \Sigma \frac{Me^{mx}}{F_o(e^m - 1)} + C_1 (a_1 + 1)^x + C_2 (a_2 + 1)^x + \&c.$$

Hence, at once,

$$u_x = \begin{cases} \Sigma \dfrac{M}{F_o(e^m - 1)} \left(1 - \dfrac{F_n(\Delta)}{F_o(\Delta)} e^{nx} + \dfrac{F_n(\Delta)}{F_o(\Delta)} e^{nx} \dfrac{F_n(\Delta)}{F_o(\Delta)} e^{nx} - \&c.\right) e^{mx}, \\ + \\ \Sigma C \left(1 - \dfrac{F_n(\Delta)}{F_o(\Delta)} e^{nx} + \dfrac{F_n(\Delta)}{F_o(\Delta)} e^{nx} \dfrac{F_n(\Delta)}{F_o(\Delta)} e^{nx} - \&c.\right) (a+1)^x, \end{cases}$$

or, finally,

$$u_x = \begin{cases} \Sigma \dfrac{Me^{mx}}{F_o(e^m - 1)} \left\{ 1 - \dfrac{F_n(e^{m+n} - 1)}{F_o(e^{m+n} - 1)} e^{nx} \right. \\ \left. + \dfrac{F_n(e^{m+2n} - 1) \cdot F_n(e^{m+n} - 1)}{F_o(e^{m+2n} - 1) \cdot F_o(e^{m+n} - 1)} e^{2nx} - \&c. \right\} \\ + \\ \Sigma C (a+1)^x \left\{ 1 - \dfrac{F_n(e^n \overline{a+1} - 1)}{F_o(e^n \overline{a+1} - 1)} e^{nx} \right. \\ \left. + \dfrac{F_n(e^{2n} \overline{a+1} - 1) \cdot F_n(e^n \overline{a+1} - 1)}{F_o(e^{2n} \overline{a+1} - 1) \cdot F_o(e^n \overline{a+1} - 1)} e^{2nx} - \&c. \right\} \end{cases}$$

EXAMPLE.

Let it be proposed to solve the equation in finite differences, corresponding to Pfaff's differential equation

$$(a + a'p^x) \Delta^2 u_x + (b + b'p^x) \Delta u_x + (c + c'p^x) u_x = X = \Sigma M' e^{mx}.$$

This equation may obviously be thrown into the form

$$(\Delta - a_1)(\Delta - a_2) u_x + k (\Delta - \beta_1)(\Delta - \beta_2) p^x u_x = \Sigma M e^{mx}.$$

Hence we obtain the primary form—

$$\left\{ 1 + k \frac{(\Delta - \beta_1)(\Delta - \beta_2)}{(\Delta - a_1)(\Delta - a_2)} p^x \right\} u_x = \Sigma \frac{Me^{mx}}{(e^m - 1 - a_1)(e^m - 1 - a_2)} + C_1 (1 + a_1)^x + C_2 (1 + a_2)^x$$

and the solution, in series, required is—

$$u_x = \left\{ \begin{array}{l} \Sigma \dfrac{M\theta^{mx}}{(\theta^m - 1 - \alpha_1)(\theta_m - 1 - \alpha_2)} \left\{ 1 - k \dfrac{(p\theta^m - 1 - \beta_1)(p\theta^m - 1 - \beta_2)}{(p\theta^m - 1 - \alpha_1)(p\theta^m - 1 - \alpha_2)} p^x + \&c. \right\} \\ \qquad + \\ C_1 (1 + \alpha_1)^x \left\{ 1 - k \dfrac{(p\overline{1 + \alpha_1} - 1 - \beta_1)(p\overline{1 + \alpha_1} - 1 - \beta_2)}{(p - 1)(1 + \alpha_1)(p\overline{1 + \alpha_1} - \overline{1 + \alpha_2})} p^x + \&c. \right\} \\ \qquad + \\ C_2 (1 + \alpha_2)^x \left\{ 1 - k \dfrac{(p\overline{1 + \alpha_2} - 1 - \beta_1)(p\overline{1 + \alpha_2} - 1 - \beta_2)}{(p - 1)(1 + \alpha_2)(p\overline{1 + \alpha_2} - \overline{1 + \alpha_1})} p^x + \&c. \right\} \end{array} \right.$$

5. In the Differential Calculus, the following transformation of a theorem previously stated is occasionally useful, namely,

$$\frac{1}{x^m} \cdot F(xD) \cdot x^m u = F(xD + m)\, u.$$

The theorem in the calculus of Finite Differences, corresponding in expression, though not in power, to this, and possibly suggested before, may be thus enunciated. If

$$(x)_m = x(x+1)(x+2) \ldots (x+m-1),$$

then will

$$\frac{1}{(x)_m} \cdot F(x\Delta) \cdot (x)_m u = F(\overline{x + m}\Delta + m)\, u,$$

a theorem which may be readily proved by induction from the fact that

$$x\Delta \cdot (x)_m u = (x)_m (\overline{x + m}\Delta)\, m + u.$$

Mr. W. R. Wilde read a description of two ancient Irish Boats, found in the county of Cavan, which he presented to the Museum on the part of Alexander Nesbitt and Robert Burrowes, Esqrs.

The Ven. the Archdeacon of Ardfert read a paper "On an original Portrait of the Old Countess of Desmond."

Mr. Wilde presented the following donations to the Museum:—

A bronze dagger, found in the Dunshaughlin Crannoge, on the part of Mrs. Rothwell, of Kells.

An iron bridle-bit, on the part of Mrs. Tyrrell, of Ballinderry, near Enfield.

The thanks of the Academy were voted to the donors.

WEDNESDAY, DECEMBER 12, 1859.

JAMES HENTHORN TODD, D. D., President, in the Chair.

WILLIAM D. MOORE, M. B., was elected a Member of the Academy.

Rev. Charles Graves, D. D., communicated a "Geometrical Method of representing the sums or differences of Arcs of any curves whatsoever."

The REV. the PRESIDENT exhibited to the Academy an ancient deed in the Irish language, and read a translation of it made by Mr. Curry.

It was an agreement of the nature of a mortgage between Domhnall, son of John, son of Mac Con (i. e., Mac Namara), and Domhnall, son of Lochlainn O'Slattery. Slattery had given a loan to Mac Namara and his brothers, of seven marks and an half, valued at fifteen cows in calf, and a bay steed, worth an unga, or ounce of *silver*. The security given by Mac Namara was his share of the lands of Bally Slattery, now Newgrove, near Kiltannon, county of Clare; and the covenant or condition of the mortgage was, that no person could redeem the land except Domhnall Mac Namara himself, or his son, or his son's son. The deed was executed on the fair-green of Killinagh. Witnesses, Sioghda, the Mac Namara, and his sons, Finglin and Mac Con; Mora, daughter of Donnchadh O'Brian; the clan (or family) of Cumeadha Mac Lochlainn Mac Namara, and many others of the tribe, who were consenting parties on both sides. The deed was made in 1502.

But the document exhibited to the Academy was not the original, for the transcriber adds, in continuation (and this clause is evidently in the same handwriting as the remainder of the deed):—"And it was thus I found it in the old charter, in presence of Teige Mac Clanachy* and of Flaithri Mac Flanachy."

And then follows, in a different hand, of the seventeenth century, and not in Irish characters, the attestation:—"Copia vera examinata cum originali."

The most curious thing to be noted in this deed is that the value of the loan is given not only in money, seven marks and an half, but also in the ancient valuation, cattle; and we are told that seven marks and an half, or nearly £5 (the mark being 13*s.* 4*d.*), were equivalent to 15 cows in calf, and a bay steed, which of itself was worth an ounce of silver. This gives us a curious criterion for estimating the value of money in Ireland in the year 1502.

The following is the original Irish of this deed, with a translation:—

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* It is to be observed that Mac Flanachy and Mac Clanachy are different spellings of the same name, the correct orthography being Mac Flanchadha. It is curious, as illustrating the loose orthography of the period, to find the same name spelt differently in the same line.

Acso cairt ⁊ dintiur ata idir domnall mac sfain mic con, ⁊ domnall mac loċlainn í ṡlatra .i. domnall ó slatra ar dtabairt gill do ḋoṁnall mac sfain ⁊ da ḋearbraitreaċaiḃ ar ċuid ḋoṁnaill ṁic sfain do baile i ṡlatra. ⁊ arí a cuid .i. tri ċuid do lſċh-ceaṫrumain in riarga ṁóir, ⁊ da ċuid do leṫċſtrumain na ċnoc. ⁊ are med in gill sin tuc domnall ó slatra do domnall mac sfain .i. sfċt marc go lcṫ a cuic buaiḃ deg ionnlaoġa ⁊ each donn, leṫ muinge innte fein, ⁊ are aċt domnaill i ṡlatra ⁊ domnaill mic sfain re ċeile .i. gan ar comas do duine ar biṫ in fearannsin ḋfuasglaḋ ó domnall óṡlatra act do ḋomnall mac sfain nó da ṁac nó do ṁac a ṁic, ⁊ ar faiṫiḋ na cillinach tuca an geallso amach, go ḟiaḋnairi do mac conmaraḋ .i. sioġda, ⁊ da ċloinn .i. finġin ⁊ mac con, ⁊ do ṁoir ingin donnchaiḋ i briain mar in cedna; ⁊ do cloinn conmeda mic loċlainn, ⁊ do ṁorain ele da sliċt noċ tuc a ced ⁊ a toil ar gach taoḃ uile ċuigiso. bliadna crist an tanso .i. mile ⁊ cuic ced, ⁊ da bliadain nisa mó in tan do rine in cunnraḋ so ⁊c[a]. ⁊ is marso fuaras annsa tſeancairt go fiaḋnairi do ṫaḋg mac clannchaḋa, ⁊ do flaṫhri mac flannchaḋa mar moedna.

Copia vera examinata cum originali.

This is the chart and indenture which is between Domnall, the son of John, son of Mac Con [Mac Namara], and Domnall, the son of Lochlainn O'Slattery; viz., Domnall O'Slattery having given a pledge (or loan) to Domnall, the son of John, and to his brothers, upon Domnall, the son of John, part of Bally Slattery; and his share is, viz., three parts of the half quarter of Riag Mone, and two parts of the half quarter of the hills; and the amount of that pledge which Domnall O'Slattery has given to Domnall, the son of John, is: seven marks and a half, in fifteen in-calf cows and a bay steed, worth an unga in itself. And the covenant of Domnall O'Slattery and Domnall, the son of John, with each other is, viz., that no person whatever is competent to release this land from Domnall O'Slattery but Domnall, the son of John, or his son, or his son's son. And it was on the green of the Killenach this pledge was given away, in the presence of (the) Mac Namara, i. e., Sioghda, and of his sons, viz., Finghin and Mac Con, and of Mora, the daughter of Donnoch O'Brian also, and of the children of Cumeadhu, the son of Lochlainn (Mac Namara), and of many more of their descendants, who gave their consent and their will, on each side, to this (covenant). The years of Christ at this time, i. e., a thousand and five hundred and two years more, at the time that this covenant was made, &c. And it was in this way I found it in the old charter, in presence of Teige Mac Clanachy and of Flaithri Mac Flanchy, in like manner.

Copia vera examinata cum originali.

The President also exhibited a Persian soldier's medal, made of a certain base metal resembling silver, with an inscription in the Persian language on one side, the reverse being blank. From this inscription it appears that the medal was worn as an amulet, to protect the wearer in battle. The following translation of it was made by the learned William Wright, Esq., Professor of Arabic in the University :—

"He is the Helper.

"O Glorious and Almighty God, the certain verification of thy great Word has sent forth this wretched slave, this person, into the midst of war against the enemy; but, saving the aid and assistance of thy holy and exalted self, I have no other. It is in every way incumbent on thee to show some care (for me)."

W. N. Hancock, LL. D., communicated a "Formula for the value of commodities, to determine the probable fall in the value of Gold."

MONDAY, JANUARY 9, 1860.

Lord Talbot de Malahide, V. P., in the Chair.

Rev. Benjamin Dickson, A. M., F. T. C. D.; Francis Clarke, M.D.; E. Alfred Conwell, Esq.; William Foley, M. D.; Captain A. M. Moore; Alexander J. R. Stewart, Esq., and Laurence Waldron, Esq., M. P., were elected Members of the Academy.

Mr. G. V. Du Noyer described, and presented to the Academy—

A SERIES OF 118 ORIGINAL DRAWINGS OF IRISH ANTIQUITIES.

Before I allude to the sepia sketches which I have the pleasure of bringing before you this evening, I beg to say a few words with reference to drawings of antiquities which I have placed in the large book portfolio now on the Library table.

In the month of August last I had occasion to visit Edenderry, and, while engaged in my geological researches over the neighbourhood, I heard frequent mention made of Mr. Murray's Museum, occupying a room in the Market-house of that town.

On the completion of my work I was enabled, through the kindness of the Rev. Mr. Murray, Rector of Edenderry, to examine his brother's museum carefully; and I found in it many objects of early Irish art, as well as implements of iron, unlike any in the Academy's Museum. Of these I made sketches; and I now beg to present them to the Academy, as they elucidate and fill up certain gaps in our collection.

I have appended to them a rough catalogue of the Irish antiquities in the Edenderry Museum.

I now beg to call the attention of the Academy to the series of rough sepia sketches of various antique sculpturings, principally Ogham stones, crosses, and tombstones, numbering in all one hundred and eighteen, which are now before you, and which I have great pleasure in presenting to the Library of the Academy.

They are all, without any exception, taken from my original sketches from nature, and are intended to form the first volume, as it were, of a like series of other objects of antiquity—but principally architectural—which, however, to some may be of equal antiquarian interest.

I trust, before long, I shall have leisure to complete this second series, which the Academy may again honour me by accepting.

Ogham Stones.—I shall first allude to the Oghams, not that I regard them as taking precedence in point of antiquity with many other sculpturings now presented to you, but they stand before us veiled with such an air of mystery that our natural promptings of curiosity lead us to give them our first attention.

The first group of five Ogham stones, so far as my information leads me, are unique. The stones are all small, the longest measuring about 2 feet 10 inches in length, and perfectly rounded, and polished on all sides, the angles being thus removed. They are arranged at the distance of 10 or 12 feet apart, around a portion of the outer diameter of an ancient burying-ground called a "calluragh burial ground," on the summit of Ballintaggart Hill, a low but well-defined knoll, about two miles to the east of Dingle, in the county of Kerry. No doubt, an ancient church once existed at this locality, but at present there is not even a foundation stone of such a building remaining.

You will perceive that two of these smooth Ogham stones bear small incised crosses on them; the first rather complicated, the latter plain. From the particular form of the first cross, I have no doubt but that the work may be regarded as of an early Christian period; but whatever the date of the crosses may be, that is also the age of the Ogham inscriptions; and all the Oghams bear the stamp of having been made as nearly as possible at the same period.

The next Ogham stone is one of some interest, on account of its peculiar position, and from its bearing on one side an incised cross of the Greek form enclosed in a simple circle.

This stone, which is about 6 feet in height, stands at the very summit level of the ancient pass over the northern flank of Mount Brandon, in the county of Kerry, which leads from the plains of the Fionagh River, on the east of Smerwick Harbour, across the mountain to the western extremity of Brandon Bay, and at an elevation of nearly 2200 feet above the sea. This Ogham and the cross were sculptured at the same period.

Without doubt, the earliest form of cross adopted by the first Christians in Ireland is that which is still distinctive of the Greek church—I mean the equal armed cross formed by the intersection of four semicircles, and thus having eight points. It is highly probable that St. Patrick, who died in the year 493, introduced this peculiar form of cross into Ireland; and it is even yet preserved to us in the little gaudy pa-

per and ribbon crosses which are sold in our streets on the 17th of March, or St. Patrick's Day.

The next Ogham pillar, which is 5 feet 10 inches high, stands on the summit of Dunmore Point, on the west flank of Mount Eagle, county of Kerry, and is, therefore, placed on the top of the most westerly cliff in Ireland. The inscription on it is quite perfect.

The Ogham stone, No. 8, stands in the stone fort called Cahir-na-gat, on the south side of Ballyferriter Hill, near Ferriter's Cove, Co. Kerry; its height is five feet above the ground, and its inscription apparently perfect.

The 9th Ogham pillar stands in the graveyard of the old church of Kilmalkedar, on the east side of Smerwick Harbour, and its inscription is also uninjured. The top of this stone is pierced with a hole.

No. 10, 11, 12.—These pillars, bearing Ogham inscriptions, are preserved in the lawn of Burnham House, near Dingle, the residence of Lord Ventry; and my friend Mr. Clibborn has informed me that they originally came from the south shore of Smerwick Harbour, having suddenly appeared there after a powerful gale of wind, which swept from off them the sand with which they had been covered for ages. I think it is to be deplored that they were ever removed from their original site. I am not one of those who approve of the uprooting and transplanting of such singularly interesting relics as those of our early art and learning, even though they should be safely deposited in such a valuable Museum as that of the Academy. One of their greatest charms is the hallowed interest which they throw around the spot on which they were first erected, and when I see one of them placed with care against a neatly polished or painted case, I sigh to think that some remote, sequestered spot, or rugged mountain gap, has lost its *genius loci*.

The Ogham stone, No. 13, is a remarkably fine example of its class. In the month of March, 1851, I was fortunate enough to discover this Ogham in the centre of an ancient rath, in the townland of Windgap, near Carrick-on-Suir, in the county of Waterford. A cave, known to be here, induced me to the spot, and, while having its entrance opened in order to explore it, I was obliged to dig around a rough block of stone which was close to it. This stone proved to be the Ogham pillar, a drawing of which is now before the Academy, and, strange to say, it was buried with the *small end downwards*, leaving the rough end projecting above the surface of the ground. The inscribed face of the stone was turned away from the mouth of the cave.

During the same month of March, in the same year, I was again fortunate in discovering no less than five other Ogham stones, all of which were made to aid in the construction of the old church of St. Seskinans, townland of Knockboy, near Carrick-on-Suir, Co. Waterford. They form the interior lintels of four of the windows, and that of the doorway on the south side wall.

I have given a rough sketch of the interior of this remarkable church, looking west, and also a ground plan of it. It will be seen that it is

a simple rectangular building, measuring seventy-three feet in length, by twenty-five in width; there are two doorways, one in the south wall, at the distance of twenty-three feet from the west gable, and the other in the north wall directly opposite. In the west gable are two narrow windows, one above the other, ogee-headed on the outside, but flat within; they are widely splayed, their sides slightly inclined, and their lintels formed of Ogham stones. This gable is prolonged into a flat belfry, pierced with two semicircular-headed openings for bells.

The masonry at either side of this belfry is known to architects as "Long and Short," and which is to be met with in Ireland in churches of a much older date than the one I am describing. Close to the east gable are two windows of the same form as those just mentioned, one in the north, and the other in the south wall. The lintels of each are formed by long Ogham stones. The doors of this church are wide, and on the outside headed with a depressed pointed arch, very nearly approaching to the semicircular. They are flat-topped within, and the lintel over that in the south wall bears some Ogham characters. So few, however, are these, that I am led to imagine that the greater part of this inscription would be found along the angle of the stone which is now buried in masonry. This stone is pierced with a hole at its western end, a work possibly contemporaneous with the Oghams.

From the architectural features of this church I believe it to be a work of the fourteenth century, but it is manifest that the Ogham inscriptions are of a much earlier date, as in some instances portions of them were and are yet concealed by the surrounding masonry. The sketches, Nos. 2 and 3 of the window lintels, are clear examples of this interesting fact.

Shortly after the finding of the Rath Ogham, and those from St. Seiskinan's Church, I had great pleasure in communicating the fact to the Rev. Dr. Graves, at the same time sending him careful drawings of them all.

The magnificent Ogham pillar, No. 21, is one well known; it is a block of red conglomerate, 13 to 14 feet high, and stands on the roadside between Carrick-on-Suir and Curraghmore.

The Ogham, No. 22, is one which I was also the first to notice in the summer of 1849; it lies in the graveyard of Gowran Abbey, county of Kilkenny, and bears on it an incised cross of the ninth or tenth century type.

The last Ogham which I have figured is one now in the Museum of the Academy. It is remarkable for being ornamented with a Greco-Irish cross, enclosed in a simple circle, in which respect it agrees accurately with the Ogham pillar from the Pass over Mount Brandon; and as the cross and Ogham letters on this stone are clearly a contemporaneous carving, without doubt it is the same age as the Brandon monolith.

Pillar Stones.—The district lying to the N. and W. of Dingle, county of Kerry, is rich in early Christian pillar-stones. The following

series of sixteen sketches represent those which I had the good fortune to meet with.

The ornamented pillar slab, 5 feet high, figured in the first sketch, is perfectly unique and striking, from the classic elegance of design in its carvings. It stands in a "calluragh" burial ground, one mile east of Ballyferriter, on the Dingle road. The upper ornament is a Greek cross, brought out in slight depresso, and enclosed in a circle, the spaces between the arms being ornamented with quaint, crook-like devices. The lowest member of the cross has a long, slender shaft leading from it, and terminating in a simple right-and-left scroll. At either side of this shaft, S-shaped scrolls, of purely Greek design, pass downwards, and terminate in a straight line, which cuts the base of the shaft at right angles. On the left side of the stone there are three letters (D, N, E), carved in a bold manner, and in the *Uncial character*,—doubtless a contraction of the word *Domine*. The top left-hand corner of the stone is pierced with a small hole. I believe this carving to be the work of the seventh or eighth century.

In the townland of Ballywiheen, close to the south-east shore of Smerwick Harbour, there are the remains of a small stone-roofed oratory, and in the graveyard attached to it is the remarkable stone, Fig. 2. In it we have another example of the Greek cross enclosed in a circle, but, unlike the former one, the emblems are brought *out in high relief*. Of its class, this carving is also unique, and I believe it to be of equal antiquity with the former. The stone is only 2 feet high, and is placed at the head of a grave.

Near the stone-roofed oratory of Kilmalkedar is the pillar-stone No. 3. It bears a simple cross, in a circle, below which is a rough inscription. This carving is in deep depresso.

The next monolith, which is 4 ft. 6 in. in height, is from the graveyard of the old stone-roofed oratory of Temple-na-Coonagh, near Gallarus. Fig. A, No. 4, represents the west, and Fig. A, No. 5, the east face of this stone. The whole of the west face of this slab is occupied by bold carvings, in deep depresso. There is first a simple cross; below this, and connected with it, a circle enclosing a cross, which is of the modified Greco-Irish type; below this, again, is a large cross of the same type, the lower arm the longest, and ending in a device like a half moon on its back; and, nearest the ground, a simple cross, the base of which is concealed in the earth. The east face bears a small simple cross, of a type like the former, but the upper arm remarkably short. The date of the carvings may be about the ninth century.

The same graveyard affords another standing-stone of a remarkable type, probably older than the former: it represents a triple cross, of a very peculiar form, and quite of a class with that on the polished Ogham stone from Ballintaggart Hill. The smaller cross below is apparently of a later period.

In the calluragh burial-ground, one mile to the east of Ballyferriter, in the townland of Reask, is the pillar-stone represented by Fig. 7. The cross upon it is of the modified Greco-Irish type, but it is surmounted

by a quaint and unintelligible ornament, which may be likened to a *crown*.

The next two illustrations are from a field near Ventry Coast-guard Station, townland of Carrickadownig. The east face of this upright slab is ornamented at the top by a singular device, brought out by lowering the surface of the stone around it. I am at a loss to describe it; but if it be looked at fixedly for a short time, it gradually assumes the *shadows* of a death-like mask, the mouth of which is concealed. Below this is engraved a slender cross, the top and base of the shaft being slightly bulged, so as to *hint* at the early form of this emblem. The west face of this stone bears also a very quaint cross, the transverse arms being very short, and ending in two deep cup-shaped hollows.

The illustration No. 10 is from a small headstone close to the remains of an old church near Ballyferriter. Both sides of the stone are ornamented with crosses of the type of the preceding.

Fig. 11. Cross, from the old church of the little village of Fahan, Ventry, county of Kerry.

Fig. 12. This resembles a headstone for a grave, and is ornamented with a device unlike anything I have seen elsewhere; it may be likened to the letter T turned upside down.

The two sketches, Nos. 12 and 13, represent a small, upright stone, from the graveyard of the old church of Kilmalkedan. Its shape is quite unique, resembling somewhat a clumsy stem and stern-post of a boat; but its style of ornamentation, clearly Greco-Irish, we may assign it to a period between the ninth and twelfth centuries.

Fig. 14. The next illustration represents the lofty but rude cross from the same graveyard; and when we contrast it with that from the graveyard of Castlegregory old church, county of Kerry, Fig. 15, we will be struck by their similarity. I have little doubt but that these crosses may be of the tenth century.

Glendalough, Co. Wicklow.—21 Sketches.

I beg now to direct your attention to the series of twenty-one sketches illustrative of the crosses and tombstones at Glendalough, in the county of Wicklow; and I believe that these include all the principal relics of this class now remaining at that celebrated locality.

When we enter the ancient gateway which leads to the long passage conducting to the graveyard of the so-called cathedral, we shall find, close to the gateway, and on the right of the passage, a large slab of mica slate set upright in the wall. It bears a rudely incised cross of the Greco-Irish type.

From the position of this slab, it is clearly not a tombstone, and my belief is, that it is the consecration or chrism cross of the graveyard. The Rev. Dr. Reeves has kindly informed me that a graveyard is not considered consecrated till a person has been buried in it. This cross is, therefore, possibly commemorative of that event, or the first burial, and is therefore a relic of no ordinary interest. Without doubt it is referable to the age of St. Kevin, who died in the year 616.

There are many crosses scattered over the graveyard of the large church at Glendalough, called "The Cathedral," and possibly one of the oldest, though the smallest of them, is represented in Fig. 2 of this group. It is a simple Greek cross, enclosed in a circle, but the lower arm is prolonged into a shaft or staff. The drawing is nearly the size of the original, which is carved out of a rough slab of mica slate.

The next sketch represents an incised cross of graceful and quaint form, partaking of the Greco-Irish type. There appears at the intersection of the arms the rudiment of that circular central ornament which in the eleventh and twelfth centuries was enlarged into important proportions, and formed the most distinctive feature of carvings of this class.

In all speculative research it is a pleasure of no ordinary kind to be able to rest the mind on a *fact* relating to the subject, or at least on what we are willing to receive as such. Dr. Petrie, to whom the student of Irish Archæology is under a debt of gratitude for the clear analytical and philosophical manner in which he has treated the subject of early Christian and pre-Norman Irish architecture, states, that he considers "the Church of the Monastery," or, as it is sometimes called, "the Priory of St. Saviour," at Glendalough, to have been erected within the period between the close of the ninth and that of the tenth centuries. I have now to submit to you a drawing of the full size of one of the marvellously sculptured stones from this singular ruin. Let us mark its ornamentation, and it will aid us in our inquiry as to the probable age of many of the sculptured stones from the neighbourhood.

The next drawing is of a flat tombstone from the cathedral graveyard; and its central ornament is so very like that of the stone from the monastery that we are insensibly led to regard them as of the same period. This stone bears a mutilated inscription in Irish, commencing with the words OR. DO., the letters being of the Uncial, or old Roman character.

The drawing No. 6 is of the small and beautifully ornamented cross from the graveyard of the Reafert Church (or Church of the Kings). Dr. Petrie states he considers this carving to be a work of the tenth century. (See Essay, page 266.)

The next cross is from the ruins on the shore of the Upper Lake at Glendalough called Temple-na-Skellig; and though its ornamentation is rude and simple, the type or idea expressed is clearly the same as the last, though very likely of an earlier date.

Nos. 8, 9, and 10. These represent the upright crosses which are placed at intervals across the alluvial flats which separate the Upper from the Lower Lake at Glendalough. The first is of the same type as that from Temple-na-Skellig, its characteristic features being the *three-quarter circles*, which are cut out of its surface at the angles of the intersecting arm, thus suggesting the modified Greco-Irish form.

The large granite cross which stands in the graveyard of the cathedral exhibits a total change in outline and general design to any of the preceding; and I do not think that it is of equal age with them; indeed, I should be disposed to attribute it to the twelfth century.

The next cross is small, also of granite, and is used as a headstone in the graveyard. It may be of comparatively modern date, and a rude copy of the head of the large cross.

The tombstone marked No. 13 is of granite, and the cross, which is rudely carved, is in high relief. It has a very twelfth-century look about it.

The other two tombstones are of mica slate; the ornamentation on that numbered 14 is of the same type as the large cross, but the other, No. 15, which is coffin-shaped, is ornamented after a very old fashion, and designed by one whose tastes lay in the study of the antique at that time. Its date may be early in the twelfth century, its general outline indicating that period.

The remaining crosses, Nos. 16 and 17, may possibly be works of the sixteenth century, for aught I could say.

Fig. 18 represents a very rude cross at present standing in the narrow doorway leading to the remains of what was once a rough-built circular Cloghaun, perched on the summit of the cliff near the Waterfall at Glendalough, and completely embowered in trees. It is known as *St. Kevin's House*. There is little doubt but that this structure is contemporaneous with the Saint whose name it bears, and who died, as I stated before, in the year 616. As to the cross, its extreme rudeness renders any criticism as to its probable age very hazardous.

Figs. 19, 20. These represent the ruins of a small cross standing opposite the door of the Reafert Church. It is only 2 feet 6 inches high, and may or may not be ancient.

The perforated flagstone from the graveyard of the cathedral belongs to a class of antiquities which I shall allude to last.

The next group of five sketches represents four small slabs of red sandstone and a low squared pillar-stone, from the old church-yard of Peccaun, in the county of Tipperary, near Cahir. It is remarkable that the Greco-Irish cross, enclosed in a circle, is here again seen; and it shows how wide-spread and general was that peculiar type of cross over the south-west of Ireland.

The three succeeding sketches are of early Christian tombstones. They are all drawn to the full size of the originals, and the simplicity of their inscriptions is very striking. The low pillar-stone with the flat cross in a flat circle is clearly not of equal antiquity with the other carvings, being probably a work of the twelfth century. The similarity of design between this cross and that on one of the tombstones from Glendalough will be at once apparent. The corner of this pillar is pierced diagonally with a hole, but to effect this a deep nick was first cut out of the side near the angle.

The last group of fifty-three sketches comprise monoliths, crosses, and tombstones, from various districts.

The first illustration represents the supposed shaft of the cross of St. Adamnanus, standing in the grave-yard of the church on the summit of Tara Hill. Without daring to enter into the discussion as to the identification of the celebrated Lia Fail, or "Stone of Destiny" (a distinc-

tion claimed, I understand, for this monolith by the highest authority), this relic will be regarded with considerable interest, from the probability of its being the veritable crowning stone of the ancient Kings of Leinster, and the singular carving which appears on it in high relief.

If this be St. Adamnan's cross, it is a work of the early part of the eighth century, as that celebrated ecclesiastic died in the year 704.

The next cross is of fully equal interest with that just described. It stands in the N.E. corner of the graveyard of the old church which crowns the summit of the Hill of Skreen, adjoining Tara Hill on the east. Without doubt, it is a work of great antiquity; most probably of the age of St. Columbkille, who selected this hill as the site for a religious house, and whose Well is yet pointed out on the spot. If this be his cross (and I see no reason to doubt it), it is a work of the close of the sixth century, St. Columb having died A.D. 597, and the figure of the Crucifixion, which is rudely carved on it in high relief, is the oldest sculptured representation of that event in Ireland, if not in Britain. The cross is formed of coarsely crystallized, dove-coloured limestone, and appears to have been brought from the neighbourhood of Ardbraccan, where a similar limestone is yet quarried.

The next two illustrations represent a singularly grand monolith, called "the giant's headstone." It is near Clonmel, on the side of the mountain in the county of Waterford, and stands at present fully nine feet above the ground. Without doubt, it is a pagan monument, *Christianized*, if I may so express it; and I should say that the crosses sculptured on it are of the ninth or tenth century type; the larger one is *especially characteristic* of that period.

The next cross stands opposite the west gable of the old church of Slaty, in the Queen's County, near Carlow, and is also of the tenth century type. It is formed of granite, and is 8 feet 6 inches in height.

The next drawing represents a flag-stone from the interior of the old church (but not the *oldest* church) from Inchagoil Island, in Lough Corrib. By comparing it with the tombstones from Clonmacnoise, described and figured by Dr. Petrie, we may safely assign it to a period between the close of the ninth and beginning of the twelfth century.

To the same period I assign the incised cross on the upright flagstone from the graveyard of the old church in Church Island in Lough Currane, at Waterville, county of Kerry—(Fig. 7)—the carvings on both being of the Greco-*Irish* pattern.

The next two illustrations are of sculptured tombstones; and though of the earlier types of this kind of decoration, they are not, I think, quite as ancient as those preceding.

Fig. 8 is from the graveyard of Baptistgrange old church, near Thorny Bridge, county of Tipperary.

Fig. 9. From Castletown church, county of Meath.

Figs. 10, 11. These are two views of the same stone, the incised cross being of the twelfth century type. It is unique, however, in having the central circular portion at the intersection of the arms cut out

so that the slab is here pierced through. The length of the stone is about 3 feet.

The next illustrations, Figs. 12, 13, represent part of the head of what was one of the finest of the large standing crosses in Ireland, and is formed out of a single block of granite. It now lies in the graveyard of the old church of Dromiskin, county of Louth, the fragment as it stands being nearly 4 feet above the ground. Its type is that of the cross radiating out of a circle. The carving is remarkably delicate, considering the rough texture of the stone. In the centre of the cross is a raised square tablet, on which are carved four nondescript monsters, having large heads, with their mouths open, and armed with a row of formidable teeth; they are each in the act of swallowing a small fish, whose elongated tail is curled round the thin extremity of a flexible horn-like projection which starts from behind the eyes of the larger animals. The bodies of these big animals are prolonged so as nearly to complete a circle, and curled round and round each other as they approach the centre of the tablet, where they end in a simple interlaced plait representing a cross. The centre of the upper arm contains a carving in high relief, representing two men in the act of feeding a horse, which appears carefully covered with a long cloth, fastened across the chest, and falling over the back beyond the loins. The first figure carries a vessel like a large mether, which he is in the act of presenting to the horse, while the figure behind him appears as if soothing and coaxing the animal, his arms being extended before him.

In the compartment formed by the left arm of the cross there is the representation of a hound, with his head in the air, as if baying, and on the corresponding side is the figure of a man, the head and face of which are well carved; the rest of the body is covered by a loose robe; the legs and feet are wanting. The opposite side of the cross is comparatively plain, being ornamented by the interlacing of two bands, which at the top and intersection of the arms form an ornament of the triquetra type. The sides of the top arm are decorated with a semi-Greco-Irish pattern in high relief, and the outer diameter of the circle with a simple plait of three bands. I believe this cross to be of the eleventh or twelfth century.

The next cross, Fig. 14, is also of granite, but of a very different class to the former. It stands in the graveyard of Newcastle Church, county of Dublin, and is only 4 feet 6 inches high, not including the square block of stone which forms its base. At the intersection of the arms it bears upon it a small flat cross, of the simplest form, carved in relief.

Figs. 15, 16. These two incised crosses are, I think, attributable to the twelfth century. The first is from Castletown Church, county of Meath; the next is from the old church of Monksgrange, near Drogheda.

Fig. 17. This cross is from the townland of Ballyneale, four miles from New Ross, county of Wexford. I am doubtful as to what age to assign it. Its similarity in every respect, in design, execution, and size, to the small cross from the old church of Fahan, near Ventry,

county of Kerry, is very striking. It may be of the same age as it, and, therefore, possibly of the tenth or eleventh century.

Fig. 18. This represents a cross placed over a holy well, dedicated to our Lady, near Kilmurry, county of Cork. The inner cross is evidently formed by modern scratchings, the work of the devotees who come to pray at the well.

Fig. 19. This is a fragment of a tombstone from the old church of Dowth, county of Meath. From the fact of the edges of the stone having been chamfered off, I am disposed to regard it as a thirteenth-century work, although the design of the cross is derived from the old Irish type.

Fig. 20. This singular relic, having a standard cross enclosed in a circle carved upon it, is formed of a small block of yew timber, and placed in the interior of the old church of St. Patrick's Well, near Clonmel, county of Tipperary, near the N. E. angle of the old stone altar, which is yet remaining in this ruin. I regard it as a work of the fourteenth century.

Fig. 21 represents a tombstone from the grave-yard of Dromkeen, county of Limerick. The cross is of the old twelfth century type; but the work much more modern.

Figs. 22 and 23. These two illustrations are from singularly small tombstone flags, used as lintels over two doors in the Tower of Ardmullaghan old church, on the south bank of the Boyne, near Navan, county of Meath. I believe them to be the work of the thirteenth century, but after the early Irish type.

Fig. 24 represents a tombstone in the interior of Kildare Abbey; It is coffin-shaped; and though the design of the cross is very early Irish, I think the carving is not older than the fourteenth century.

Fig. 25. A tombstone from the Cathedral of St. Canice, Kilkenny; possibly of the fourteenth century. The cross is carved in high relief, and richly foliated.

Fig. 26. Stone cross at head of a grave in the churchyard of Oughterard, county of Kildare. The form is unusual, and I supposed it to be of the fifteenth century.

Fig. 27. This represents a group of small, rudely-formed granite crosses, from the roadside near the village of Carrick, at Bannow, county of Wexford. Where such crosses have been erected, and they are common in the county of Wexford, it is customary to stop funerals and rest the coffin there, and, on leaving, to place at the spot a small wooden cross, a bundle of which is previously provided. Some of these wooden crosses are represented in the sketch.

Fig. 28. Cross of a very old type, deeply carved into one of the quoinstones in the wall near the west gable of the old church of Clogrennan, county of Carlow.

Fig. 29. This represents a tombstone from Mourne Abbey, near Mallow, county of Cork. The two fish, which appear above the arms of the cross, and the two Maltese crosses below, are, I think, armorial bearings, and may probably be those of one of the Hacket family, whose

ancestor founded an abbey at Cashel, in the county of Tipperary, about the beginning of the fourteenth century.

Figs. 30, 31, 32. These represent tombstones from the Cathedral of St. Canice, Kilkenny, on which are sculptured trade emblems. The first is dated 1609, and is in memory of a weaver named William Hollichan. It bears on it the shuttle, the rubber, and the stretcher, which is constantly applied to the cloth as it is newly woven. The second is of Richard Clonan, a shoemaker: his emblems are a large hatchet-like knife, a smaller knife like a long trowel, an awl, and an instrument for applying heel-ball, the upper leather of a shoe, and a last; and the third is of Donatus Brin, a carpenter, his trade being typified by a long half-T rule, a bit and brace, a hatchet, and a hand-axe. The two last tombstones present the peculiarity of appearing to have been carved during the lifetime of the owners, spaces having been left blank for the insertion of the dates of their deaths, which the survivors omitted to fill up.

In the catacombs at Rome very many of the early Christian tombstones bear trade emblems on them; and it is singular that this custom should have been introduced into Ireland at the close of the sixteenth and beginning of the seventeenth centuries. Even yet, at the town of Galway, many of the Claddagh men have their trade emblems carved on their tombstones, the "*bearing*" of the Admiral of the Claddagh fleet being a hooker in chief, above, a basking shark or sunfish, both being very "*proper*."

Fig. 33. The head of a beautifully-designed foliated cross in the cathedral of St. Canice, seventeenth century.

Fig. 34. Quaint tombstone, from Faughat old church, county of Louth, bearing the letters H. K. and five crosses; possibly seventeenth century.

Fig. 35. Tombstone of Derby O'Bryen, 1690, from the graveyard of the old church of Ballypatrick, county of Kilkenny.

Fig. 36. Singularly rude—seventeenth century—cross and crucifixion, the former having been designed from the eleventh or twelfth century type. The figure is very ill sculptured, and the whole work clumsy. Above the head is a cherubim, and at the feet a skull.

Figs. 37, 38, 39, 40, 41. These are all from modern tombstones, which have been designed after the types of ancient crosses. The first four examples are from the graveyard of the old church of Killavan, near Carrick, county of Wexford; they bear the dates of 1750, 1754, and 1821. The cross figure, 41, is from the graveyard of Bannow old church, county of Wexford.

Fig. 42. This represents the well-known tombstone from Selskar Church, county of Wexford, which bears on it, in low relief, the representation of a medieval galley and a large human head. This work is clearly of the twelfth or thirteenth centuries, and most likely Anglo-Norman.

Fig. 43. I here present you with an undoubted Irish carving of a human head, of very nearly, if not the same, period as the former. It is to be found in the topmost stone of the outer arch of the doorway of the old church of Killeshan, county of Carlow, and the contrast between

it and the former is very striking; the bluff, beardless, or well-shaved face of the supposed Anglo-Norman contrasting badly with the broad and lofty forehead and carefully trimmed beard and moustache of the intellectual-looking Celt.

Fig. 44. This illustration represents a slab of dark-red grit, 4 ft. 6 in. high, standing in the graveyard of the old church of Kilquain, near Mallow, county of Cork. It is called by the people, "The Sinners' Stone," and is perforated at one side by a large hole. I cannot help thinking that this and other similarly pierced pillar-stones were simply whipping-posts, used not so much for secular as for ecclesiastical offenders. In the collection of sketches which are before you there will be found no less than five such hole-bearing pillars, of various ages: some of them Ogham stones, and two of them with no other mark than this hole. I should like much to know if the discipline or punishment of public whipping was recognised by the early Irish Church either before or after the Synod of Cashel.

Figs. 45, 46. Two views of a remarkably ornamented quern-stone, which, when I saw it many years since, was preserved amongst the Natural History collection of the Ordnance Survey Office, in the Phœnix Park. It is the top stone of a *Dish* quern, and I believe it to be a work of the twelfth century.

Fig. 47. Another quern, of, very likely, the same age, preserved in the Museum of Antiquities in Belfast. It is ornamented with the Greco-Irish scroll.

Fig. 48. This represents a large antique vase, of coarse granitic-looking pottery; and when I saw it, more than eight years since, it was used as a receptacle for rain-water by the owner, a carpenter named Lukeman, living at Castletown demesne, near Pilltown, county of Kilkenny. At the time, I offered a reasonable sum for it, but was refused. It would be well if this unique specimen of ancient Irish ceramic art could be obtained for the Museum of the Academy, and I have lately taken some steps to have this object effected.

Figs. 49, 50, 51, 52. These represent, in the full size, antique carvings, in red deal or pine wood, of axes and spear-heads of the ancient Celtic type. They were all found in Ballinderry Bog, near Tobbermore, county of Derry, in the month of July, 1851, and are now preserved in the Belfast Museum. I regard these mock weapons as *toys*, for there were children in those days who, doubtless, played at soldiers. The method of hafting these axe-heads is singular: one is especially so, where the head of the axe passed through the thick handle, and was then pegged, to keep it in its place. I have shown how it was likely those mock weapons were hafted.

Fig. 53. This last drawing is that of a rude carving, in stone, of a nude female figure, placed over a holy well near Kanturk, county of Cork; a very modern work, probably the end of the seventeenth century.

If as yet I have not been able to contribute as worthily as I would wish to the Academy's publications, I at least can enjoy the pleasure of

aiding by my pencil others more versed in antiquarian research than I can ever hope to be, and in this way help to record, in as faithful a manner as I am capable of, an interesting class of relics, some of which have been preserved in Ireland from the earliest Christian times, and which are not surpassed in Northern Europe for quaintness or originality.

My object in making this presentation to the Library of the Academy arises from a wish to increase its value to the antiquary; and I think it only right that these drawings should not be usable, except under the same conditions as those imposed on our manuscripts. The only personal reward which I venture to seek is, that those gentlemen who may find occasion to copy from them, or otherwise use them, will have the courtesy to mention the source from whence their information was derived.

Resolved,—That the special thanks of the Academy be presented to Mr. Du Noyer for his valuable donation.

Mr. Edward Clibborn read a paper—

ON THE NUMBER, QUALITY, USES, AND RELATIVE POSITIONS OF THE WELLS IN OR NEAR DUBLIN, ATTRIBUTED TO OR NAMED AFTER ST. PATRICK: CONSIDERED IN RELATION TO A GREAT ECONOMIC PUBLIC SUPPLY OF WATER, IN ADDITION TO THAT NOW POSSESSED BY THE CITY.

Mr. Clibborn stated that his attention was called to the subject-matter of the present communication by Alderman Atkinson, M.R.I.A., calling on him, and informing him that Mr. B. L. Guinness, M.R.I.A., had lately presented the citizens of Dublin with £100, to enable them to place the poor of Dublin in such a position as to have at their disposal a copious supply of water fit for drinking. Having discussed this matter with Mr. Atkinson, it was agreed that an application should be made to Trinity College to allow the spring well at the end of Dawson-street to be utilized for the purpose of supplying passengers with water. This well was reputed to be the original well of St. Patrick. The application to the College gave rise to a call on Mr. Clibborn that he should prove that this was so. He immediately commenced inquiries in the neighbourhood, for the purpose of ascertaining the local traditions bearing on the point, in the hope of substantiating the popular belief; but these traditions tended to disprove the usual impression that this well really was the original well of St. Patrick. Mr. Gilbert's "History of Dublin" having led to an opposite conclusion, Mr. Clibborn, with a view to ascertain on which side the probability lay of this well being St. Patrick's or not, continued his investigations. His first reference to any authority on the subject was to Swift's translation of Jocelyn's "Life of St. Patrick," written in the twelfth century, in which we read that St. Patrick, having performed several miracles at Finglas, crossed the water, probably the Tolka River. Then, pursuing his course toward Dublin city, he arrived at a certain point about one mile from the village of Ath-cliath, which Mr. Clibborn inferred was the original of Oxmantown, set down

in Rocque's famous Map of Dublin, published in 1756, as the west end of North King-street, near Smithfield, the present cattle market of Dublin. This place is found to be just a mile distant from an elevated spot near the bridge over the canal on the Finglas road, from close to which St. Patrick might have first seen the plain on the north side of the city flooded by the tides, the village of Ath-cliath and the city of Dublin in the distance on the opposite side of the river. At Ath-cliath, according to the legend, St. Patrick was entertained at the house of a certain woman, who complained to him that the water of the stream running by her house was always saltish, from the tide mixing with it, and that it was very troublesome going some distance up the stream to get the pure water. This stream, the author concluded, was the Brathogue, a river laid down on Speed's Map of 1610, and recognised before its entry into the present city in the Ordnance Survey Maps. In consequence of the complaint of his landlady, the saint produced a well of pure water on the spot, to which his name was given. Mr. Clibborn having found, in the pump of Mr. Carton, a fit representative of the well of St. Patrick, was led to inquire in its neighbourhood for an ancient holy well, which should realize the character of the water in the original well of St. Patrick, and found one close by, which was pointed out to him by Mr. Brophy, and which appeared to realize all that could be said for the original well produced at Ath-cliath by St. Patrick for the benefit of his hostess and her neighbours. This ancient well he was disposed to consider the true original well. It is in Mr. Bailie's timber-yard, corner of George's-hill and Cuckoo-lane, in a vault, approached by a great flight of steps, also leading to a vaulted chamber, which appears to have been an ancient church. The local tradition leads to the conclusion that these vaults extend to a great distance, south to the Liffey, and westwards to the Thief's Hole, near the Park Gate, which was opened about thirty years ago, when it was examined by the police, in consequence of a report that the body of a murdered female had been hid therein.

Jocelyn's legend went on to state that, after the saint left the village of Ath-cliath, he came to the noble city of Dublin, where, having brought to life the children of the king who ruled over it, the king, with his court and the citizens, proposed to be baptized, and the saint again struck the ground with the staff of Jesus, and produced the "Southern Well" of St. Patrick. This was the well in Nassau-street, to which attention was at first directed.

Having gone into many arguments to prove the existence of two wells of St. Patrick, the original or northern, and the "southern well," the author proceeded to show that Dr. Rutty's statements of the qualities of the waters of the two wells were perfectly consistent with the uses for which, according to the legend, they were intended—the one for domestic purposes being pure water, and the other, for baptismal purposes, being slightly saline, but not so much so as to render it unfit for ordinary use. He then went on to say that, taking the narrative as it was given by Jocelyn, it enabled us to map out the topography of Dublin and its immediate neigh-

bourhood as it was supposed, in the tenth century, to have existed in the fourth century, when St. Patrick was said to have visited Dublin, &c.

Looking at the matter as a practical question, Mr. Clibborn continued his inquiries in Nassau-street and its neighbourhood, to trace, if he could, the ancient well of St. Patrick, which Dr. Rutty, in 1757, was unable to find; and he discovered that there were several wells in the neighbourhood, all claiming to be the original well. Having taken into account the claims of all, he ultimately came to the conclusion that a well behind the house No. 9, Nassau-street, now inaccessible to the public, but which was described as having been open to the public by means of a flight of steps from Frederick-lane, about 100 years ago, and then visited by believers in the efficacy of the water, had more pretensions to the title of being the old spring well of St. Patrick than any of the others in the neighbourhood. In this opinion he was strengthened by a map of the city of Dublin, which appears to be as old as 1710, and which has the site of St. Patrick's well on it. This was 100 years later than Speed's map, which does not extend so far east as the site of this well.

Having disposed of the question of the locality of the ancient "southern well of St. Patrick," the author drew attention to the interesting fact, that he found, as he went down Leinster-street, the supply of spring water appeared to be very great, and capable of being utilized for all purposes to any extent. From the traces of ancient baths and wells, and from the modern pumps in the locality, he was led to believe that there was a perpetual supply of water, which was in quality only inferior to that obtained in such abundance from Mr. Carton's pump in Halston-street, close to which he believed was the original well of St. Patrick.

Mr. Clibborn suggested that measures should be taken forthwith in this locality, as well as in all others throughout the city, where there is a similarly abundant supply of spring water, to put it within the reach of the poor, by means of pumps to which they should have access, without getting the leave of any one.

MONDAY, JANUARY 23, 1860.

James Henthorn Todd, D.D., President, in the Chair.

Mr. W. R. Wilde read a paper "On the discovery of a Crannoge, called Cloneymore, in the county of Cavan," and, on the part of Mr. O'Brien, presented a number of antiquities found there.

The thanks of the Academy were voted to Mr. O'Brien.

Mr. E. Clibborn read the second part of his paper on the Wells attributed to St. Patrick, &c.:—

In continuation of his paper on the ancient wells in and near Dublin, attributed to St. Patrick, Mr. E. Clibborn explained that it appeared

to him that Jocelyn's legend, though of but little or no value for the biographical matter relating to St. Patrick, must be taken to be of considerable interest, not only as containing topographical notices of the wells attributed to St. Patrick, but also of the localities in which they existed. And further, as the legend, when published by Jocelyn in the twelfth century, must have conformed to the local traditions of the day, it might be taken as evidence bearing upon the topography of Dublin and its environs for probably one hundred years earlier. As it also appeared that there were topographical matters in the legend as it now stands, which could not have been in it in the twelfth century, as these were not older than the fifteenth or sixteenth century, it was clear that these had been inserted in the text by a late editor. So that, making all judicious allowances and corrections in the text of Jocelyn's manuscript which legitimate criticism would allow, we have in it, in the absence of all other testimony, an outline of a concurrent testimony, as to certain topographical matters relating to Dublin and its vicinity, extending over a period of nearly 500 years, or from the tenth to the fifteenth century, though the incidents in the legend should have, if real, occurred in the fourth.

The perfect adaptation of the topographical parts mentioned in the legend with those now existing in, and which must have existed near the site of the old city of Dublin before the low lands on the north side of the Liffey were reclaimed, led Mr. Clibborn to take the text of Jocelyn's legend to be a correct statement, as to other topographical facts which we could not now confirm; such as the existence of one or more of the ancient wells, which, it would appear from the legend, existed in or near Dublin.

There could be no mistake about the existence of a well called after St. Patrick, at Finglas, for such existed; but the legend said nothing about that well; yet it made it probable that a legend had existed in reference to that well, as well as to the locality of Finglas. The legend goes a step further; for it allows us to infer, that the woman at Ath-cliath, who complained to St. Patrick of the badness of the water there, had heard of his producing a well at Finglas, or somewhere else. And thus, as it were, she was led to put it upon the Saint to prove his power at Ath-cliath, by making another well there, as he had at Finglas, or wherever else it had been mentioned that he had miraculously produced a good spring well—an event which the legend-writer appears to have considered of such minor interest, compared with the production of the two great wells or fountains of Dublin, that he has not noticed it at all.

As to the position of one of the two great wells attributed to St. Patrick in the legend, i. e. the northern well of Dublinia, it must have been at or near Ath-cliath; but as Ath-cliath was within a mile of a certain position on the Finglas road, from which the site of that village and of the city of Dublin could have been first seen by a person coming towards Dublin from the north; and as the limit of inhabitable or un-

flooded ground at high water came also within the distance of a mile from the same position, it is clear that we should look for the site of the northern well of St. Patrick at or near the village latterly called Oxmantown, which was in the sixteenth century included within the limits of the city of Dublin.

Though Oxmantown and the country near it, in modern times, was inhabited by Fingallians, so called, it did not follow that, antecedently to their settlement in that locality, an Irish colony, village, or town, did not occupy the same place, for it was the only position adapted for a village, as it was here the only stream of fresh water, the Brathogue, running into the Liffey from the north, existed. There was no choice left then for the site of Ath-cliath of the legend in the twelfth century, which must have been the same as that of Oxmantown in the sixteenth, as indicated by Speed's map of 1610, and Rocque's map of 1756. In the former map the track of the stream which passed near Oxmantown is given, and agrees perfectly with the statement in the legend as to its water at Ath-cliath being spoiled by the tide, which would still be true, if the tide were not kept out, and if the land on the south side of North King-street had not been raised above high water-mark.

In 1860 the water of the Brathogue, which formerly went to North King-street, runs into the main sewer in Upper Dominick-street, and finds its way down Lower Dominick-street, and not long since was used to supply a sort of canal or ornamental water in the centre of the old Mall in Sackville-street, but is now lost in the sewerage of Great Britain-street.

Returning to the topography of Ath-cliath in the legend, its distance from a certain point on the Finglas road, its position at or near the only stream on the north side of the Liffey, the low level of the bottom of that stream, at the site of the village, compared with the levels of the tides in Dublin Harbour, and the fact that at or near the locality thus indicated, we find a wonderful supply of pure spring water, prove, as far as can be desired, not only the locality of the Ath-cliath of the legend, but also indicate the immediate propinquity of the site of the ancient well attributed in the legend to the agency of St. Patrick.

The legend attributes this well to the Saint, though it does not name it after him. It is not distinctly stated that this well was the original well of St. Patrick, but it looks as if the legend contained words which distinctly claimed it to be such, and that the modern editor of the legend in the sixteenth century qualified them, so that little could be deduced from them which would have denied the honours then paid to the "Southern Well of St. Patrick in Dublin," which, in Jocelyn's time, had claims put forward in its behalf as the original well of St. Patrick, which Jocelyn's original text must have in his own day repudiated; and the usage of the term "southern," as applied to the well in or near the present Nassau-street, shows that the editor, in the sixteenth century, only imperfectly understood his business of falsifying and doctoring the old legend to make it fit the then actual condition of things.

Though Jocelyn's legend tells us nothing of the causeway or hurdle road over the ford leading to Dublin city from Ath-cliath, yet his usage of this name in relation only to the village on the north side of the Liffey is pregnant with valuable topographical information, and helps to get us over certain engineering difficulties in which the question of an approach from the north to the city of Dublin was involved.

Everybody can understand what use a hurdle bridge would have been if over the low land, which could at certain times be forded or waded by passengers up to the deep bed of the river. Jocelyn's legend tells us nothing directly of the shallowness of the tide water from Ath-cliath to the bed of the river, but we know that must have been a fact, from the relation of other facts to this, and of this to others, so there can be no doubt about it. Neither does he tell us anything directly about the depth of the river close to the city, or of the force of the retiring tide after leaving the flooded lands above that point on the south bank of the Liffey, above which we cannot suppose the buildings of ancient Dublin to have ever extended. This point is evidently indicated by the old Bridge at the end of old Bridge-street. But both the returning tide and its great force, from the vastly greater quantity of water which in those times must have passed up and downwards in the same time that it passes now, when so much low ground is reclaimed, are indicated by certain events mentioned in the legend, as to the cause of the drowning of the daughter of the King of Dublin, and the drifting of her body to sea by the current.

So that, in one way or another, the number of direct and indirect facts and incidents which exist in Jocelyn's legend exhibit the most distinct knowledge of the topography of ancient Dublin in the twelfth century, or earlier. And, from the statements in favour of the *northern* well having been the *original* well of St. Patrick, it looks as if the original writer of the legend, whether he were Jocelyn or not, had belonged to Mary's Abbey, or to some other of the old religious foundations on the north side of the Liffey; and so he told the legend, to cover, at least, a claim to the well on his side of the river and its waters, to be as good, if not much better, for domestic purposes, than that of the southern well of St. Patrick,—a claim which we are disposed to grant, if the water of Mr. Carton's pump, in Halston-street, be so much better than the water of the southern or famous well of St. Patrick, which we believe it is, because it is used for a vast variety of purposes, for which the spring well water of the neighbourhood of Nassau-street is not fit.

The northern well is now accessible by means of a fine flight of steps, which also lead into a large vaulted chamber or crypt, which lies east and west; and though now, to a great extent, filled up with old sawdust, and timber here stored, has clearly a church character in the semicircular arching of the roof, and the careful finishing of the openings in the roof, to admit light and air, and also in the lateral arches which lead off right and left, like chapels.

It really looks like a church in a catacomb, or crypt, over which a church might have been erected, but over which none appears to have been ever intended, for the openings in the roof are a development of an original idea of the party who constructed the building.

Never having visited the churches in the Roman catacombs, I am unable to follow out the analogies, if such exist, between this structure and those cavities believed to have been used as churches in the Roman catacombs; and, indeed, till the great vault is cleared out, and the vaults adjoining it examined, it would be presumptuous to volunteer any opinion as to the original use of this curious place, which may have been one of a class used for ecclesiastical purposes, as two others like it, with wells, are said to exist in Dublin.

It is worthy of notice, that in Jocelyn's legend there is no remark which would enable one to exactly place or find the old or northern well of St. Patrick, or, if there was in the original text, his editor in the sixteenth century has expunged it. His interests were clearly connected with the southern well, and the doings at it; and hence it is probable he may have ignored facts, which might explain to us the nature and uses of the extraordinary vaulted chamber, near to which the ancient well exists, which we would claim as the ancient or original well of St. Patrick at Ath-cliath, afterwards Oxmantown, and, finally, the northern part of the city of Dublin.

In an economic point of view the author considered the ancient well as the exponent of the natural or original supply of pure spring water, not only of its immediate neighbourhood, but of the surrounding district, probably extending a considerable distance from it, where an abundance of spring water exists,—not so pure as that found in Mr. Carton's pump, near this well, which may now be considered the fountain-head, but pure enough, making allowances for infiltration, &c., as to indicate a connexion with it and many pumps in the north side of Dublin, which have an abundant supply of water, the quality of which appears greatly to depend on the care taken of them, and the extent of their usage.

The notices of the *southern* well of St. Patrick, in Jocelyn's legend, are of little practical application in an inquiry as to the locality of that well, except so far as his notices of the *northern* well are made by his later editor to apply to it, and so ignore the very existence of the other well, where we are to infer, in the sixteenth century, little or nothing of a public nature occurred to attract attention, nor would it have been likely, for at that time those old Irish influences in favour of St. Patrick, and his legends, had been lost or ignored in the neighbourhood of St. Mary's Abbey, near whose limits the ancient well in St. George's-hill was situated.

In the sixteenth century, in its own locality, it may have ceased to be known as St. Patrick's well, or a well dedicated by that Saint to St. John the Baptist. There is a tradition in the neighbourhood, that the

well in George's-hill was latterly dedicated to St. Anne, which may have arisen from the name of a street of this name near it. Were this so, the great vault near it may have been called St. Anne's Church. The name, George's-hill, where the great vault comes close to, may indicate that, at one time, it might have been dedicated to St. George by the English residents in this locality, though at first, the probability is that the well, and the vault near it, if originally intended as a baptistry, or place of worship, may have been dedicated to St. John.

As to the exact locality of the southern well of St. Patrick, which was open, and acknowledged as such, in 1728, when its water ceased to flow, but little need be said, though in 1757, Dr. Rutty, in his Synopsis of Mineral Waters, published in that year, says as much, as if it was then extinct, or could not be found. Its locality was indicated by the name of St. Patrick's-well-lane, which is given to Nassau-street, and Leinster-street, in Brooking's Map of Dublin, dated in 1728, the year the well dried up, though it did not then cease to exist, for we are informed by Mr. Gilbert, in his History of Dublin, that the Corporation made an attempt, in 1731, to restore the well. That, however, appears for several reasons to have been abortive, and very shortly after the well must have fallen into disuse, as Dr. Rutty, whose inquiries about wells in Dublin extended over several years before 1757, did not get access to this well, though he examined wells in its neighbourhood, the water of which he analyzed; while the water of the well in George's-hill, unless he considered it "Mary's Abbey" water, he also failed to notice, possibly because the two wells were hid or preserved in vaults or crypts, which were then in the possession of individuals, who may have denied access to them for some years.

It looks as if the ultra English feelings which appear to have influenced the Corporation of Dublin, and the inhabitants of the neighbourhood of the southern well of St. Patrick, and which led them to change the name of St. Patrick's-well-lane, when the well existed, to Nassau-street, also led them to shut up, or, as it were, hide the well, and make nothing of it, and, especially as it had failed to give that great supply of water which recommended it to the Corporation of Dublin and the citizens, formerly, as a sacred and abundant supply of wholesome spring water. So great was that supply, we may infer from the later version of Jocelyn's legend, that it was considered the *fountain* of Dublin. In 1728, it ceased to have any pretensions to that title, and it does not appear to have recovered itself in 1731, or afterwards.

Judging, however, from many facts stated in the paper, the author concluded that the main supply of water still existed, but that it developed itself lower down the street than before 1728, and might be found now in any quantity in the College Park, Leinster-street, &c., and might be considered as indicated by the main streams from the drainage operations in the College Park, and the numerous excellent pumps, wells, and old baths, which, till lately, existed in this locality, which appears to be placed over a great fracture or crack in the calp rock,

through which the water from the Dublin mountains appears to force itself to the surface of the earth.

The ceasing of the stream or great supply from the old locus of the well of St. Patrick, in St. Patrick's-well-lane, or Nassau-street, and the appearance of so much water at a lower level, in the continuation of the same line of street, may indicate that the crack in the calp rock has closed towards the west, and opened towards the east, from whence, latterly, several overflows of water have occurred without apparent cause, possibly in connexion with slight earthquake pulsations or movements, some of which have been noticed, suggesting the possibility that the change of the locus of the adit of the spring water, which originally took place apparently behind the house No. 9, Nassau-street, has now, in a great degree, gone towards Leinster-street; for the wells behind Nos. 9 and 15, and in Morrison's Hotel, at the corner of Dawson-st.—all claiming, with the well on the opposite side of the street, accessible from the Provost's garden, to be the veritable southern well of St. Patrick—never now overflow, or produce a constant stream, and that a large one, too, which the extant notices of the southern well of St. Patrick lead us to believe existed before 1728; just such a stream of water as, we may infer, runs, in a great measure, to waste into the sewerage of the lower parts of Leinster-street, &c.

It is this supply of water, not long since utilized in the College Park, in the baths, and wells, and the pump wells outside the College walls, we would propose more generally and publicly to utilize, by means of public pumps, to which all might have access. In the same way, we would propose that the water belonging to the ancient supply of the northern well of St. Patrick should be more generally utilized by means of public pumps.

The same plan the author would extend to the immediate locality of the St. Patrick's well, which, till lately, was accessible in the cathedral church of St. Patrick; and also to the waters of all the ancient holy wells in other parts of the city, north and south. And thus it is to be hoped a great public benefit (which has, by sufferance of Mr. Carton, Mr. Anderson, Mr. Lalouette, and others, on the north side of Dublin; and of Mr. Nichols, Mr. Farrell, and others, on the south side; and of the Linen Hall, the College, the Bank, the Mansion House, the Royal Dublin Society, been allowed the public, more or less) should be again put on the ancient footing; and all be allowed free access to the old spring water, which is everywhere so abundant beneath the subsoil of the city.

The general elevation of the "plat" of the city has apparently lowered the overflow levels of the natural springs, the water of which is now generally accessible only by means of pumps, which it is proposed to place in many places of the city, where they may be accessible to all, at all hours, and free from any hindrance of neighbours or others.

Mr. Clibborn concluded with a hope that, if this were done, health, morality, and economy would be greatly promoted within the city; and

that an enormous saving might be effected in the present consumption of pipe water; so that the spring-well water of the several St. Patrick's well districts, as well as that of other ancient well districts in Dublin, might become a great supply of water in aid of that now derived from the Dodder and the Grand and Royal Canals; and the present demand for good drinking water, and water for other purposes, in a great measure, locally, if not generally, met, simply and economically, by the public utilization of the spring-well water of Dublin.

Lord Talbot de Malahide exhibited a peculiarly shaped stone hammer, found at Glencoy, county of Antrim.

Mr. W. R. Wilde exhibited two drawings, representing celts with handles, taken from sculptures on stones near Vannes, Britany.

MONDAY, FEBRUARY 13, 1860.

JAMES HENTHORN TODD, D. D., President, in the Chair.

JOHN KELLS INGRAM, LL. D., was elected Secretary to the Council, in the room of the Rev. J. H. Jellett, resigned; and James Haughton, Esq., was elected a Member of the Academy.

DR. ROBERT M'DONNELL read a paper—

ON THE FORMATION OF SUGAR AND AMYLOID SUBSTANCE IN THE ANIMAL ECONOMY.

AT the meeting of the Academie des Sciences held on the 23rd of March, 1857, Professor Bernard read a memoir upon the physiological mechanism of the formation of sugar in the liver. In this communication he announced the discovery of a particular substance formed by the liver, readily changed into sugar in the presence of certain ferments, and hence named by him "glucogenic matter." He asserted that in animals fed exclusively on meat, the liver, to the exclusion of all other organs in the body, possessed the power of making this substance, a non-azotised compound, analogous to starch, and, like it, convertible into sugar.

Hensen, somewhat prior to Bernard, and quite independently of him, had isolated this substance, the discovery of which, without doubt, constitutes one of the most important facts of animal physiology. Its discovery excited a very lively interest in the scientific world; and physiologists have since very warmly discussed the following questions regarding it:—

1st. Has the liver the power of forming it from azotized compounds?

2nd. Is the liver endowed with the function of converting it into sugar during life and health?

3rd. Has the liver the exclusive privilege of forming it, or is it met with in other tissues and organs?

These questions are among the most interesting and delicate of physiology, and certainly do not bear to be treated of dogmatically.

In the following communication the term "amyloid substance" shall, for reasons elsewhere indicated, be substituted for "glucogenic substance;" and it may be well to state that this is a generic term applied to animal substances having special characters, apparently forming a link between the immediate (azotized) principles of animal structures, and the (non-azotized) vegetable formations, in some varieties presenting the characteristics of starch or dextrine of vegetable origin, yet in others giving unquestionable indications of the presence of nitrogen.

The species of amyloid substance spoken of in this memoir belongs to the former group, and, being free from the intimate admixture of azotized matters, is consequently distinct from the amyloid substance of Virchow, which, although in histological characters analogous to cellulose and starch, yet, as met with in the prostate gland, the spleen, choroid plexus, &c., has not yet been shown to be convertible into sugar capable of fermentation.

The first may be indicated as *the amyloid substance of Bernard*, or (being evidently nearer to the vegetable kingdom), *of first species;* the latter as *amyloid substance of Virchow*, or *of the second species.*

The amyloid substance of Bernard, or of the first species, is a ternary compound isomeric with dried grape sugar. It is a neutral, whitish, inodorous, insipid matter, soluble in water, insoluble in alcohol and strong acetic acid.

In the presence of saliva and other animal ferments it is converted into sugar, which ferments on the addition of yeast, and reduces the cupro-potassic solution; iodine in contact with it produces a peculiar brown coloration, more or less intense, disappearing on the application of heat, and reappearing when the fluid cools below 80°; like dextrine, it causes the plane of polarization to deviate to the right.

It was first obtained by Bernard by treating the boilings of the liver with four or five times its volume of absolute alcohol, and subsequently freeing the precipitate thus formed from azotized matters by boiling it for some time in a concentrated solution of caustic potash. This method is objectionable. The acetic acid process, although not economical, is preferable, and, indeed, is invaluable as a test for the presence of the substance in question in the various tissues of the organism.

The organ or tissue to be examined is boiled in a small quantity of distilled water; the whole is then bruised in a mortar with animal charcoal, thrown on a filter, and some drops allowed to fall into glacial acetic acid. If amyloid substance of the first species is present, it forms a more or less abundant white, flaky precipitate.

Gelatine and casein are not arrested upon the filter by the animal charcoal, but the first is soluble in acetic acid, and the latter, although at first precipitated, is at once re-dissolved by the glacial acid. These substances, therefore, do not interfere where acetic acid is used, but the contrary is the case with alcohol.

If the tissue, while still raw, be pounded in a mortar with animal

charcoal, the albuminoid materials are more completely retained by it upon the filter; but one never can feel satisfied that absolutely no gelatine passes through when fibrous and muscular structures are being examined.

For this reason the acetic acid process seems less subject to error than any of the modifications of the methods in which alcohol and potash are used, and, accordingly, in the following experiments the former has been the process adopted:—

1st. Has the liver the power of forming amyloid substance of the first species from azotized materials? This question may probably be answered in the affirmative. The connexion between this substance and sugar is so close that the question may be made more general. Are saccharine and amylaceous matters formed in the animal economy from azotized matters? Chemists have obtained of late years a great number of results which tend to show that ternary compounds may result from azotized elements. Lehman has obtained it from hæmatine. Dogs fed for many days on meat exclusively are found to have amyloid substance in the liver, and, on being killed, saccharine matter is found sufficiently abundant in the blood and tissue of that organ. Bitches fed exclusively on meat for days continue to form milk containing sugar. I have lately verified the same fact in cats. It is argued, however, that, nevertheless, the amylaceous and saccharine matter enters from without, for that the herbivora find the amylaceous principle in vegetables; that it accumulates in their tissues, and through this channel enters the organisms of the carnivora; that, in short, while the bitches and cats are secreting milk, they are obtaining starchy materials from whence to elaborate the sugar of it from the meat on which they live.

That this is not the case, may be argued from the following experiments:—

First experiment:—Six samples of mutton were obtained, as fresh as possible, and treated as follows: two ounces of each chopped up and boiled in one ounce of distilled water for half an hour; the whole bruised in a mortar, and made into paste with animal charcoal; the paste, placed in a filter, was washed with boiling distilled water, merely enough to allow a small quantity to pass through, which was let drop into a test-tube containing glacial acetic acid. In no one of the six instances did any precipitate of amyloid substance result.

Second experiment:—Six samples of beef, obtained quite fresh, were similarly treated. In no one instance did any precipitate of amyloid substance result.

Third experiment:—The flesh of two rabbits was thus treated: the hind quarters chopped up; boiled for some hours in as much water as was sufficient to bathe the whole; the highly gelatinous broth strained off and evaporated to a small bulk, mixed with animal charcoal, placed in a filter, and washed with boiling distilled water, so that a few drops were yielded, which were allowed to drop into glacial acetic acid. A small amount of a white substance was precipitated, which did not give with iodine the characteristic reaction. The fluid obtained from the

filter was, of course, highly gelatinous, and gave an abundant precipitate when dropped into absolute alcohol.

Fourth experiment:—Mutton, beef, veal, and rabbit flesh was treated thus: of each two ounces were pounded to pulp in a mortar, thoroughly mixed with one ounce of distilled water; the expressed fluid boiled, filtered, and placed in tubes over mercury, with yeast; equal portions of the same meats, when reduced to pulp, were mixed with saliva, and for some time kept at a temperature between 100° and 120°; subsequently, one ounce of distilled water was added to each of the expressed fluids, boiled, filtered, and placed in tubes with yeast, as the rest. In all a little more carbonic acid gas was formed than in the tube (always used as a corrector), containing an equal quantity of yeast, placed in distilled water. The meat, mixed with saliva, did not give more than that to which no saliva had been added, as it should have done did the meat contain amyloid substance convertible into sugar by contact with saliva.

Is the liver endowed with the power of converting its amyloid substance into sugar during life and health? This question is answered differently by some of the most eminent living physiologists. In taking one side, therefore, I do so with the greatest diffidence, feeling strongly the great delicacy of the question. It seems to me that there is, on the whole, evidence that the amyloid substance met with in the liver is, as it were, on its way upwards towards the more exalted or complex immediate animal principles, and that its conversion into sugar is not its normal destination; that the process of healthy assimilation tends, if the expression may be used, to promote it from the rank of ternary to that of quaternary compounds; and that its transition into sugar is, therefore, a deviation from this progressive course—a dissimilative instead of an assimilative process.

No one now doubts that if an animal, which has been fed for some time exclusively on meat, is killed by pithing, that, although no sugar exists in the portal blood, it is found in the hepatic; but it is doubted by some whether this glucogenesis is a perfectly normal process going on during life. In making experiments on the tissue of the liver immediately after death, no matter what rapidity, precision, and care are exercised, it must be confessed that results are met with which seem contradictory. However, the object being to ascertain the condition of the hepatic blood during life, I have had recourse to catheterism of the right side of the heart—an operation which, in the hands of others, has given results corresponding with those to which I now allude.

1st. In twelve experiments made on dogs, for some weeks before fed exclusively on meat, traces of sugar were found in the blood of the right side of the heart in five; there was no sugar discoverable in the blood of the remaining seven.

2nd. In four rabbits fed on boiled eggs, meat, and butter, for some days, no sugar was detected in the blood drawn from the right side of the heart.

3rd. In three dogs fed on mixed diet, and three rabbits fed on car-

rots, potatoes, &c., sugar was found in the blood of the right side of the heart, and in equal quantity in the blood taken from the carotid.

4th. In three rabbits fed on vegetables, sugar was found in the blood of the right side of the heart, drawn during life; but double, and in one instance more than treble the amount, was found in the blood sucked from the same locality after the animals were killed (one by pithing, two by hydrocyanic acid).

Hence one seems in some degree justified in concluding that in vegetable-eating animals the blood is normally saccharine, but that the liver does not appear during life to form and pour out into the blood of the hepatic vessels sugar specially derived from the transformation of the amyloid substance into that material.

The fact that fibrine is deficient in the blood leaving the liver, does not militate against the view that the amyloid substance is a matter in progress of assimilation towards becoming an azotized material; it may lead to the supposition that the fibrine is destroyed in the liver by parting with some of its nitrogen to combine with the ternary compound.

Lastly, has the liver the special privilege of making, to the exclusion of other organs and tissues, the amyloid substance of the first species?

It is now satisfactorily known that it has not: and the facts recently brought forward upon this point are, perhaps, the most conclusive evidence which can be offered that this amyloid substance is related to the tissues in which it is found rather as a reparative material, or protoplasma, than as one formed for special transformation into sugar.

Amyloid substance of the second species has been found in various forms, widely diffused throughout the animal organism, either as normal or morbific deposits; in the form of tunicine, identical in composition with cellulose uncombined with azote; as chitine consisting of cellulose in union with a proteic compound, it has been caused to ferment by Berthelot; while, as met with in the prostate, spleen, choroid plexus, and, in what is known as amyloid degeneration of many organs, it has as yet resisted all attempts to change it into fermentescible sugar. This, probably, is on account of its intimate admixture or chemical union with azote, and the analogy, therefore, comes to be striking between this matter and the azotized fats of nervous centres (cerebrine).

It is, however, the existence of the first species of amyloid substance in other organs and tissues than the liver to which the present question refers, and with regard to which the following facts are before us:—

1st. Amyloid substance (*of the first species*) of Bernard, is abundant in the liver: much more so in animals fed on saccharine and amylaceous food than in those fed on meat—diminishing rapidly in quantity in the livers of animals not fed at all for some days, except in the case of hybernating animals, when it is found in quantity many days after the animal is asleep.

2nd. It is found in the placenta, most plentiful, about the third and fourth months of utero-gestation.

3rd. It exists in the lung and muscles of the fœtus, as well as in the epithelial cells of the skin, respiratory and digestive organs.

4th. It is beautifully seen in the cells of the formative material of the soft horn of the foot of the fœtal calf.

(5th. It is met with in the muscular flesh of healthy horses?)

6th. In the cartilage of the embryo of the chick.

7th. In the muscles and lungs of hybernating animals.

8th. In muscles paralyzed in consequence of section of their motor nerves.

9th. Although easily separable from the liver tissue by boiling water, it does not in its natural (raw) state produce with iodine its characteristic reaction.

This last is one of the fundamental points which leads to the notion that in this organ it gets into union, more or less intimate, with some azotized compound, and passes from the order of starch to that of proteic compounds in its normal assimilative progress.

That the retrograde process, destructive assimilation, or disassimilation of the muscles, &c., is, under certain circumstances, accompanied by the production of sugar, lactic acid, and inosite, all non-nitrogenous, is corroborative of the same view.

Rev. Charles Graves, D. D., read a paper "On a hitherto undescribed class of Monumental Stones found in Ireland," supposed by him to be maps; and in the course of the paper he established a law of alignment of the raths, duns, and lisses, which are found to be, in general, three by three in straight lines in all parts of Ireland.

MONDAY, FEBRUARY 27, 1860.

JAMES HENTHORN TODD, D. D., President, in the Chair.

IT was resolved, on the recommendation of the Council, that the Committee of Publication be restored, pursuant to Chapter IX. of the By-Laws, some time repealed; that the Committee of Publication shall meet the day following each meeting of the Academy; and that it shall be part of its duty to decide as to whether the papers read to the Academy shall appear in the Proceedings or in the Transactions.

The following is chapter ix. of the By-Laws, now re-enacted:—

"I. That a Committee be formed, corresponding to the Committee of Publication of the Royal Society.

"II. That the Committee shall consist of seven members—three from the Committee of Science, and two from each of the other Committees.

"III. That it shall be the duty of this Committee—

"1. To report to Council on all papers offered for publication in the Transactions.

"2. To superintend the final correction of the press, and to see that the printing and engraving are executed in a manner creditable to the Academy.

"3. To arrange all details connected with the printing and publication of the Transactions of the Academy and the Proceedings.

"IV. That the Committee of Publication shall have liberty to call in any member of the Council or Academy to assist them in reading or judging of any paper."

Rev. Charles Graves, D. D., concluded his paper, commenced at the last meeting, "On the Disposition of the Ancient Raths and Lines of Road in Ireland."

John Francis Waller, LL. D., one of the Secretaries of the Royal Dublin Society, made a formal deposit, on the part of that body, of a number of Irish antiquities, to the Museum of the Royal Irish Academy, the preliminaries of which had been arranged between the officers and councils of both institutions some time ago.

Mr. Wilde proposed, on the part of the Academy, the special and marked thanks of that body to the Royal Dublin Society for the valuable deposit which had just been made, and for the liberal manner in which that institution had acted in the transaction—a liberality which he, as well as Dr. Waller, believed would act as a stimulus to other public bodies, whose museums contained some specimens of Irish antiquities, of little value in their isolated condition, but of great importance to a national collection. Mr. Wilde explained that collections such as that of the Royal Dublin Society, or even individual specimens, were most valuable to the Museum of the Academy, as filling up blanks or connecting links in the chain of species, explaining the objects and uses of other articles in the Collection, illustrating varieties of art, and by their number showing how such things were in "common use" in former times. He dwelt upon the benefits which the reciprocity of Societies like those in Kildare-street and Dawson-street would produce to science and the country. He believed the Royal Irish Academy had taken the initiative in this matter sixty years ago; and said, from several entries in the minute-books of the Academy, the Council, and the committees, as well as from the number and character of the donations presented, it was quite manifest that it was the original intention to have a museum of some kind—possibly a general one, including articles illustrative of the three different sections of the Academy, as may be seen from the list of presentations prefixed to the fifth volume of the Transactions, consisting, besides the antiquities specified, of fossils and mineralogical specimens, ores, and examples of woods, engravings, and even stuffed birds. It appears that about the year 1801 it was thought advisable to confine the collection within certain limits, as may be gleaned from the following circumstances:—The Rev. Charles O'Connor having presented some Italian fossils, with a catalogue, the Rev. George Graydon some fossil fish from Montebolca, and the Right. Hon. William Conyngham having given the Academy a collection of hard woods, General Vallancy, on the part of the Royal Dublin Society, addressed the following letter to the President of the Academy, Dr. Kirwan, on April 2, 1801:—

"Sir,—The Dublin Society having purchased a very fine collection of fossils by your recommendation, which is regularly classed under

your care and directions, in a Museum open at all times to the public, and this collection being deficient in volcanic productions, have requested me to make this application to the Royal Irish Academy, over which you preside. The Dublin Society have been made acquainted that the Academy is in possession of a numerous collection of volcanics, presented by the Rev. Mr. Graydon. It is by his consent that this application is made to the Academy, requesting the favour of this collection being added to the Museum of the Dublin Society, which then will be as perfect as most collections in Europe.

"The Society also request of the Academy the specimens of hard woods presented by Mr. Conyngham; and if to these they would be pleased to add the cast of Lackshimi,* for the use of the Academy of Figures of the Dublin Society, it would be pleasing.

"If the Royal Irish Academy will consider that the funds of the Dublin Society enable them to pay a professor to lecture on mineralogy, and servants to keep their museum in order and to show them to the public, it must be evident that knowledge will be more diffused—the great desideratum of the Academy—by these things being in the Society's Museum than in the house of the Academy; and this consideration alone has induced the Society to make the request."

By a resolution of Council it was agreed that the volcanic specimens and hard woods "should be lent to the Dublin Society, a receipt being taken acknowledging them to be the property of the Royal Irish Academy, and to be removable at pleasure." And upon April 20, 1801, it was resolved—"That it is the opinion of Council that the collection of volcanic specimens and of hard woods should not be separated from the Leskean collection whilst it is accessible to the public"—so that the Academy virtually presented that collection to the Dublin Society. The latter body, by a letter dated May 2, agreed to "accept of the donation upon the conditions expressed."

Some of these fossils were engraved for the Academy and figured in the fifth volume of the Transactions, and are still preserved in the Dublin Society's collection. When arranging the Museum for the reception of the British Association, three years ago, Mr. Wilde felt the want of a single specimen of an ancient boat, although more articles of that description —carved out of single trees—had been found in Ireland than in any other country in Europe. Knowing, also, that the Royal Dublin Society possessed two specimens of such boats, and having learned the feelings of some of its most influential members on the subject, he induced the Council of the Academy to ask them from that body. The answer evinced the most liberal spirit on the part of the Royal Dublin Society, who, as trustees for public property, could not absolutely give those things away; but they agreed to "deposit" them with us upon a receipt

* The Indian idol now in the Tea-room of the Academy, and described in one of the early volumes of the "Transactions."

somewhat similar to that which they gave the Academy for its valuable collection of "volcanics" in 1801. The Council of the Dublin Society not only acceded to our request, but, in the most liberal manner, offered us (on certain conditions) all that valuable collection of Irish antiquities, amounting to 104 articles, now brought under the notice of the Academy.

Mr. Clibborn and Mr. Wilde were appointed by the Council to effect the transfer of these antiquities. Some explanation should be offered as to the length of time which has elapsed since the arrangements were made between the two Societies. First, a selection of them, made by the late Mr. Kemble, was exhibited at the Manchester Exhibition, in 1857, where they were almost the only articles of their class, and where, for the cause of archæology, it is to be regretted, they did not appear to attract the slightest notice. The year following they were exhibited in the new Museum of the Royal Dublin Society, and were afterwards sent to the Art Exhibition in Limerick. Difficulties also arose on the part of the officers of the Dublin Society, owing to the Museum of that body being in the transition stage from the old house to the new, so that the transfer of the whole of these antiquities was only completed within the last two months.

The resolution was seconded by the Rev. Dr. Carson, and passed unanimously.

Mr. Wilde exhibited to the meeting the various articles deposited by the Dublin Society, consisting of ancient weapons and tools of stone, copper, and bronze; belts, swords, spears and battle-axes; ornamented brazen cauldrons, bridle-bits and enamelled head-stall ornaments; wooden vessels, bog-butter, antique shoes, bronze pins, and fibulæ, and a magnificent silver brooch with an Ogham inscription, which, together with a bronze-handled dagger, were considered to be unique. The uses of several of the articles were explained. He also exhibited the "bog man," which was found in the county of Galway in 1821, completely clad in deer-skin, beautifully sewn together with fine gut. Mr. Wilde mentioned that Dr. Petrie had described the circumstances under which this body was found, in the "Dublin Philosophical Journal" for 1825; but, he regretted to say, it was not now in the same state of preservation as when first brought under the notice of the public.

Mr. Wilde presented, on the part of Viscount Castlemaine, an antique bronzed winged celt or palstave, found near Glasson, in the neighbourhood of Athlone; and from Thomas B. Huthwaite, Esq., a bronze socketed celt, and an ancient bronze spear-head, found some years ago in the neighbourhood of Tullamore.

The following is the list of articles deposited by the Royal Dublin Society:—

7 stone celts; 2 stone punches; 1 stone hammer-axe; 2 small perforated touchstones; 2 small soapstone rings; 1 large Kimmeridge-coal ring; 4 urns, with fragments of some others; 2 ancient single-

piece boats; 1 wooden single-piece vessel, in process of formation; 1 ancient leather shoe; 2 pieces of bog-butter; 12 plain metal celts (4 copper and 8 bronze); 17 bronzed winged celts, or palstabs; 13 socketed bronze celts; 2 bronze gouges; 2 bronze armour rings; 1 large solid bronze ring, or armlet; 1 bronze engraved sword-blade; 1 bronze dagger, with metal handle attached; 1 curved bronze battle-axe; 2 bronze spears; 1 ancient bronze spoon; 2 bronze sliding-keys; 1 large, decorated bronze cauldron; 2 shoe-shaped bronze plates; 2 bronze bridle-bits; 4 bronze headstall ornaments; 1 bronze model of gold torque; 1 plain bronze pin; 3 bronze ring-pins; 3 bronze spring brooches; 2 whole and 1 half silver bracelets; 1 perfect angular ditto; 1 massive silver brooch, with Ogham inscription; 1 large silver ring-brooch, wanting pin; 1 highly decorated ring-brooch, wanting pin, of white metal, covered with gold plate; 1 human figure in skin dress.

Mr. Wilde also exhibited, on the part of—

John Murray, Esq., of Edenderry: a bone pick; and a flint arrow-head, attached to its wooden shaft by a fastening of gut.

The thanks of the Academy were given to Lord Castlemaine, Mr. Huthwaite, and Mr. Murray.

STATED MEETING, FRIDAY, MARCH 16, 1860.

JAMES HENTHORN TODD, D. D., PRESIDENT, in the Chair.

THE Secretary of the Council read the following Report from the Council:—

REPORT.

WHEN the last Annual Report was prepared, the following Papers were nearly ready for publication in the Transactions of the Academy:—Mr. Jukes and Professor Haughton, on the Lower Palæozoic Rocks of the South-East of Ireland; Lieutenant Renny on the Constants of the Barometric Formula, and a Postscript to the same. These have since been completed, and are included in the Twenty-third Volume of the Transactions, which has been issued to the Members.

In addition to these Papers, the Volume contains the following, which had been printed before the date of the last Report:—

IN THE DEPARTMENT OF SCIENCE.

Mr. Donovan on Galvanometric Deflections producible by Attrition and Contact of Metals.

Mr. Haughton's Discussion of the Tidal Observations made by direction of the Academy, in 1850–51.

Mr. Mallet on the Construction of Artillery.

Mr. Salmon on the Degree of the Surface Reciprocal to a given one.

Mr. Forster on the Molecular Formation of Crystals.

Dr. Robinson on the Lifting Power of the Electro-Magnet. Part III.

Dr. Lloyd on the Intensity of the Earth's Magnetic Force.

Dr. Kinahan on the Genus Oldhamia.

IN POLITE LITERATURE.

Dr. Hincks on the Personal Pronouns of the Assyrian and other Languages.

Dr. Wills on Dreams.

Dr. Hincks on a Tablet in the British Museum in Cuneatic Characters.

IN ANTIQUITIES.

The President on an ancient Irish Missal, now in the collection of Lord Ashburnham.

The Twenty-fourth Volume has been commenced by the printing of Dr. Lloyd's Paper "On the Light reflected and transmitted by thin Plates."

The Academy, on the recommendation of the Council, has lately re-established the Committee of Publication. To this body all questions relating to the printing of the Transactions and Proceedings of the Academy will be in the first instance referred; and it is hoped that under their superintendence the Papers read before us will in future be issued to the Members with greater promptitude and regularity.

Arrangements have also been made for the wider circulation of our Transactions among the learned Societies of Great Britain, and of foreign countries. The Scientific, Literary, and Antiquarian portions will for the future be published separately, and transmitted respectively to the learned bodies which occupy themselves with those several departments of research.

The Academy has received during the past year many interesting and valuable communications, of which abstracts or notices have appeared in the Proceedings.

In Mathematics we have had Papers from Sir William R. Hamilton, Professor Graves, and Mr. Carmichael.

In the Sciences of Observation and Experiment, from Dr. Lloyd, Mr. Jukes, Mr. Graham, Mr. Haughton, Mr. B. B. Stoney, Dr. Hancock, and Dr. Robert M'Donnell.

In Polite Literature, from Dr. Graves, Dr. Hincks, and Mr. Wilde.

In Antiquities, from Dr. Reeves, Mr. Wilde, Mr. Clibborn, Dr. Kinahan, the Archdeacon of Ardfert, the President, Mr. Du Noyer, and Dr. Graves.

The progress of the Catalogue of the Museum was delayed for want of funds during the greater part of the past year. A letter having been addressed by the President to the Lord Lieutenant on the subject, his Excellency kindly interested himself in procuring the assistance of the Government towards the completion of the work, and the Lords Commissioners of her Majesty's Treasury were induced to grant the sum of £200 towards that object. Members of the Academy have subscribed upwards of £160 for the same purpose; and the sum of £8 10*s.* has been received from sales of Part I. since the 31st of March last. The manuscript of a further portion of the Catalogue, containing the descriptions of articles composed of animal materials, has been laid before the Council, and will, it is hoped, be published before the end of the Session.

The Council desire to express their grateful appreciation of the services rendered by Mr. Wilde in the preparation of this important work. That gentleman has devoted, and continues to devote, a large portion of his valuable time and labour to the task. He has, moreover, since the period of our last Report, made a tour through Scandinavia and Northern Germany, for the express purpose of obtaining information respecting the great collections of national antiquities which have been formed in those countries. He believes that the knowledge he has thus acquired will assist materially in the preparation of the forthcoming portion of the Catalogue; and he is also of opinion that the relations which he has succeeded in establishing between the Directors of Foreign Museums and this Academy will be found most useful in promoting friendly communications, and leading to the interchange of drawings, models, and typical specimens of antiquities.

The Royal Dublin Society have deposited in the Museum of the Academy such articles in their collection as were illustrative of Irish history and antiquities. We trust that the example of their enlightened liberality will have due weight with other public bodies, or individuals, who may have in their possession similar objects interesting to the antiquary; and that they will recognise the propriety of depositing all such relics in the Museum of this Academy, which would thus become what it is our ambition to make it—a complete repository of all the existing monuments and memorials of the Hiberno-Celtic race. It is to be observed that, by intrusting their antiquities to the keeping of the Academy, the possessors will in no degree surrender or compromise their rights of property.

We are indebted to Mr. Hardinge and Dr. Reeves for the commencement of a very useful undertaking, in accordance with a plan proposed by the former of those gentlemen. We allude to the Register of Antiquities, which has been drawn up for the period commencing with the 1st of January, 1859. It is intended that immediately on the acquisition, by gift or purchase, of any article for our Museum, all the particulars respecting it which it is desirable to place on record shall be at once noted down, and afterwards transferred to the Register, in which they will be preserved without risk of loss, and will be always accessible for purposes of identification and of antiquarian research. A mass of authentic materials will also thus be gradually accumulated, which will greatly facilitate the continuation of the Catalogue at a future time.

The Academy are aware that a considerable body of Tidal Observations, of great scientific value, was made some time since at various stations on the coast of Ireland, the cost being defrayed by the Academy. The first Part of these observations was published in Volume XXIII. of the Transactions, together with a discussion of them by Professor Haughton, in which some highly interesting results were arrived at. Dr. Carson has presented to the Council the liberal donation of £50 towards the publication of the remaining observations; Professor Haughton has, at our request, undertaken to edit this Second Part, and it is hoped that ere long it will be placed in the hands of the Members.

With regard to the finances of the Academy, the Council have the pleasure of stating that they are in a satisfactory condition. All liabilities have been discharged up to the latest period; the funded property has been slightly increased by the investment of the Life Compositions, in accordance with the Rule to that effect; and the Treasurer hopes that the balance to be carried over, after the closing of the accounts on the 31st inst., will be larger than that of last year.

It has been thought desirable to insulate the Museum and Library from the rest of the premises occupied by the Academy, in order to guard, so far as possible, against the extension of fire which might originate in the dwelling-house. With this view, the Board of Works is at present constructing iron doors to separate the Library and Museum from the remainder of the building.

The President, in his inaugural Address, called attention to the necessity of preparing a new edition of the Laws and Statutes of the Academy. From the frequent partial changes which have been made in them, it is, in some cases, difficult to determine whether or not a particular provision has been repealed, or still continues in force. The Council have undertaken, and made considerable progress towards completing, a systematic revision and consolidation of the entire body of our Statutes. It would greatly facilitate this useful operation, if the Academy would intrust the Council with power to classify and re-arrange the Laws, and to introduce such changes of expression as will not alter the substance or sense. The Council would thus be enabled, without much difficulty, to submit, for the acceptance of the Academy, a complete and self-consistent code.

The Academy has lost by death during the past year seven Members, viz.:—

Francis Barker, M. D.; elected 9th January, 1837.
Hugh Carlile, M. D.; elected 13th May, 1850.
Henry Grattan, Esq.; elected 24th August, 1857.
Henry Hutton, Esq.,; elected 28th February, 1825.
Rev. Dionysius Lardner; elected 16th March, 1820.
Robert M'Dermott, M. D.; elected 9th June, 1856.
William F. Montgomery, M. D.; elected 28th April, 1828.

And three Honorary Members, viz.:—

Baron Alexander von Humboldt.
Washington Irving, Esq.
Right Hon. Lord Macaulay.

Nine Members have been elected within the year, viz.:—

F. Clarke, M. D.
E. A. Conwell, Esq.
Rev. B. Dickson.
William Foley, M. D.
James Haughton, Esq.
W. D. Moore, M. B.
Captain A. M. Moore
A. J. R. Stewart, Esq.
Laurence Waldron, Esq., M. P.

No Honorary Members have been elected.

It was Resolved—That the Report of the Council be adopted, and that the Council be authorized to act on the recommendation of the Report in reference to the By-Laws of the Academy.

The ballots for the annual election of President, Council, and Officers having been scrutinized in the face of the Academy, the President reported that the following gentlemen had been duly elected:—

President.—James H. Todd, D.D.

Committee of Science.—Rev. George Salmon, D.D.; Rev. Samuel Haughton, M.A.; William H. Harvey, M.D.; Rev. J. H. Jellett, M.A.; Robert W. Smith, M.D.; Rev. Joseph A. Galbraith, M.A.; Rev. Humphrey Lloyd, D.D.

Committee of Polite Literature.—Rev. W. H. Drummond, D.D.; Rev. Charles Graves, D.D.; John Kells Ingram, LL.D.; Rev. Samuel Butcher, D.D.; Rev. Joseph Carson, D.D.; John F. Waller, LL.D.; Digby P. Starkey, Esq.

Committee of Antiquities.—George Petrie, LL.D.; Charles Haliday, Esq.; John T. Gilbert, Esq.; Rev. William Reeves, D.D.; Lord Talbot de Malahide; Eugene Curry, Esq.; William R. Wilde, Esq.

Treasurer.—Rev. Joseph Carson, D.D.

Secretary of the Academy.—Rev. Charles Graves, D.D.

Secretary of the Council.—John Kells Ingram, LL.D.

Secretary of Foreign Correspondence.—Rev. Saml. Butcher, D.D.

Librarian.—Rev. William H. Drummond, D.D.

Clerk, Assistant Librarian, and Curator of the Museum.—Mr. Edward Clibborn.

The President nominated, under his hand and seal, the following Vice-Presidents:—Rev. George Salmon, D.D.; Lord Talbot de Malahide; Rev. J. H. Jellett, A.M.; Rev. Samuel Butcher, D.D.

MONDAY, APRIL 9, 1860.

James Henthorn Todd, D.D., President, in the Chair.

Mr. G. Johnstone Stoney read a paper "On the Rings seen when viewing a luminous point through striated specimens of Calc Spar."

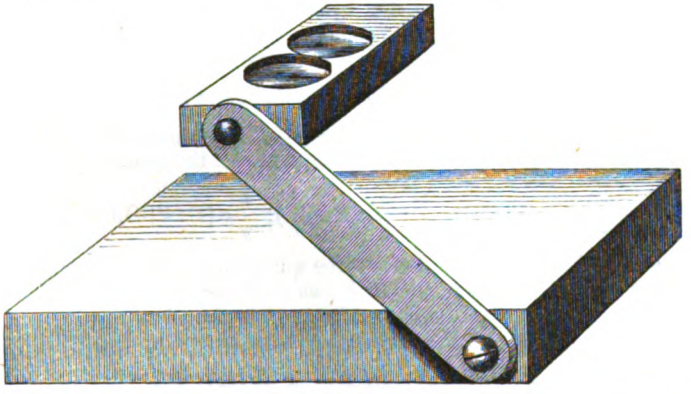
Mr. G. J. Stoney also described—

AN EASILY CONSTRUCTED STEREOSCOPIC MAGNIFIER OF LOW POWER.

Two lenses, of from $1\frac{1}{2}$ to 3 inches' focus, mounted in the simple manner represented in the figure, have proved a very useful instrument for many purposes.

The lenses are to be selected of exactly equal focal length; they are then to be placed as close together as possible, and inclined in their cells, so that their axes may converge to a point a little short of the

distance of their principal focus. The object to be viewed is, of course, to be placed where these axes intersect, and the head raised so far above the instrument that the eyes, when directed towards the object, may look through the *centres* of the two lenses. This will require the eyes to be raised about three inches above the lenses. The object will be then seen standing out in the strongest stereoscopic relief, showing many details which cannot otherwise be seen with the same power; and enabling dissections to be made with the greatest ease.



The inclination of the axes of the lenses should not exceed an angle of about 25°, which requires, if the lenses be of large aperture, that a small segment of each be ground away where they are in contact. Another essential condition is that the line in which the planes of the lenses intersect be perpendicular to the line joining their centres. The degree to which this has been attained may be readily tested by viewing a window-bar by reflection in the mounted lenses; and if the adjustment prove defective, it may be rendered complete by paring one of the cells in which the lenses lie. A pencil line should be drawn down the middle of the board or box which forms the foot of the instrument, to mark where the object is to be placed.

There are two advantages in having the lenses mounted so close together that the eyes need to be withdrawn to some distance in using them. It prevents any sensible squint, and it enables parts of the object much nearer than the focus of the lenses to be seen distinctly, simultaneously with the more remote parts. The result is, that the stereoscopic effect is complete, and that the feeling of perfect tranquillity in the eyes enables the instrument to be used for any length of time without a sense of strain.

While working with an instrument of this kind there is a tendency from natural associations to bring the eyes gradually too close. This should be checked from the first, and the habit will soon be conquered.

SIR WILLIAM R. HAMILTON read a paper—

ON ANHARMONIC CO-ORDINATES.

1. LET ABC be any given triangle; and let O, P be any two points in its plane, whereof O shall be supposed to be given or constant, but P variable. Then, by a well-known theorem, respecting the six segments into which the sides are cut by right lines drawn from the vertices of a triangle to any common point the three following *anharmonics of pencils* have a product equal to positive unity:—

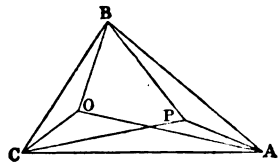


Fig. 1.

$$(A.PCOB).(B.PAOC).(C.PBOA) = +1.$$

It is, therefore, allowed to establish the following system of three equations, of which any one is a consequence of the other two:—

$$\frac{y}{z} = (A.PCOB);\ \frac{z}{x} = (B.PAOC);\ \frac{x}{y} = (C.PBOA);$$

and, when this is done, I call the three quantities x, y, z, or any quantities proportional to them, the *Anharmonic Co-ordinates of the Point* P, with respect to the *given triangle* ABC, and to the *given point* O. And I *denote* that point P by the *symbol*,

$$P = (x, y, z);\ \text{or, } P = (tx, ty, tz);\ \&c.$$

2. When the variable point P takes the given position O, the three anharmonics of pencils above mentioned become each equal to unity; so that we may write then,

$$x = y = z = 1.$$

The given point O is therefore denoted by the symbol,

$$O = (1, 1, 1);$$

on which account I call it the *Unit-Point*.

3. When the variable point P comes to coincide with the given point A, so as to be at the vertex of the first pencil, but on the second ray of the second pencil, and on the fourth ray of the third, without being at the vertex of either of the two latter pencils, then the first anharmonic becomes indeterminate, but the second is equal to zero, and the third is infinite. We are, therefore, to consider y and z, but not x, as vanishing for this position of P; and consequently may write,

$$A = (1, 0, 0).$$

In like manner,

$$B = (0, 1, 0),\ \text{and } C = (0, 0, 1);$$

and on account of these simple representations of its three corners, I call the given triangle ABC the *Unit-Triangle*.

4. Again, let the sides of this given triangle ABC be cut by a given transversal A′B′C′, and by a variable transversal LMN. Then, by another very well known theorem respecting segments, we shall have the relation,

$$(\mathrm{LBA'C}) \cdot (\mathrm{MCB'A}) \cdot (\mathrm{NAC'B}) = +1;$$

it is therefore permitted to establish the three equations,

$$\frac{m}{n} = (\mathrm{LBA'C}), \frac{n}{l} = (\mathrm{MCB'A}), \frac{l}{m} = (\mathrm{NAC'B});$$

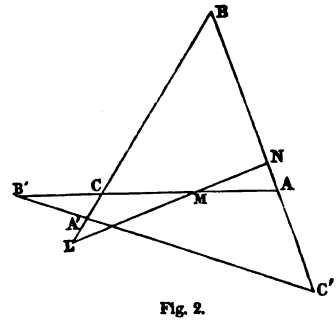


Fig. 2.

where l, m, n, or any quantities proportional to them, are what I call the *Anharmonic Co-ordinates of the Line* LMN, with respect to the given triangle ABC, and the given transversal A′B′C′. And I *denote* the *line* LMN by the *symbol*,

$$\overline{\mathrm{LMN}} = [l, m, n].$$

For example, if this variable line come to coincide with the given line A′B′C′, then

$$l = m = n;$$

so that this given line may be thus denoted,

$$\overline{\mathrm{A'B'C'}} = [1, 1, 1];$$

on which account I call the *given transversal* A′B′C′ the *Unit-Line* of the Figure. The *sides*, BC, &c., of the given triangle ABC, take on this plan the symbols [1, 0, 0], [0, 1, 0], [0, 0, 1].

5. Suppose now that the *unit-point* and *unit-line* are related to each other, as being (in a known sense) *pole* and *polar*, with respect to the given or *unit-triangle*; or, in other words, let the lines OA, OB, OC be supposed to meet the sides BC, CA, AB of that given triangle, in points

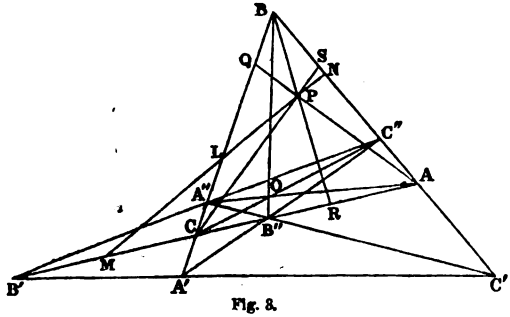


Fig. 3.

A″, B″, C″, which are, with respect to those sides, the harmonic conjugates of the points A′, B′, C′, in which the same sides are cut by the

given transversal A′B′C′. Also, let the variable *point* P be situated upon the variable *line* LMN; and let Q, R, S be the intersections of AP, BP, CP with BC, CA, AB. Then, because

$$(BA'CA'') = (CB'AB'') = (AC'BC'') = -1,$$

we have

$$\begin{cases} -\frac{m}{n} = (LBA''C), -\frac{n}{l} = (MCB''A), -\frac{l}{m} = (NAC''B) \\ -\frac{n}{m} = (LCA''B), -\frac{l}{n} = (MAB''C), -\frac{m}{l} = (NBC''A); \end{cases}$$

as well as

$$\begin{cases} \frac{y}{z} = (QCA''B), \frac{z}{x} = (RAB''C), \frac{x}{y} = (SBC''A), \\ \frac{z}{y} = (QBA''C), \frac{x}{z} = (RCB''A), \frac{y}{x} = (SAC''B); \end{cases}$$

and therefore,

$$\frac{-lx}{nz} = (MARC); \quad \frac{-my}{nz} = (LBQC).$$

But, by the pencil through P,

$$(MARC) = (LQBC);$$

and by the *definition* of the symbol (ABCD), for any four collinear points,

$$(ABCD) = \frac{AB}{BC} \cdot \frac{CD}{DA},$$

which is here throughout adopted, we have the *identity*,

$$(ABCD) + (ACBD) = 1;$$

therefore

$$(MARC) + (LBQC) = 1,$$

or,

$$lx + my + nz = 0.$$

6. We arrive then at the following *Theorem*, which is of fundamental importance in the present system of Anharmonic Co-ordinates:—

"If the unit-point O be the pole of the unit-line A′B′C′, with respect to the unit-triangle ABC, and if a variable point P, or (x, y, z), be situated anywhere on a variable right line LMN, or $[l, m, n]$, then the sum of the products of the corresponding co-ordinates of point and line is zero."

7. It may already be considered as an evident consequence of this Theorem, that any *homogeneous equation* of the p^{th} *dimension*,

$$f_p(x, y, z) = 0,$$

represents a *curve of the p^{th} order*, considered as the *locus* of the variable *point* P; and that any homogeneous equation of the q^{th} dimension, of the form

$$F_q(l, m, n) = 0,$$

may in like manner be considered as the *tangential equation* of a *curve of the q^{th} class*, which is the *envelope* of the variable *line* LMN. But any examples of such applications must be reserved for a future communication. Meantime, I may just mention that I have been, for some time back, in possession of an analogous method for treating Points, Lines, Planes, Curves, and Surfaces in Space, by a system of Anharmonic Co-ordinates.

8. As regards the *advantages* of the Method which has been thus briefly sketched, the *first* may be said to be its geometrical *interpretability*, in a manner *unaffected by perspective*. The *relations*, whether between *variables* or between *constants*, which enter into the formula of this method, are *all projective;* because they *all* depend upon, and are referred to, *anharmonic functions*, of groups or of pencils.

9. In the *second* place, we may remark that the great principle of *geometrical Duality* is recognised from the very outset. Confining ourselves, for the moment (as in the foregoing articles), to figures in a *given plane*, we have seen that the *anharmonic co-ordinates* of a *point*, and those of a *right line*, are deduced by processes absolutely *similar*, the one from a system of *four given points*, and the other from a system of *four given right lines*. And the *fundamental equation* ($lx + my + nz = 0$) which has been found to *connect* these *two systems* of co-ordinates, is evidently one of the most perfect *symmetry*, as regards *points* and *lines*. An analogous symmetry will show itself afterwards, in relation to points and planes.

10. The *third advantage* of the anharmonic method may be stated to consist in its possessing an *increased number of disposable constants*. Thus, within the plane, *trilinear* co-ordinates give us *only six* such constants, corresponding to the *three* disposable *positions* of the *sides* of that assumed *triangle*, to the perpendicular distances from which the co-ordinates are supposed to be proportional; but *anharmonics*, by admitting an *arbitrary unit-point*, enable us to treat *two other constants* as disposable, the *number* of such constants being thus raised from *six* to *eight*. Again, in *space*, whereas *quadriplanar* co-ordinates, considered as the *ratios of the distances* from *four assumed planes*, allow of only *twelve* disposable constants, corresponding to the possible selection of the *four planes of reference*, *anharmonic co-ordinates*, on the contrary, which admit either *five planes* or *five points* as *data*, and which might, therefore, be called *quinquiplanar* or *quinquipunctual*, permit us to dispose of no fewer than *fifteen constants as arbitrary*, in the general treatment of *surfaces*.

(*To be continued.*)

Rev. Dr. Reeves read a paper—

ON MARIANUS SCOTUS, OF RATISBON.

It is worthy of observation, that our native annals, which are so full and minute in recording the names of ecclesiastics who became distinguished at home, utterly ignore the existence of those who went abroad. The memory of St. Gall, St. Columbanus, and St. Cataldus are engraved on the map of Continental Europe;* St. Fiacra is stereotyped in the language of France;† St. Fridolin is blazoned on the banners and arms of Glarus;‡ St. Coloman, an Irish monarch's son, is patron saint of Lower Austria;§ Franconia glories in the Irish Kilian: yet not one of these worthies finds a place in the Annals of Tighernach, of Ulster, or the Four Masters. For this silence of the annalists there are two ways of accounting. In the first place, the early tide of missionary emigration from Ireland was entirely eastwards, and for centuries there was little or no reflux. The pilgrims found in central Europe abundant occupation for the residue of their lives, and there established a home for themselves, either in the martyr's grave or in the hearts of the people. In this manner, having abandoned their native country in early life, ere they had made a name, and all intercourse with it being at an end, they were soon forgotten.

In the second place, the nature of our annals demanded such silence, and thus what at first might be judged a defect becomes an internal testimony of their truth. *They admitted nothing on hearsay.* I do not, indeed, mean to assert that Tighernach, Cathal Maguire, or the O'Clerys were not copyists, or that they witnessed all which they record. But this I say, that each successive compiler transferred and embodied the matter of various collateral and well-authenticated originals, in which generations of scribes had in the great monasteries noted down, as in a day-book, particular events as they occurred; which records were preserved on the spot where they were written. We can easily draw the picture of an enterprising and diligent scribe, starting from his monastery with his leathern wallet on his back, to take a circuit of the kindred institutions of his province, in order to make an authentic compilation from original entries, for the benefit of his own institution, either with a view to increase its literary stores, or repair the damage done by that minister of oblivion—fire. In such compilations the names or acts of those who had abandoned their country were not likely

* The city and canton of *St. Gall*, in Switzerland; the town of *San Columbano*, near Pavia, in the district of Lodi; and the town of *San Cataldo*, in the south of Italy, near Otranto, are geographical monuments of the Irish.

† *Fiacre*, a 'hackney coach.' See Du Plessis, tom. i., p. 683, note 29; Menage, "Dict. Etymol.," voc. *Fiacre*, tom. i., p. 589.

‡ An engraving of the canton seal, where he is represented in his pilgrim's garb, may be seen in the *Mittheilungen der antiquarischen Gesellschaft in Zurich*, vol. ix., part 1, tab. 12, No. 10.

§ He was son of Maelsechlann Mor, sovereign of Ireland, 979 (Ulster Jour. Archæol., vol. vii., p. 297).

to find a place. And, even in the middle ages, when the diffusion of Christianity, with its attendant civilization, brought round a closer connexion and increased intercourse between the pilgrims and their brethren at home, the old principle continued to operate, and the annals ran on, not as records of *the Irish*, but *of Ireland;* so much so that, among all the Irish foundations on the Continent, and all their exclusive congregations, I can discover but three names that have found their way into our domestic records, and these, of individuals who were high in office and celebrity before their departure.

At 784 the Four Masters record the death of "Ferghil, the Geometer, Abbot of Achadhbo, in Germany, in the 13th year of his episcopate." This was the celebrated Virgilius, who became Bishop of Salzburg. The Annals of Ulster, at 788, simply say:—*Feirgil abb Acaidboo moritur.*

At 1042 the Annals of Ulster and Four Masters relate that "Ailell, of Mucnomh, Superior of the Irish monks in Colonia, died."*

Lastly, at 1085, according to the Four Masters, "Gilla-na-naemh-Laighen, illustrious Bishop of Glenndaloch, and afterwards Superior of the monks in Wurzburg, died on the 7th of April."†

High in honour abroad, though forgotten at home, were the two Mariani, each of whom bore the designation of *Scotus*, and who, on account of the identity of their assumed names, have by many distinguished writers been treated of as but an individual. Their real names, however, were different, and though nearly contemporary, and natives of the same province, their labours lay in different fields, and their literary remains vary in their character. Marianus Scotus the Chronicler was born in 1028, and educated under Tighernach Boirceach, of Moville.‡ In 1056 he withdrew to Cologne; in 1058 he removed to Fulda;§ in 1069 he retired to Mentz; and in 1082 he died. His Chronicle is his great monument, but it has long been well known to the learned of Europe; and Florence of Worcester, one of England's worthies, is glad to make the Irishman's work the basis of his compilation.‖ Marianus' autograph,

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* This Ailell, of Mucknoe, in the county of Monaghan, is called *Helias* by Marianus Scotus the chronicler, at 1042 (Pertz, Monn. SS. v., p. 557). Thus we find *Helias* to be the continental equivalent for *Ailill.*

† Zeuss (Gram. Celt. Præf., p. xxiii.) proposes our *Marianus* as the continental equivalent for *Gilla-na-naemh.* But in this he errs, for the latter name is latinized by *Sanctinus*, and this Gilla-na-naemh was of Leinster, and died April 7; whereas our Marianus was a Donegall man, and died on the 9th of February,—added to this, that our Marianus calls himself *Muiredhach.*

‡ This is deducible from Marianus's observation,—*Ita Tigernach Borchech mihi culpabili in aliqua levi culpa pronuntiavit.*—An. 1065 (recte 1043). Pertz, v., p. 557. Tighernach of Boirche (i. e. Mourne) was abbot of Maghbile (Moville, Co. Down), and died in 1061. His son Flaithbertach died in 1098.

§ Pancirolus says of the *Notitia utriusque Imperii*, "Cum multo tempore latuisset, tandem quæ a Mariano Scoto Monacho Fuldensi scripta fuerat, in ultimis Britaniis, annis abhinc 36 inventa, in lucem prodiit."—Notitia dignitatum utriusque Imperii, Præf., p. 3*b* (Genev. 1623).

‖ See the "Monumenta Historica Britannica," p. 522.

with his assumed name, containing also a memorandum of his native, name, *Maelbrigde*, has been edited in Pertz's Monumenta by G. Waitz from a Vatican MS. formerly belonging to St. Martin's of Mayence.* With this Marianus we have nothing further to do.

The other Marianus Scotus, whose own name was *Muiredhach Mac Robartaigh*, was a native of Tir Conaill, the modern county of Donegal. He left Ireland in 1067, that is, eleven years after the Chronicler. A memoir of him and his successors, composed by an Irish monk of Ratisbon, and carefully edited by John Bollandus, in the second volume, for February, of the Acta Sanctorum,† from a manuscript preserved in the Carthusian monastery of Gaming,‡ in Lower Austria, furnishes the following particulars concerning the history of this good man:—

Marianus was a native of the north of Ireland, and remarkable as well for the beauty of his countenance as the strength of his body. In his youth he was carefully instructed by his parents in sacred and secular literature, with a view to his entering the clerical office. In process of time he assumed the monastic habit, but seemingly without entering any regular order; and, taking two companions, called John and Candidus, he set out from home, having as his ultimate object a pilgrimage to Rome. Arriving, on their way, at Bamberg, they were kindly received, and, after a year's sojourn, were admitted to the order of St. Benedict in the monastery of Michelsberg. But, being unacquainted with the language of the country, they preferred retirement, and a small cell at the foot of the hill was assigned them for their use. After a short stay, they received the license of their Superior to proceed on their way; arriving at Ratisbon, they met a friendly reception at the nunnery of the Upper Monastery (Obermünster), where Marianus was employed by the Abbess Emma, in the transcription of some books. From this he removed to the Lower Monastery (Niedermünster), where a cell was assigned to himself and his companions, in which he diligently continued his occupation of writing, his companions preparing the membranes for his use. After some time he was minded to resume his original journey; but a countryman called Muircertach, who was then living as a recluse at the Obermünster, urged him to submit to the Divine guidance the determining whether he should proceed on his way, or settle for life at Ratisbon. He passed the night in Muircertach's cell; and in the hours of darkness it was intimated to him that, where on the next day he should first behold the rising sun, he should remain and fix his abode. Starting before day, he entered St. Peter's Church, outside the walls, to implore the Divine blessing on his journey. But scarcely had he come forth, when he beheld the sun stealing above the

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* Monum. Germ. Hist. Scriptores, tom. v., pp. 481–562.

† "Acta Sanctorum," Febr., tom. ii., pp. 365–372.

‡ Latinized *Carthusia Gamnicensis*. It is sometimes called *Kemnick* and *Gemnikho*. The monastery was founded by Duke Albert in 1332, and secularized by Joseph II. in 1782.—Pez, SS. Rer. Austr. tom. i., col. 935; Ersep und Gruber's *Allgemeine Encyclopædie*, sub *Gaming*.

horizon. "Here then," said he, "I shall rest, and here shall be my resurrection." His determination was hailed with joy by the whole population. The Abbess granted him this Church of St. Peter, commonly known as Weich-Sanct-Peter, with an adjacent plot, where, in 1076, a citizen called Bethselinus (Bezelin) built for the Irish, at his own cost, a little monastery, which the Emperor Henry IV. soon after took under his protection, at the solicitation of the Abbess Hazecha. The fame of Marianus, and the news of his prosperity, presently reached Ireland, and numbers of his kindred were induced to come out, and enter his society. The early connexions of the monastery were chiefly with Ulster, his own native province, and the six Abbots who succeeded him were all from the north. The seventh was a southern. From Weich-Sanct-Peter, another Irish monastery, called St. James's of Ratisbon, took its rise in 1090. Marianus' original companions, however, did not continue with him, for John went to Göttweich, in Lower Austria, where he became a recluse under Bishop Altmann. Clemens proceeded on a pilgrimage to Jerusalem, where he ended his days. Of Marianus himself, nothing more is recorded in this memoir, except his great skill and industry as a scribe. "Such," says the memoir, "was the grace of writing which Divine Providence bestowed on the blessed Marianus, that he wrote many and lengthy volumes, with a rapid pen, both in the Upper and Lower Monasteries. For, to speak the truth, without any colouring of language, among all the acts which Divine Providence deigned to perform through this same man, I deem this most worthy of praise and admiration, that the holy man wrote from beginning to end, with his own hand, the Old and New Testament, with explanatory comments on the same books, and that, not once or twice, but over and over again, with a view to the eternal reward; all the while clad in sorry garb, living on slender diet, attended and aided by his brethren, both in the Upper and Lower Monasteries, who prepared the membranes for his use. Besides, he also wrote many smaller books and Manual Psalters, for distressed widows, and poor clerics of the same city, towards the health of his soul, without any prospect of earthly gain. Furthermore, through the mercy of God, many congregations of the Monastic Order, which, in faith and charity, and imitation of the blessed Marianus, are derived from the aforesaid Ireland, and inhabit Bavaria and Franconia, are sustained by the writings of the blessed Marianus."

He died on the 9th of February, 1088.

Aventinus, the Bavarian annalist, styles him, "Poeta et Theologus insignis, nullique suo seculo secundus,"* and thus describes one of Marianus' compilations:—

"Extant Reginoburgii in inferiori Monasterio, Divini Davidis Hymni, cum commentariis in membranis scripti, opus Mariani. Ejus præfationem, ut fides fiat, subtexo de verbo ad verbum: Anno domi-

* "Annales Boiorum," p. 554, ed. 1554.

nicæ incarnationis, MLXXIV, Hainrico juvene Imp., Machtylda Abbatissa S. Mariæ, et S. Herhardi Abbateam regente, decem novalis Cycli xi. anno Indict. xii. Marianus Scotus, septimo peregrinationis suæ anno collegit modicas istas undas, de profundo sanctorum Patrum pelago, scilicet Hieronymi, Augustini, Cassiodori, Arnobii, et de opusculis S. Gregorii: et pro suæ animæ salute, in honorem salvatoris Domini nostri Jesu Christi, et ejus genitricis, semperque Virginis Mariæ, et S. Herhardi confessoris, scripsit, et in unum librum perstrinxit. Prolixas enim et salubres Catholicorum Patrum expositiones non omnes avido cordis amore petunt. Multi sunt etiam, qui etsi tales legere vel habere vellent, tamen minori censu, vel intellectu, vel aliqua causa existente occupati, illas invenire et legere non possunt. Nunquam tribuatur ad transcribendum extra Monasterium, nisi pro eo congruum relinquatur vadimonium. Georgii feriis cœpit, Mathæi et Hemerami finivit."*

2. *Liber Mariani genere Scoti, excerptus de Evangelistarum voluminibus sive doctoribus.*†

3. The third manuscript of our countryman, Marianus, is the most interesting, not only on account of the beauty of its execution, but also as supplying the Irish name of the writer; for I may here observe that the use of Latin forms to represent Irish names is very arbitrary; thus, *Malachias* stands for Maelmaedhog, as in the case of Malachy O'Morgair; for Maeliosa, as in the case of Maeliosa, bishop of Down (1152): *Gelasius* represents several compounds of Gilla, as Gillamacliag, Gilladomhnaill; so also *Marianus* represents Maelbrigde, as in the case of Marianus, the Chronist; Muiredhach, as in the case of the present Marianus; and Maelmuire, as in the case of Marian Gorman, the Martyrologist.‡

The existence of this manuscript has been known to the literary public since 1679, when Lambecius' catalogue of the Imperial Library of Vienna was finished. From it Cave, Harris, Oudin, Lanigan, and Zeuss have drawn information. And, in later times, Denis, in his catalogue of the MSS. in that collection, has given fuller and more interesting details. But it requires an Irish eye to discern, and Irish wit to unfold, the essential points and beauties of our exquisite MSS.; and both of these qualifications are possessed in an eminent degree by our former associate, Mr. Charles P. Mac Donnell, who, during a residence in Vienna, spent some time in the examination of Marianus' principal manuscript, and kindly intrusted me with the carriage of the following communication:—

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* It is curious to find a library practice of modern times suggested by a writer of so early a date.

† Cotton, Tiberius, E. iv. 26, foll. 162–178. The once noble volume which contains this treatise is a MS. of the twelfth century. It was one of those which suffered in the disastrous fire of 1731, but it has lately been inlaid, and, with occasional damaged margins, is still in a fair and legible condition.

‡ Cod. MS. Theol. membr. Biblioth. Palat. Vindobonæ. *Hodie* viii. D. 26. No. 1247. *Olim*, Ambr. No. 49.

"Among the literary treasures stored in the Imperial Library at Vienna, there is an autograph (unedited) manuscript of our illustrious and venerable fellow-countryman, Marianus Scotus, the Chronographer,* being a copy of the Epistles of St. Paul, with an interlinear gloss, apparently an original production of Marianus himself, and a copious marginal commentary, consisting of extracts from the Fathers and theological writers popular in his day—a commentary which attests the patristic learning and research of that truly eminent man. Harris, in his edition of 'Ware's Writers of Ireland,'† notices this Codex; as does also Lanigan in his 'Ecclesiastical History of Ireland,' both referring to the authority of Lambecius. Lanigan says that those notes of Marianus, 'although well worthy of the light, have not, as far as I know, been as yet published'‡—a statement in which he merely follows Lambecius, whose words, in reference to this MS. are, that it contains: 'Omnes Epistolæ Sancti Pauli Apostoli, celeberrimi Chronographi Mariani Scoti, monachi Fuldensis, propria manu, anno 1079, exaratæ, et ab eodem annotationibus marginalibus et interlinearibus, hactenus quidem *nondum editis, editu tamen dignissimis*, illustratæ: in quarum fine hæc ipsius legitur subscriptio: Explicit Epistola ad Hebræos, habens versus DCCC. In honore Individuæ Trinitatis, Marianus Scottus scripsit hunc librum suis fratribus peregrinis. Anima ejus requiescat in pace, propter Deum devote dicite Amen. XVI. Kal. Junii hodie feria VI. anno Domini MLXXVIIII.' "§

The learned and laborious Denis, one of those highly cultivated and gifted men whom the dispersion of the old society of the Jesuits threw upon the world, and who, in these circumstances, was made chief librarian in Vienna in the latter part of the last century, has given a more detailed analysis of this valuable manuscript.‖ In this notice I shall mainly follow his guidance, taking care, however, to give the extracts exactly as they stand in the manuscript itself. The MS. is a large quarto, consisting of 160 folia of vellum; the text in a fine clear hand of the eleventh century, in letters of moderate size; the gloss, both lineal and marginal, being written in small, delicate characters, but evidently by the same pen. Fol. 136 is written only on one side; ff. 146 and 154 were cut away to one-half their original size, after having been written, as is manifest from some of the letters on the remaining halves being partly cut away.

The Codex contains all the Epistles of Saint Paul, strictly according to the text of the Vulgate, and in the same order in which they now stand in our Bibles, except that, between those to the Colossians and to

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* This is a mistake. The writer, however, errs in company with a host of great names.

† Ware's Works, vol. ii., p. 66, Writers.

‡ Vol. iv., p. 7.

§ Comment. de Biblioth. Cæs. Vindob. lib. 2, cap. 8, p. 749, old edition.

‖ Denis, Codd. MSS. Theol. Biblioth. Palat., vol. i., p. 1, col. 131.

the Thessalonians, the apocryphal Epistle to the Laodiceans* is introduced, with this marginal observation, however: "*Laodicensium epistola ab alio sub nomine pauli putatur edita.*" With the exception of the last-mentioned, which is left uncommented, the Epistles are all accompanied with an interlinear gloss, and are elucidated by ample marginal quotations from the following Fathers and theological writers: St. Gregory, St. Jerome, St. Augustine, Fulgentius, Origen, Cassian, Haimon, Leo, and Alcuin; and also from the Liber Pastoralis, Petrus Diaconus, Ambrosiaster (now rejected in tom. ii., ed. Maur. Paris, Append. p. 21), and Pelagius† (whose Commentarii in Paulinas may be seen, tom. xi., Opp. S. Hieronymi, edit. Vallars. col. 835). As far as the Epistle to the Colossians, the prevailing extracts are from St. Gregory; and from that to the end the most frequent are from the false Ambrosius. Denis suggests that improved readings of the text of the Fathers might be, perhaps, obtained by a collation of their works as printed, with the passages quoted from their writings in this MS., which exhibit in many instances considerable variations from the usually accepted readings.

The first six folia are taken up with the following introductory matter:—

I. Incipit Prologus Hieronimi in epistolam ad Romanos, which opens:—

.i. quando ad eos scripsit
Romanos non dum uiderat apostolus: nec
.i. romanis .i. paulus .i. gentibus
in eis ipse ut in ceteris primus fidei
.i. barnabas 7 clemens ut in
iacerat fundamentum. Sed aliis discipulis
libro clementis dicitur
crediderant predicantibus. Ab apostolo
.i. in fide cepta per predicationem discipulorum
solo indigent confirmari.

Romani sunt qui ex iudeis gentibusque crediderunt.

and so forth, ending on fol. 2 facie, thus:—

et non in vanis et corruptibilibus nomen ueritatis
ascribere simulacris.

Throughout the above passage Denis remarks that there are many readings different from those printed.

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* In the Book of Armagh this spurious epistle comes in between Colossians and 1 Timothy, with the salvo, "Sed Hirunimus etiam negat esse Pauli," fo. 138*aa*. See Calmet on Col. iv. 16, where it is printed with various readings. It exists in many MSS., and has even found its way into printed Bibles.

† In the Book of Armagh are some prologues bearing the name of *Pilagius*, who is also cited in the Irishman Sedulius' commentary on St. Paul's Epist., under the signature *Pil.*

II°. Incipit Argumentum hieronimi
in epistolam ad Romanos—

which commences:—

Epistolæ pauli ad romanos
causa. hæc est et ecclesiam
e duobus populis, &c., &c.,

and ends on the 14th line with the words:—

Breves singulis versibus ac verbis apposita*.

Denis observes that the only passage resembling this, that he could find, in the words of St. Jerome is one in the commentary on the Epistle to the Galatians.

III°. Pauli apostoli epistolæ numero quatuordecim sunt.
In the enumeration of the Epistles which follows here, the apocryphal epistle to the Laodiceans, though contained in the body of the MS., is omitted.

IV°. Item prologus clementis vel (uel argumentum) hieronymi,
beginning:—

Omnis textus vel numerus epistolarum,*

and ending on folio 3 facie, with the words:—

ad Philimonem de onesimo (hortatur) servo qui (a paulo credens in Christum) emendatus
melior factus est. (per paulum)

V°. Explicit argumentum. Item hieronimi,
beginning:—

Paulum apostolum proferam, quem quotienscunque lego,

and ending on the 11th line, fol. 3, verso, with the words:—

fugam simulat ut occidat,

being, as Denis ascertained, a passage from the 48th epistle of St. Jerome to Pammachus.†

VI°. Incipit argumentum omnium epistolarum
quod (uel hieronimus) pelagius composuit,

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* So in Book of Armagh, fo. 106 *bb*; where no author assigned.
† S. Hieron. Opp., tom. i., col. 221 (Ed. Vallars.).

beginning on fol. 3, verso, with the words:—

.i. in apostolo
Primum queritur quare post euangelia quæ
supplementum legis sunt, et in quibus nobis
exempla et precepta uiuendi plenissime
digesta sunt.*

and ending, at foot of fo. 5 fac., in the 85–86 line, with the words:—

Cognoscentes uos habere meliorem
.i. premiorum in futuro
et manentem substantiam.

Denis remarks that in the glossed Bible, which he has quoted before, this passage is unhesitatingly attributed to St. Jerome, and inquires, "What if it should really be from the pen of Pelagius?"

VII°. Explicit argumentum. Incipit prologus Ambrosii in apostolum,†

beginning:—

Ut rerum notitia habeatur principia
rerum requirenda sunt—

and ending on fol. 6 verso, with line 59–60, as follows:—

servum autem Jesu Christi se
profitens exutum a lege ostendit.

VIII°. Incipit argumentum epistolæ ad Romanos,‡ which runs as follows:—

Romani sunt in partibus Italiæ. et hi preventi sunt a falsis apostolis. et sub nomine domini nostri Jesu Christi in legem et prophetas erant inducti. Et hos revocat apostolus ad ueram et euangelicam fidem, scribens eis a corintho.

These are the last words upon this page, which was not quite filled up. Previous to the time when the pagination was last marked, four folia were cut out here, that is, between the present ff. 6 and 7; and cut out so heedlessly, or so hurriedly, that the knife nearly detached the present fo. 6 along with them.

On fo. 7 begin the Epistles in the usual series, as has previously been observed; each preceded by a summary like those already noticed. The number of verses contained in each Epistle is set down at the end of each: thus, in that to the Romans are reckoned vv. 911; in the 1 Corinthians, vv. 980; in 2 Corinthians, vv. 292; and so forth. Divi-

* Book of Armagh, fo. 105 *ba*.
† In the Book of Armagh this is ascribed to Hilary, fo. 105 *aa*.
‡ Ascribed to Pelagius in Book of Armagh, fo. 107 *b*.

sions of the Epistles into chapters are also indicated by marginal numerals.

It would require considerable time, patience, and research, even under the guidance of the erudite Denis, to analyze this admirable manuscript in the detail that all who have hitherto noticed it concur in believing due to its value and importance. For the present, I am obliged to confine myself to this slender sketch, which I close now by giving the passages from the foot of folia 10, 17, 87, 141, and that at the end, by which the authorship is proved; presenting the correct reading of those, in Irish, on ff. 10, 87, and 141, which Denis has printed very erroneously; and lastly, by giving the interlinear gloss, in which, at the end, the illustrious Marianus signs, in his mother tongue, his native Christian and family name—a fact now for the first time noticed, a name now for the first time ascertained, after ages of oblivion.

The words on the margin at the foot of fol. 10 are:—

Satharn casc innocht for x. Kl. Apríl. anno domini m.lxxuiiii.
Mariani misero domine miserere.*

The words at the foot of fol. 17, Denis correctly prints, as follows:—

Ascensio Domini hodie ui. non. maii anno domini
m.lxxiiii. Mariani misero domine miserere.†

But the Irish words at the foot of fol. 87 he has printed in the following uncouth and inaccurate form:—

feil comgaill in div ſain didiñ. Aimpede ſdia
in dilgud domuirfo ac tros.‡

The words in the original being beautifully written (in what Denis calls Anglo-Saxon characters) as follows:—

Feil comgaill indiu for áin diden. A impede for dia
indilgud do muiredaċ tróg.§

Again, Denis has printed the words at the foot of fo. 141 in a similarly mutilated shape, omitting also the year, which is written above the line; he read them as follows:—

feil bſenain innoct ſdardain Aimpede ſdia in dilgud
domurfo ac tros.‖

* "Sabbatnm Paschæ in nocte x. Kl. April, A. D. 1079." This is printed and interpreted in Zeuss, Gr. Celt. Præf., p. xxiv., note.

† Also given by Zeuss from Denis, *ut supra*.

‡ Not noticed by Zeuss, who probably was deterred by Denis' corrupt reading.

§ "The festival of Comgall (i. e. June 10) to-day, on Friday of Refuge. His entreaty of God for forgiveness to Muiredhach the miserable." Here tróg is the equivalent of *miser*. The 10th of June in 1079 fell on the seventh Friday after Easter.

‖ Also omitted by Zeuss, probably for the same reason as the last.

The words being beautifully written in the original, as plainly as possible:—

a. d. mlxxuiiii.
Feil brenain innocc for dardain. a imrede fordia indilgud do muredach trog.*

The last folio concludes with the following words, which are all written in vermillion, with the exception of the Irish name of the illustrious chronographer, traced between the lines, in black, with his own hand—for the name is written in precisely the same hand as that in which the gloss throughout the volume is written:—

Explicit epistola ad hebreos
habet uersus dccc.

IN HONORE INDIUIDUAE TRINITATIS
.i. muirdach trog macc robartaigh†
MARIANUS SCOTTUS SCRIPSIT HUNC
LIBRUM SUIS FRATRIBUS PEREGRINIS
ANIMA EIUS REQUIESCAT IN PACE.
PROPTER DEUM DEUOTE DICITE. AMEN.‡
XUI. KL. IUNII HODIE FERIA. UI. ANNO DOMINI
M.LXXUIIII.

Here then we have, in the gloss, the Christian and family name of the illustrious chronographer, written with his own hand in his mother tongue—*Muiredach mac Robartaig*.

The family of Mac Robhartaigh were the hereditary guardians of the venerable *Cathach* of St. Columbkill, and, as such, *herenachs* in Tyrconnell, and vassals of the O'Donells, the ancient princely rulers of that region. As guardians of that reliquary, they are mentioned in the "Annals of the Four Masters." In 1497 one of the events of a battle at the pass of Ballaghboy, between the O'Donells and the Mac Dermots, which proved disastrous to the former, is thus recorded:—

Ro beanadh beos an cathach colaim chille amach, agus do marbhadh a maor (.i. mag robartaigh).

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* "The festival of Brendan (May 9 or 16), in the night, on Thursday, A. D. 1079. His entreaty of God for forgiveness to Muiredhach the miserable." It is impossible to say whether Brendan of Birr, or Brendan of Clonfert is here intended, for their festivals always fall on the same day of the week, the former being the 9th, and the latter the 16th of May. In 1079, both fell on Thursday.

† "Muiredhach, the miserable, Mac Robartaigh."

‡ Responding to the petition, some pious old German of the fifteenth century has written in, on this page, *Amen, got dem [dies v] Erleich.*

Translated by our learned fellow-countryman, O'Donovan :—

The Cathach of Columbkille was also taken from them, and Magroarty, the keeper of it, was slain.

Two years after this battle the Cathach was restored to the O'Donells (ad an. 1499); and in 1567 the same annalists chronicle a battle between the O'Neills and O'Donells at Farsetmore, a low-water ford near Letterkenny, in which, amongst those that fell, was—

> Magrabhartaigh aga mbaoí ioncoimhéd cathaige colaim cille.

Rendered in O'Donovan's translation—

"*Magroarty, who had the custody of the Cathach of St. Columbkille.*"

Almost contemporary with this Marianus was Donnall Mac Robartaigh, St. Columba's successor at Kells, whose name is engraved on the silver case of the Cathach,* and whose death is recorded by the Four Masters at 1098.† By them he is called O'Robhartaigh; but this interchange of Mac and O' is common in early records. Dermot O'Robhartaigh, Abbot of Durrow, died in 1190. Ballymagroarty, in the parish of Drumhome, county of Donegal, is so called from *Baile-mecc-Robhartaich*, being originally the possession of Mac Robhartach, keeper of the Cathach; and Ballymagrorty, in the parish of Templemore or Derry, has the same origin. In 1609, the Inquisition of Donegal finds the "Island of Torro [Tory], whereof O'Rohertye is both herenagh and corbe."‡ Among the general pardons in the same year, various members of the clan are mentioned under the forms *M^cRuertie*, *Magroertie*, *M^cgroertie*, *Magrertee*, and *Roertie*.§ At the present time the name has been moulded into *O'Rafferty*, *Rafferty*, and *M^c Grotty*.

The following addition to the recommendation of the Council, adopted by the Academy on November 30, 1854, was adopted by the Academy :—

"That if any Member of the Council, whose name is printed in italics in the ballot-lists, be re-elected by the Academy, he shall be considered the junior Member of that Committee," with the following addition :— "That this rule shall apply to the last election."

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* See Reeves's "Adamnani Columba," p. 319.
† Ibid., p. 285.
‡ Ul. Inquis. Appendix, No. V.; Pat. Rolls, Jac. I., p. 382*a*.
§ Pat. Rolls, Jac. I., pp. 151 *b*, 152 *a*.

MONDAY, APRIL 23, 1860.

JAMES HENTHORN TODD, D.D., President, in the Chair.

GEORGE V. DU NOYER, M. R. I. A., read—

A CONTINUATION OF NOTES ON SEPIA SKETCHES OF VARIOUS ANTIQUITIES PRESENTED TO THE LIBRARY OF THE ROYAL IRISH ACADEMY.

WHEN last I had the pleasure of presenting to the Library of the Royal Irish Academy a series of 118 Sepia sketches of various antiquities, but chiefly crosses, I expressed a hope that ere long I should find leisure to add to that collection. I now feel happy at being able to realize that expression, and I beg that the Academy may again honour me by placing this succeeding series of seventy-eight sepia sketches amongst the former.

The Academy has to thank the Rev. Charles Graves for having placed in my hands a most valuable and interesting series of original sketches and rubbings of Oghams and crosses, in order that I might copy them for the Academy, as I have done, thus adding greatly to whatever value the present collection may possess; and we have also to thank Charles Halliday, Esq., for having contributed a sketch of a remarkable cross, which will be found in its place in the series.

Before alluding to the subject of crosses, I wish to direct your attention to the three first illustrations on the walls of the Library. The first is from a stone in the townland of Ranesgrange in the county of Wexford, and it represents a class of inscriptions which the Rev. Dr. Graves believes to be veritable Oghams, either of remote antiquity or of an occult form of letter, to the deciphering of which we have as yet no clue.

The second drawing represents an inscribed stone from a very perfect but small stone circle in the townland of Currubeha, near Rosscarberry, in the county of Cork. These Dr. Graves calls tool-marks. The relative position of this stone with regard to the other upright stones forming this circle is shown in the ground plan of the whole work. The central stone is a block of white quartz.

Close to this circle is a very perfect giant's grave or kistvaen.

The first thirty-two drawings are all from sketches and rubbings by Dr. Graves, and I trust he will favour us with some account of them; for my part, I look forward with interest to his remarks regarding them, but more especially as to his ideas with reference to the classification of the crosses.

One of the objects of my former communication was, an effort to arrive at some definite and accurate ideas on this subject. I stated my belief that the earliest form of cross existing in Ireland was that known as the Greek or Maltese, the arms of which were constructed by the in-

tersection of four parts of circles, and the whole often enclosed in a circle, and this I showed was the absolute form of cross introduced into Ireland by St. Patrick in the fifth century.

On examining closer into the subject, I find reason to modify this idea somewhat; and I am led to believe that the straight-armed cross with bifurcated ends, or such like simple decorations, may in Ireland rank, in point of antiquity, with the cross of eight points.

This supposition is well borne out by the singularly interesting small pillar tombstone of Luguaedon Mac Clmenuch, which is still preserved in the grave-yard of the older of the two churches on the small island of Innishagoil in Lough Corrib.

The learned Dr. Petrie considers that this tombstone was erected in the fifth century, to the memory of a nephew of St. Patrick, and I believe that this opinion is received as correct by all archæologists. We have here, therefore, clear evidence that the simple straight-armed cross with bifurcated ends was a recognised form of this emblem at that early period. It, however, appears to me that this widening of the arms at their extremities is suggestive of the more ancient form, theoretically giving to the cross the eight terminal points characteristic of the earlier Greek type, and indicative of its having been derived from it.

Mr. Hope, in his "Costume of the Ancients," supposes that the nimbus or auriole, which is so constantly represented surrounding the heads of saints and angels, as well as that of the Second Person of the Trinity, in the most ancient of our illuminated MSS., was originally suggested to the early Illuminators by the well-known Pagan practice of placing flat metal disks over the heads of important or favourite divinities, in order to protect them from the injury of the rain or the desecration of birds. The nimbus is, therefore, merely a sketch in outline of such a head-plate when seen from the ground.

This peculiar decoration to the heads of sacred personages was looked on by the early Christians as an old and recognised conventional mode of expressing consideration for the objects of their adoration or respect, and, to sanctify it more effectually, or rather to christianize it, they traced within it a cross, radiating from the head of the figure, and formed either by the intersection of four parts of circles or of slightly curved lines. After a time, when a detached cross was required to be carved in stone or wood, the nimbus was referred to as a model for the sculptor, and hence, I believe, we have not an improbable origin for the circle being represented in such close connexion with the cross. After a time this compound cross underwent many modifications in form. Sometimes the circle was omitted, and eventually, if retained, it was superseded by the cross, which was made the more important feature in the design, and prolonged beyond its diameter. As centuries rolled on, the Pagan origin of the circle as connected with the cross appears to have been overlooked, and this adjunct to the sacred emblem of Christianity was retained merely on account of the picturesque effect which it gave to an unsightly object, as the plain Latin cross certainly is. In the tenth, eleventh, and twelfth centuries we see the full

development of the cross and circle in such monuments as those at Clonmacnoise, Monasterboyce, Dromiskin, &c., &c., and, in the collection of sketches now before you, in that of St. Cronan's cross at Roscrea in the county of Tipperary.

As I cannot at present enter further into this subject, I shall proceed to describe the original drawings of antiquities which are now before you.

Crosses.—The second of these illustrations is that of a remarkably fine standard cross on the Island of Inis-Mac-Saint in Lough Erne, said to be the cross of St. Nen. I have no reason to doubt the accuracy of this tradition, and believe that this cross bears evidence of being the work of the sixth century—St. Nenn, or Nennid, according to Colgan, having died A. D. 523 or 530. The cross is formed of three blocks of gray limestone, now much weather-worn, being furrowed deeply by the action of the rain. The head, or absolute cross, is cut out of one thick slab, the flat shaft is another, and the angular plinth the third. They are all morticed one into the other. The cross is clearly of the modified Greek form, though very rudely executed.

The next illustration represents the small cross at St. Doulough's, in the county of Dublin, said to be the cross of St. Doulough, or, more properly, Duilech. I have no doubt but that tradition is again correct in assigning this cross to the period of the saint whose name it bears. If so, its date is the seventh century, and its form in general is remarkably similar to the cross last described. The plinth, formed of steps, is clearly modern.

Fig. 4. This drawing represents one of the standing crosses at Tullagh, in the county of Dublin; its type is that of a cross radiating from a circle, the arms being clearly defined by the stone having been widely pierced around them at their intersection. The lower arm is prolonged to form the shaft, and the whole rests on a large squared plinth. This cross is, possibly, of the eighth or ninth century.

Fig. 5. The next illustration is that of another cross, at the same locality as the former, and which may possibly be not quite so ancient as it. Its outline is copied from that of the modified Greek form, but the cross is decorated by a broad bead or simple moulding, which, most probably, passed quite around every portion of its edge. The field (to use an heraldic term) thus enclosed is occupied by a carving in high relief of a full-length figure, apparently that of a female. The head of this effigy is bare, or at least all trace of any head covering is destroyed, if it was ever present. The figure is robed in a long inner garment, which reaches to the ankles, just allowing the ends of the feet to appear below it. The shoulders are covered by a short cape, which is, apparently, attached to a long cloak, held up in front by both hands, the arms being bent across the chest in an easy attitude. I think we may regard this as a work of the ninth or tenth century.

Fig. 6. This represents the very fine, and, in one respect, unique cross standing in the grave-yard of the Abbey of Kildare, and when it rested in its plinth (a square block of granite standing close by, and which is nearly five feet in height), it must have been an imposing mo-

nument indeed. The top of this cross is an archæological puzzle, for it is impossible to say whether it is now perfect or not. So far, it is complete and unbroken, and sufficiently suggestive of a cross, but in reality it is not one—inasmuch as the upper arm is wanting—if, however, we suppose this added to it, we get a cross radiating from a circle of the same type as the first of the Tullagh crosses; it may, therefore, be of equal antiquity with it. The head of the Kildare cross is morticed into the shaft in a similar manner to that from Inis-Mac-Saint in Lough Erne.

Fig. 7. We have here a sketch of the ancient cross at the village of Finglas, in the county of Dublin. Like that of St. Doulough's, it has undergone much mutilation, and has been injudiciously restored. The head is formed out of a single block of granite, and its squared plinth is of the same kind of stone. The top of this cross is so far perfect, though time has nearly obliterated the various plaits, scrolls, and other ornamentations with which it was decorated.

In this relic we have the cross radiating from the circle, but this distinctive feature is brought out merely by carving. The form of that portion of the cross which is *within* the circle is distinctly Græco-Irish, the arms being sufficiently broad to allow at their intersection of the introduction of a flat circular boss, the portions of the cross extending beyond the circle are ornamented with various kinds of interlaced scroll-work. The greater part of the original shaft is wanting, and its place supplied by a small squared block of granite, thus making it too short, and quite out of proportion to the rest of the work. The original square plinth, which is ornamented round the edges by a simple incised line, yet remains, but it has been perched on a mass of masonry, which gives it an unnecessary height.

I believe we may attribute this cross to the tenth century.

Figs. 8 and 9. These drawings represent two views of the large cross at Roscrea, in the county of Tipperary, said to be the cross of St. Cronan, or, at least, it is dedicated to that saint; and, without doubt, it must have been one of the most imposing ornaments of its class in Ireland. Its type is that of a cross radiating from a circle; but the outlines of both have been so skilfully and artistically modified that nothing further is left for the most critical taste to require. The block of red sandstone out of which it has been carved must originally have measured over 5 feet 6 inches square; and as a portion of the shaft is yet remaining close at hand, and of equally large proportions, we may suppose that, including the plinth in which it stood, it must have measured fully 20 feet in height.

On one side of the cross, and carved in the highest relief, is a full-length figure, supposed to represent St. Cronan. The head is apparently bare; the face smooth and youthful-looking; the arms are bent across the chest, the right hand above the left, and both grasp a pastoral staff, or cambutta, of the early Irish form, accurately resembling those formed of bronze, of which we possess several in our Museum. Owing to the weathering of the stone, the costume of this effigy cannot

be now determined. On the opposite side of the cross is a figure of the Crucifixion, also carved in the highest relief, which deserves our especial attention for its many peculiarities. The head is erect; the arms most rigid, and simply, I might say conventionally, carved; the hands are also idealized, and are not represented as pierced with nails. The face of the figure, so far as its features can now be discerned, is calm; the head is bare; the forehead bounded by a narrow band, apparently confining the hair, which falls in long curls over the shoulders. The beard is pointed and forked, after the Saxon fashion. The shoulders are broad and the waist slender, and surrounded by a belt, which supports a short kilt. The rest of the figure is unfortunately wanting.

The *expression* suggested by this effigy, even as we see it now, is one of the greatest dignity and repose; and when we look on it, we forget that it represents a suffering man, and are willing to recognise in it a symbolism of divinity. In conveying to the mind this impression, such efforts of art as this (when executed in Ireland prior to the close of the twelfth century) differ totally in style and spirit from similar designs, when idealized according to the spirit of the Latin Church. Those represent the figure as either writhing in pain or dead from the greatest physical suffering; but in the *Celtic* idea all thought of this appears to be lost. The expression of any mere human weakness is carefully avoided—possibly as a matter of faith—and the figure on the cross is not the representation of an absolute event, but the embodiment of an idea. This is a very striking and singular difference in the peculiar mode of thought of the early Celtic as contrasted with the Latin Christians; but its full discussion belongs rather to the divine than the antiquary.

In Fig. 10 I have given a restoration of the head of this cross, as by this means we can best appreciate the exceeding beauty of its design, which is especially evinced in the form of the pierced spaces which separate the cross from the circle. St. Cronan, according to Colgan, died early in the seventh century; but this work is clearly of a much later date, probably the tenth or eleventh century.

Fig. 11. This sketch represents the standing cross near the Dargle, in the county of Wicklow; and it affords us another example of a Crucifixion, but very different from the former in all essential points. The figure is nude; the head hangs powerless on the right shoulder; while the body is represented as slightly bent from lassitude. These peculiarities, as I have already remarked, are the characteristics of the Latin idealization of the Crucifixion; and, taken in connexion with the general style of the work, and the roughness of its execution, induce us to believe that it is not a work of any great antiquity. The peculiar form of the plinth also, which is that of a truncated cone, is quite unlike any other remains of this kind of unquestionable antiquity with which I am acquainted, and therefore I think this cross may not be older than the seventeenth century.

Fig. 12. This is a simple short-armed cross, carved in relief on a slab of granite; the arms very flat and wide; the lower member of which is much shorter than the others. The only peculiarity about it is the oc-

currence of two large, rounded bosses at either angle of the base of the lower arm, in which mode of decoration it is certainly unique. It is from the grave-yard of the old church of Kilbride, in the county of Dublin. To this I cannot assign any date.

Fig. 13. This represents the broken fragment of a small cross, formed out of a slab of mica slate from the Reafort Church at Glendalough. The ornamentation is very singular, and merely suggestive of a cross. It consists of four deeply incised short curves, *bent outwards*, and ranged round an imaginary centre. The extreme outline of the cross is that which would be given by a flat-armed cross radiating from a large circle, the arms scarcely extending beyond its circumference.

This completes my present list of original sketches of crosses; and I shall now direct your attention to the second group of illustrations, which are entirely architectural.

Architecture.—I know of no more appropriate example with which to commence this branch of my subject than that of a rude massive monolith, the simplest and, no doubt, the earliest effort of constructive art which it is possible for the most primitive people to devise. It does not follow, however, that such a monument as this indicates merely the lowest state of civilization in the people who erected it; such would be a hasty conclusion. For example: the Israelites, when they wandered in the desert, and there erected simple monoliths, or great piles, or pyramids of stone, after the fashion of the Egyptians (as we read in the Book of Joshua), were undoubtedly a civilized people, acquainted with all the arts and sciences of their time. They erected a costly tabernacle; they worked in metals, as we read in the 16th chapter of the Book of Numbers; they spun and wove; and having "spoiled the Egyptians" as part payment for their previous state of servitude to them, it is clear that they understood and could appreciate luxuries and comforts of living, as the valuables thus acquired could be only thus applied. It would be wrong, therefore, to argue that, because such a people left behind them in their journeying only such records as a standing stone or a rude pyramid, that therefore they knew no better art, and had not the skill, taste, or power to erect more elaborate works. All that we have to say is, that they did not require them, and that their genius and ingenuity found another channel for its exercise. Such, to a certain extent, may be the correct reasoning with regard to the people who constructed our huge monoliths and cromlechs, stone circles, and kistvaens. They could not have been very helpless savages, but a community capable of acting in concert to a great extent, and acquainted with some of the chief mechanical aids to construction, as applied to the moving of heavy masses of stone. Let us for a moment suppose that there is a block of rock lying on a moor or mountain side, and roughly measuring 26 ft. in length, 6 ft. in breadth, and 3 ft. in thickness, and that it is desirable that such a pillar-stone should be placed upright in the ground. Assemble the men of the parish or mountain side, and let us see how much of their art and science will be evoked, and what time it will take them to accomplish such a task. I venture to say that, if left entirely to their own resources in every

respect, the stone would probably never be raised, or, if it was, the cost, time, and labour expended would be something serious. How would the first lift of six inches at one end of the stone be accomplished, when the weight to be moved would be about 27 tons (allowing 145 lbs. per cubic foot)? The shears which would support half of this burden would need to be beams of "hardy oak," and the ropes "a cable that never was broke." But let us imagine the block raised to an angle of 45° or 55°. The shears can no longer be worked with effect; props have to be introduced beneath the rising mass, and a new motive power must be devised to hoist it still higher, and eventually to place it upright.

In the monolith to which I now direct your attention, such a stone as I have imagined has really been set on end near the village of Ballinageary, in the county of Cork; and, simple as it looks, its great size, and the consciousness of its enormous weight, impress the beholder with feelings of positive wonder and admiration.

The next progressive effort at constructive art is to be found in our cromlechs; and the example of one which I present to you in the illustrations (Figs. 2 and 3) is beyond question the most perfect, shapely, and skilfully put together structure of the kind that I am acquainted with in Ireland. The table-stone, which is of granite, measures 12 feet by 11 by 4; and, allowing 170 lbs. to each cubic foot, it would weigh something like 38 tons. This block is poised on three tall, upright stones, also of granite, all of which terminate very sharply; and thus a remarkable appearance of lightness is imparted to the whole group. I have endeavoured to illustrate this in the view I have given of the cromlech, looking south. The form of the table-stone, as here seen, is remarkably quaint. The other view, or looking to the west, is also very striking, but less picturesque.

A curious superstition attaches to this monument. People having a wish which they hope may be gratified come here and cast a stone on to the rounded sloping surface of the table-stone, expressing at the same time their desire. If the stone remains there, the wish is to be realized; if not, it had better be abandoned.

Without doubt, the covering stones of our cromlechs and the larger monoliths are boulder blocks, and now occupy the same locality, or very nearly the same, as that in which they were deposited by the floating mass of ice which, in the ancient glacial sea, carried them from their parent site. We all know the simple theory suggested for their construction: that the covering blocks were dragged up an inclined plane of earth to the required position and height, when the props were inserted beneath it, and the earth removed; or the mass of stone which was considered suitable to form a cromlech having been discovered or selected, the props were inserted beneath it as it lay, and the ground lowered around it for the required distance. Simple though either process is in its description, to carry it out successfully in practice would require much care and ingenuity, as any error in the details of execution would involve the failure of the whole undertaking. If the props should happen to be placed in such a manner as not to accord with the centre of gravity of

the mass to be supported, no after efforts would be sufficient to remedy the original mistake, and the block should be deserted as unmanageable. I really think that the manner in which the table-stone of the Dundalk cromlech is balanced on its three supports, is a marvel of rude constructive art, and worthy the genius of our best engineers.

In the latter Pagan or early Christian structures which have remained to us, there is but little mechanical skill evinced in their construction beyond what could have been accomplished by mere patience, without much skill. In the dry masonry of the stone forts, cashels, cahers, or cloghauns, there is not the same nicety of work as that observable in the later primitive stone-roofed oratories. Many of them (of which that at *Kilmalkedar*, in the county of Kerry, is the most remarkable) are so admirably constructed that the blade of a knife, sometimes not the point of a penknife, could be inserted between the stones. All the doorways of such structures as I have alluded to, whether Pagan or Christian, are flat-topped, the lintel being formed of one large stone; the sides converging more or less; and it is not till we arrive at the true Pelasgic style of architecture, introduced into Ireland, most probably, by St. Patrick in the fifth century, and retained for fully 400 years after his time, that this extreme simplicity of architecture in doorways and windows gives place to a more careful mode of construction, and the rudiments of decoration, either as an incised line or a raised architrave, are introduced in them; while in the building generally mortar is sparingly used, and the stones are squared, chiselled, and dressed. As an example of this rudely decorated Pelasgic architecture, I present you with a sketch of the doorway of St. Fechin's Church at Fore in the county of Westmeath: first, because it is a characteristic type of its class; and, secondly, because it admirably illustrates the primary object of this inquiry, viz., the classification of the Irish crosses.

Archdall, on the authority of the Annals of the Four Masters, states that St. Fechin died of the plague which ravaged Ireland in the year 665; and Colgan, in his Acta Sanctorum, at page 135, alludes to the cross which St. Fechin placed over the door of his church at Fore—(*vide* Dr. Petrie's "Essay on the Ecclesiastical Architecture of Ireland," at page 175). We have here, therefore, in Fig. 4, a work and carving of undoubtedly the seventh century.

This doorway, which is flat-topped, the sides converging much, is formed of eight stones, including the lintel. It measures at top 2 ft. 8½ in. wide, increasing to 3 ft. 2 in. at its present base; the length of the lintel is 5 ft., and its maximum depth 2 ft. The door is completely surrounded by a raised flat architrave, 6 in. in width; above this the lintel on the exterior is ornamented by a raised, flat, long, rectangular tablet, on which is incised the cross alluded to by Colgan. The form of this emblem is that of the modified Græco-Irish type, in which the arms are widened merely at the extremities, and it is enclosed in an incised double circle. It is somewhat remarkable that this cross and circle appear too large for the tablet on which they are carved, the former not being perfect, and the cross is not placed perpendicularly on it. This, doubtless, indicates want of skill in the carver, and bears out the supposition that it was

cut after the doorway had been erected. Possibly St. Fechin himself might have been the fabricator of his own signum, and may have known more of preaching than sculpture. In the interior this lintel has been roughly chiselled away over the doorway, evidently to admit of the reception of the wooden door, which, no doubt, once closed this aperture; here also is carved a simple straight-armed cross enclosed in a circle, both being very rudely and deeply cut into the stone.

Fig. 5. The next illustration represents the doorway of the Round Tower of Lusk in the county of Dublin, and if similarity of design is any argument in favour of similarity of age in ancient Irish church architecture, we may safely conclude that this tower and the ancient church at Fore are of equal antiquity.

Fig. 6. This is a view of the doorway of the ancient church of Myshall in the county of Carlow, and its style of construction leads me to think it a work of the eleventh or twelfth century. Its general similarity in design to the doorway of the larger of the Round Towers at Clonmacnoise, called O'Rourke's Tower, attributed by Dr. Petrie to the twelfth century, is very striking, though the peculiarity which it exhibits of having a projecting abacus extending from the exterior to the interior of the wall, at the springing of the arch, would lead me to assign it to an earlier period.

Fig. 7. This represents the doorway of the old church of Ballyhay, near Charleville, county of Cork, its style being that of rude twelfth-century art.

Fig. 8. We have here a view of the Round Tower of Dromiskin, in the county of Louth, which in many respects is unlike the ordinary ecclesiastical Round Tower, its points of difference being very striking, and all tending to show that it is a structure of mediæval times.

The chief peculiarity which this building exhibits, distinguishing it from all others of its class with which I am acquainted, is its shortness, as compared with its diameter: its height is not much over 40 feet to the springing of the conical roof, while its circumference is 54 feet 6 inches.

The doorway of this structure is semicircular-headed, consisting of two arches, the inner one deeply recessed, and to these the sides of the door correspond. At the springing of the arch are large blocks of stone, which project far beyond the soffit of the outer arch, when they are carved to represent the capitals of pilasters. They must have originally supported a detached and massive circular moulding, which filled up the angle between the outer and inner arches, and corresponded to the circular, detached pilasters which supported the capitals. It is evident that this supposition must be correct, because the capitals, as they now appear, support *nothing*,—an architectural solecism of which the builders of the tower were doubtless never guilty. This door is 4 feet 7 inches high, 2 feet 2 inches wide at the spring of the arch, and faces due east. The tower is divided into three floors: the first received light from the door, which is 13 feet from the ground; the tower below this, being hollow, the second floor was lighted by a very small triangular-headed window, which is quite of the early primature form of such openings, and is placed

close to where the floor of the third or upper apartment would come, and this last was lighted by four very large flat-headed windows, about 6 feet in height, and which face the four points of the compass.

In modern times, the tower was used as a belfry, and the walls below the springing of the conical roof have been cut into to receive the ends of cross-beams to support the bell. On account of the top openings in this tower being surmounted by large flag-stones for lintels, I cannot think that these apertures were ever widened from their original size to allow of the bell being better heard.

Fig. 9. This gives a general view of the tower, showing the position of the doorway and one of the large window openings in the upper floor of the tower.

Fig. 10. This shows the position of the small triangular-headed aperture lighting the second floor.

Fig. 11. This gives a section of the tower, showing the manner in which the floors were supported by offsets for the second floor, and a recess in the wall to receive the ends of joists for the third apartment.

The next doorway is that of the Round Tower of Donoughmore, in the county of Meath, and it is especially worthy of our attention, as being the only structure of the kind in Ireland which is stamped with the most marked emblem of Christianity, viz., the Crucifixion. The door which faces the east is semicircular-headed, the sides converging; it is ornamented by a broad, flat, raised architrave, which completely surrounds it, in which respect it resembles the doorway of the Round Tower of Lusk. On this moulding, on the south side of the door, and at the springing of the arch, is a female head, which projects boldly from the surface of the masonry; and on the opposite side, but *beyond* the limits of the architrave, is a corresponding male head, exhibiting the beard and moustache, the forehead being bound by a plain fillet. Over the keystone of the arch is an oblong stone, on which is carved, in high relief, the upper part of the figure of the Crucifixion, the legs, from the waist downwards, appearing on the keystone itself. It is worthy of note that the figure is nude, the head resting on a long, squared cushion, and the lower extremities are twisted so as to present a complete profile view of the right leg, the knee of which is bent, and thus it allows the left leg, from the knee downwards, to appear behind it. This attitude is not *cross-legged*.

It is perfectly evident that the carving and decoration just described are contemporaneous with the erection of the tower, as it has been produced in relief, leaving the field of the stones level with the surface of the surrounding masonry.

From the fact of the head of the effigy being supported by a cushion, and the body twisted to express pain, an idea which was carefully avoided in all early Irish ecclesiastical art prior to the close of the twelfth century, I am decidedly of opinion that the Round Tower to which I now allude is not older than this period, and most probably may date to the early part of the thirteenth century. The introduction of the mortuary cushion under the heads of recumbent effigies is strikingly characteristic of Anglo-Norman and Franço-Norman taste, and its introduction in sepulchral monuments dates from the eleventh cen-

tury on the Continent, but was not generally adopted in England till a century afterwards, during the reign of Henry II., 1154. In the succeeding reigns of John, Henry III., and the first Edwards, it gradually came more and more into use, and it reached its full development in the reign of Edward III., from 1330 to 1377.

I do not suppose that our antiquaries will claim for Ireland the originating of this peculiar feature in monumental art, as it evinces a state of society more luxurious and refined than that which obtained amongst the primitive Irish in the pre-Anglo-Norman period of their history. If, therefore, we ever find the mortuary cushion introduced into Irish monuments, we may safely conclude that they partake of a decided admixture of the Anglo-Norman element.

Fig. 13. This illustration represents the door of the old church of Annagh, near Tralee, and, though simple, is characteristic of the least decorated style of architecture during the close of the thirteenth century. The form of the arch is equilateral, and the hood or drip-moulding is carried completely round it, and prolonged down the sides of the door, where it forms a distinct member in its mouldings. This style of door is very unusual in Ireland, and it forms a link connecting the Anglo-Norman taste in architecture with ours.

Fig. 14. The form of door represented in this illustration is also very unusual in Ireland. It is from the old church of Brigown at Mitchelstown in the county of Cork, and though the arch in this instance is semicircular, its moulding is uninterruptedly prolonged down each side of the doorway, after the manner of the door of Annagh Church, the narrow rib which projects from the moulding all along its inner edge being clearly indicative of early thirteenth-century taste.

Fig. 15. We have here a sketch of the doorway of the old church at Cloghaun, a miserable village of four or five cabins, situated on the S.W. shore of Brandon Bay, in the county of Kerry; its form is rectangular, and very much that of the early Irish Church. It is, however, too wide for its height, and the angle of the stones is chamfered off all round, and the stones themselves are all of small proportions. From this I argue that the work is not of any great antiquity, possibly the fourteenth century, but it bears, however, the stamp of genuine Irish taste about it, and on that account may not be uninteresting.

Fig. 16. In this illustration we have all the characteristics of the pure Anglo-Norman art. It represents a doorway in the tower of the Abbey of Kildare; its design is very tasteful and unusual, and I think we may assign its age to the latter part of the thirteenth century.

Fig. 17. This drawing is offered as a characteristic example of the doorways of most of our old churches, which are so plentifully scattered over the eastern and south-eastern portions of Ireland. It is taken from the old church of Tullaghmelan, near Knocklofty, Co. Tipperary; the arch is of the depressed pointed form, the drip-moulding very prominent and broad; the entire door-head consists of only six stones, viz., two for the principal arch, and four for the drip moulding surmounting it. At the apex of the arch is a somewhat rude representation of the head of a bishop, crowned with a mitre of an exceedingly old form, and which was most

generally in use during the twelfth century. The mitre looks as if formed of an external framework of metal, the ribs of which stood prominently out, and within which was the cap or head covering. The helmets most commonly in use in England, as well as on the Continent, during the thirteenth century, as we find in Stoddart's "Vetusta Monumenta," and from the Painted Chamber at Westminster, were constructed on this principle; the framework is mostly coloured yellow, as if to represent brass or metal, the intervening spaces being red or purple, as if to indicate the inner cap, called by the Romans "cudo" or "galerus," of dyed leather, cloth, or felt.* I should not be surprised if on research we found that many of the mitres of our mediæval ecclesiastics were constructed on precisely this principle.

Fig. 18. This illustration is offered as a characteristic example of a doorway of one of those square tower castles so common over the south of Ireland; its style of masonry is somewhat novel, as many of the stones are interlet one into the other, after the manner of some of our very oldest Pelasgic buildings, a circumstance which is here merely accidental, and indicates nothing more than unusual care on the part of the builders.

Fig. 19. An ogee-headed door from the north wall of the cathedral of Ardfert; its date may be late in the fifteenth century.

Fig. 20. The last illustration of a doorway is that from the old church of Moymet, attached to the castle of the same name, near Trim, in the county of Meath. The arch is equilateral-pointed, formed out of two stones, and the angle is ornamented by the simple bead and ogee moulding, the curves of which would, in the absence of all other evidence, enable us to determine the century in which the church had been erected. We have, however, historical evidence for this. Sir Lucas Dillon, father of the first Earl of Roscommon, and son of Sir Robert Dillon, who was Attorney-General to Henry VIII., built the castle and church of Moymett, after having received the grants of the Abbey of the Virgin Mary at Trim, and the townlands of Ladyrath, Grange of Trim, Cannonstown, and Rathnally, in the year 1567.—(Butler's History of Trim.)

I have now to direct your attention to a few windows and loop holes, with which I shall conclude this short notice of well-marked peculiarities in early, as well as mediæval, Irish architecture.

Fig. 21. We have here a sketch of the east window of the old church of St. Peter, at Ferns in the county of Wexford. The window itself is of the pointed lancet form externally, but semicircular within, and most of the stones which form it evidently belonged to a much older window. They are for the most part ornamented by an incised zig-zag or herring-bone pattern, but are placed in the window without any reference to their original position or fitness for one another. The inner arch of the window springs from an abacus, which is ornamented with the large pellet moulding, but the stones at either side do not quite correspond with each other. This window, as we now see it, may be a reconstruction during the early part of the thirteenth century.

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* See Mr. Albert Way's "Memoir on a Bronze Relic, supposed to be of the Saxon age," and published in No. 45 of the "Archæological Institute Journal."

The Castle of Ferns, in the county of Wexford, of a much older work, is said to have been erected by the Fitzgeralds at the close of the twelfth century; its architectural details, however, clearly point to a later period, one not earlier than the close of the thirteenth century. The loop-holes of which Fig. 22 gives an illustration, and the window from the same castle, Fig. 23, have none of the twelfth-century style about them, but more especially the latter, the outer arch of which is equilateral-pointed, the inner trefoil-shaped, in which respect it is peculiarly indicative of thirteenth-century taste. It is not likely that the twelfth-century architects in Ireland anticipated the change from the semicircular to the pointed arch, which took place in England a century later. Ledwich is undecided as to the age he has assigned for this castle, and, in the absence of historical evidence, we may be allowed to adopt that afforded by its architecture. The loop-holes from this castle, of which Fig. 22 is an illustration, are about six feet in length, and have been designed both for cross as well as long bow. The wings of the loop having been widened at the exterior surface of the wall, to allow of greater lateral scope for the weapon, while the circular openings both above and below are intended to give it greater length of range and command of surface.

Fig. 24. This represents another window from Ferns Castle, and is even more characteristic of thirteenth-century architecture than the former; indeed, its style is that of the reigns of Edward I. and II., from A. D. 1272 to 1327, or thereabouts. It is possible, therefore, that the castle may not have been erected till the beginning of the fourteenth century.

Figs. 25 and 26. These illustrations represent cross-bow loops from the Castle of Ballymoon, near Bagnalstown, in the county of Carlow. The first exhibits marvellous beauty of design in such an unimportant feature as this; and it will be remarked that, unlike the loops from Ferns Castle, the widening of the wings, for greater lateral range, has been effected within the wall, and not at its exterior surface. Fig. 26 is much more rude; but this may partly be the result of the more rapid weathering of the granite with which it has been constructed.

The Castle of Ballymoon is a remarkable, and, in Ireland, quite an unique building. I believe it was erected by the Knights Templars during the year 1311, that in which their Order was annihilated by Philip of France; and tradition asserts that, though nearly completed, this castle was never inhabited. In plan the castle is a large, open enclosure, measuring 134 feet square; the walls from 16 to 20 feet in height, parapeted on top, and from 7 to 8 feet in thickness, thus allowing small rooms and deep recesses being constructed in its thickness. In the centre of the south wall is a massive, stunted, square tower, consisting of two arched apartments, and answering the purpose of a keep. This rises to double the height of the surrounding wall, having one-half projecting beyond it, and the other extending into the interior of the enclosure. On the north wall, near its north-west angle, is a small rectangular projection, answering the purpose of a tower, equal in height to the wall, and looped so as to command it. In the centre of the east wall is a similar projection, answering the same pur-

pose; and at the south-east angle the south wall has been prolonged beyond the wall on the east side, so as to induce the construction of an angular projection, which has been looped, and thus answers the purpose of a flanking tower. Throughout their circuit, the walls have been looped by such cross and long-bow slits as those which I have figured. There are a few small windows in this building, of which I have given illustrations in Figs. 27 and 28. It is singular that the window (Fig. 27) nearly resembles a window-loop in the south tower attached to Cormac's Chapel at Cashel, the date of which is the beginning of the twelfth century. The sills of both are deeply curved, the difference being that the loop from Ballymoon has its sides converging. In the interior of this castle the walls bear evidence of having had massive wooden buildings attached to them, especially against the north wall; doubtless, these were the residences of the garrison of military churchmen, who occupied this building, which, no doubt, was sufficiently strong to resist any sudden attack from the native tribes of the district.

Fig. 29. I shall conclude these remarks by directing your attention to the ancient covering over a well dedicated to St. Bridget, on Faughart Hill, in the county of Louth. This is indeed a remarkable structure, and bears a singular resemblance to the gable and part of the roof of an ancient stone-roofed oratory, the opening to the well representing the doorway to the church. There is little doubt but that this structure may have been erected during the period when St. Bridget lived, viz., in the fifth century.

Rev. Dr. Graves made some remarks on certain drawings in the collection, which had been made from his own sketches, supplied to Mr. Du Noyer.

The marked thanks of the Academy were voted to Mr. Du Noyer for his donation, and the Council were requested to take such measures as shall preserve the collection, and make it permanently available for the use of the Members of the Academy and the public.

The Secretary of the Academy read a continuation of a paper by Sir W. R. Hamilton, LL. D., "On Anharmonic Co-ordinates."

Denis H. Kelly, Esq., presented the concluding part of his alphabetical index to Mr. E. Curry's catalogue of the Royal Irish Academy's Irish manuscripts.

The special thanks of the Academy were voted to Mr. Kelly for his donation.

J. T. Banks, M. D., exhibited the original writ issued, appointing commissioners to inquire into the alleged lunacy of Dean Swift, and also the return of the jury who held the inquisition.

MONDAY, MAY 14, 1860.

Rev. John H. Jellett, M. A., Vice-President, in the Chair.

John G. Adair, Esq., Charles A. Cameron, M. D., and the Rev. James Graves, were elected Members of the Academy.

On the recommendation of the Council, it was—

Resolved,—1. That attendance at the Stated Meetings of the Committee of Publication, as prescribed by the resolution of February 27, 1860, shall reckon as attendance at the Meetings of the Council.

2. That the sum of £50 be placed in the hands of the Council for the purchase of antiquities for the Academy's Museum.

Captain A. T. Blakely, R. A., read a paper—

ON THE PRACTICAL APPLICATION OF A PRINCIPLE ANNOUNCED TO THE ACADEMY BY R. MALLET, ESQ.; AND SOME REMARKS ON RIFLED CANNON.

For at least two centuries the advantages of cutting spiral grooves in the inside of the barrels of small-arms has been known, although we possess no record to prove that the reason for it was understood until Mr. Robins investigated the subject, about 100 years ago. That gentleman not only explained how the resistance of the atmosphere retarded the flight of projectiles, and its friction deflected them from their expected course, and how the latter evil was lessened by "rifling" the barrel, thus giving the projectile a rotation about an axis parallel to that of the gun; but he also distinctly pointed out the gain in range to be obtained by using elongated shot. He died before completing his experiments; and, until about the year 1823, no progress seems to have been made in that direction, though I have no doubt that the subject was investigated during the interim, and that at this very moment many of those investigations could be found on the shelves of a certain public office, neatly tied up with red tape, and most correctly labelled.

In 1823, Captain Norton, of the 34th Regiment, began to fire elongated bullets, and he soon overcame those unexpected difficulties which meet the first experimenter in every branch of science. His success was unfortunate for himself, and useless to his country, which only acknowledged the justice of his views after Messrs. Delvigne and Minié had worked out the problem for the French Government.

The advantage of an elongated projectile obviously is, that the air has a less surface to resist than if the same weight of bullet were in a spherical form, and that, consequently, less velocity is lost in passing a given distance through the atmosphere. The disadvantage is, that the long bullet leaves the barrel with a less initial velocity the longer it is in proportion to its diameter, because the gas of the gunpowder has a less surface to press against.

It is evident that for every range there will be a particular form of bullet better suited than others, and that the very long bullet necessary to hit a target 1200 yards off may be ill suited to shoot a living object 300 yards distant, as this would have time to move after seeing the flash of the rifle before the slow-moving bullet reached them. Sportsmen have abandoned very long bullets, after a fair trial of them. Public opinion is now attempting to force their use on the army.

It seems strange, at first sight, that cannon were not earlier and more extensively rifled than they were. The reason is not obvious, why

large bullets from large rifles should not give results proportionate to those obtained from small bullets and small rifles. Colonel Cavalli, the able Superintendent of the Sardinian cannon factory, was one of the first who grappled with the difficulty. He found, however, that if he used more than a very moderate charge of gunpowder, his cannon burst. Mr. Lancaster's experience might be stated in the same words. Mr. Joseph Whitworth, perhaps the most successful mechanical engineer who ever lived, after rifling some small cannon, which projected bullets with accuracy almost incredible, rifled one with a bore of about four inches, and sides nine inches thick. It burst. He tried one with sides eleven and a half inches thick. It, too, burst.

Mr. Bashley Britten, in 1854, discovered a very simple method of attaching lead to an iron shot by soldering. His projectile enters a cannon easily from the muzzle, and, on the ignition of the gunpowder, the lead is forced by the gas to fill the grooved barrel, and give the projectile the necessary "spin." With such shells, Mr. Britten has obtained results from old-fashioned cannon far beyond all competition. He has rifled several service 32-pounders, and fired 51 lb. shells from them, getting a range of upwards of two miles with 10° of elevation, using 6 lbs. of gunpowder. From service 18-pounders he could fire 28 lb. shells with 4 lbs. of gunpowder, getting excellent ranges. He tried some 34 lb. shells and $6\frac{1}{2}$ lbs. of powder, and the gun burst. Many others tried, and minor obstacles were overcome. Either by loading at the breech, or by using expanding bullets like Mr. Britten's, windage was avoided; by coating the bullet with lead, or by planing it, excessive wear and tear of barrel was prevented; but progress was barred by the difficulty of obtaining cannon of sufficient strength to bear charges of powder proportionate to the weight of projectile, until that principle of construction was adopted which was first publicly advocated in this room by Mr. Robert Mallet on the 25th of June, 1855. As the reasoning of Mr. Mallet, and Dr. Hart's calculations, are to be found in the Transactions of this Academy, I will only briefly remind you that they recommended cannon to be built up tube over tube, each tube compressing those within it to a degree to be exactly determined by previous calculation. This compression of the inner tubes, and consequent extension of the outer tubes, is necessary, they argued, to prevent the inside breaking before communicating sufficient strain to the outside, as is the case in any thick tubes made in one piece. My object in addressing you this evening is to mention some facts which will corroborate these views.

Table A gives the dimensions of some cylinders when strained from within, as obtained by actual measurement by Major Wade, of the U. S. Ordnance. With every degree of strain, it will be observed, the outer portions of these cylinders stretched less than the inner ones, and that, too, in a greater ratio than any of the received formulæ would account for. Major Wade also burst some cannon for his Government by water-pressure, and found their strength to resist pressure from within, in some cases, only one-quarter what it would have been had the whole thickness shared equally in resistance.

TABLE A.—*Extension of Hollow Cylinders.*

CYLINDER No. 1.

Force applied.	Diameters in Inches.		Ratio of Increment to the original Diameters.		Outside less stretched than Inside.	Thickness of Metal.	Area of Cross Section.
	Interior.	Exterior.	Interior.	Exterior.			
lbs.							Sq. Inches.
0,000	·8050	1·3090	One in	One in	As one to	·2520	·83681
1,000	·8061	1·3093	732	4,367	$5\frac{4}{10}$	·2516	·83603
2,000	·8083	1·3100	277	1,309	$4\frac{1}{4}$	·25085	·83468
3,000	·8102	1·3110	155	655	$4\frac{1}{4}$	·25040	·83432
4,000	·8114	1·3120	126	437	$3\frac{1}{2}$	·25030	·83486
5,000	·8126	1·3130	107	327	$3\frac{1}{18}$	·25020	·83439
6,000	·8141	1·3140	88	262	3	·24995	·83554
7,000	·8153	1·3150	78	218	$2\frac{8}{10}$	·24985	·83607
					Average $3\frac{1}{2}$		

CYLINDER No. 2.

0,000	·8030	1·812	....	....	....	·5045	2·0723
5,000	·8030	1·812	....	....	....	·5045	2·0723
8,000	·8053	1·813	349	1,812	$5\frac{1}{5}$	·50385	2·0722
10,000	·8067	1·814	217	906	$4\frac{1}{5}$	·50365	2·0733
12,000	·8085	1·815	146	604	$4\frac{1}{7}$	·50325	2·0739
14,000	·8110	1·816	100	453	$4\frac{1}{9}$	·50250	2·0736
					Average $4\frac{1}{2}$		

CYLINDER No. 3.

0,000	·8100	1·8120	....	....	....	·50100	2·0635
5,000	·8100	1·8120	....	....	....	·50100	2·0635
8,000	·8124	1·8127	337	2,588	$7\frac{3}{4}$	·50015	2·0624
10,000	·8137	1·8130	219	1,812	$8\frac{1}{4}$	·49965	2·0616
12,000	·8151	1·8134	159	1,294	$8\frac{1}{7}$	·49915	2·0609
14,000	·8171	1·8140	114	906	8	·49845	2·0600
					Average $8\frac{1}{2}$		

CYLINDER No. 4.

0,000	·8070	1·811	....	....	....	·50200	2·0644
5,000	·8124	1·812	149	1,811	$12\frac{1}{7}$	·49980	2·0604
8,000	·8166	1·814	84	604	$7\frac{1}{5}$	·49870	2·0606
10,000	·8177	1·814	75	604	8	·49815	2·0523
12,000	·8205	1·815	59	453	$7\frac{3}{5}$	·49725	2·0585
14,000	·8211	1·815	57	443	$7\frac{3}{4}$	·49695	2·0578
					Average $8\frac{1}{2}$		

To show how rapidly the resistance of the metal in tubes diminishes from the centre, even using Professor Barlow's formula, which makes the resistance inversely as the square of distance from the centre, I have made out a Table (B) of what force each successive annular inch can exert in a cannon 4 inches in bore and 10 inches thick. The strength of each ring being 1000, the numbers in the Table show the portion of their strength which they can use. The total strength of such a tube, it will be remembered, is only one-sixth what it would be if the strain were equally distributed.

TABLE B.—*Force exerted by successive layers of Metal in a Cylinder* 4 *inches inner diameter and* 10 *inches thick, the strain on the inner film being* 1000.

		Force which could be exerted, were the inner 4 inches removed.
Inside annular inch, . . .	666	. . . .
Second ,, ,, . . .	333	. . . .
Third ,, ,, . . .	200	. . . .
Fourth ,, ,, . . .	133	. . . .
Fifth ,, ,, . . .	96	857
Sixth ,, ,, . . .	70	643
Seventh ,, ,, . . .	55	500
Eighth ,, ,, . . .	44	400
Ninth ,, ,, . . .	36	327
Tenth ,, ,, . . .	30	253
Total, ...	1663	3000

Theory gives the third inch a power of exerting one-fifth of its strength. A reference to Table A shows that Major Wade's actual measurements gave only half even of this.

Paradoxical though it may seem, a thick tube like this would be much strengthened by diminishing its thickness.

Professor Barlow's formula would give 6 inches as the thickness of maximum strength for a tube of the outer diameter of the one we have been considering. Its strength then would be 3000, or nearly double that of the thicker tube, because, the four inner rings being removed, the others could use more of their strength. Yet the Government is to this day making cannon with bores of 6 inches, and walls of nearly 12. I have said enough (I hope not too much) about the weakness of cannon made in one mass. It remains for me to record what has been done to prove *practically* the advantage of making them of concentric laminæ.

In February, 1855, I made an 18-pounder cannon of a cast-iron gas-pipe, with two layers of wrought-iron hoops shrunk on it. It was so strong that I afterwards had it bored out to the diameter of a 24-

pounder. It was then 2½ inches thick at the strongest part, yet it bore being fired with 4 lbs., 5 lbs., 6 lbs., 7 lbs., and ultimately several times with 8 lbs. of powder, and a 24-pound shot.

In May, 1855, I altered an ordinary cannon, cutting away some of the useless outside part, and replacing it with metal, put on with initial tension. This was a most satisfactory experiment, for an unaltered cannon of cast-iron, of the same size and weight, and one of brass, were tried against it. All three were fired 68 times with one charge of powder and one shot; 26 times, 1½ charge, 1 shot; 5 times, 1½ charge, 1 shot; 5 times, 1½ charge, 2 shots; 110 times, 2 charges, 2 shots.

The cast-iron gun here burst at this round. Firing was continued from the brass gun and mine, 74 rounds more, with double charges of powder and 2 shots, when the brass gun was found to have utterly lost its shape. After the destruction of both its rivals, 134 rounds more were fired from my gun with the same charge; then double charges of powder, and 3, 4, and 5 shots were tried, till the barrel was filled. It was fired 158 times with a double charge of powder, and crammed to the muzzle with bullets. Although these two guns and three others were finished by me before Mr. Mallet read his paper here, yet I had taken such precautions to keep my proceedings secret (as we were engaged in war with Russia at the time) that it is utterly impossible he could have learned anything from me.

In the spring of 1855 Mr. James Longridge, a civil engineer, noted for his mathematical skill, arrived at the same conclusion as Mr. Mallet, Dr. Hart, and myself. He put them into practice by making a 9-pounder gun of a thin iron tube, with wire wound round it with an accurately measured tension. This is, doubtless, the way to make the strongest possible tube from a given quantity of metal, and will, I expect, be found of great value in the construction of monster mortars. Next in point of date comes the French naval rifled cannon, adopted in 1858. It is made only in two layers, the inner of cast-iron, and in one piece; the outer one of wrought iron, and in five pieces. About the same time Colonel Cavalli commenced to make his breech-loading cannon in two layers also, the inner tube being of brass, but short, extending only round the seat of the charge, and a few inches in front of it. The rest of his guns are of cast-iron. In 1859 the celebrated Armstrong gun was adopted into the military service of this country. It, too, is built up. The inner layer is made by twisting bars of iron into coils, welding each coil into a short cylinder, and then welding those cylinders together end to end. The next layer is made by welding together lengthways two long pieces, semi-cylindrical in section; the third layer is made of coils, like the first, but these are not welded to each other. I should observe that Sir W. Armstrong disclaims most distinctly any desire to obtain strength by adjusting the size of the different layers, and although I talked over with him the theory advanced by Mr. Mallet and myself some months before he brought forward his present gun, yet he learned nothing from Mr. Mallet or myself; and if he puts the tubes together with the requisite degree of tension, he does so by pure accident.

Last year Mr. Whitworth, taught by his previous failure, and rightly attributing the success of the Armstrong gun to *its strength*, himself adopted the same principle of construction for his 80-pounder gun. This he made of a tube of what he calls homogeneous iron, and tapering slightly outside. On this conical tube he forced short tubes of wrought-iron, and over these a third layer of tubes. This method of putting tubes together is, I think, much better than that used by the French Government and by Sir William Armstrong, who heat the outer tubes and allow them to shrink on the inner ones.

Within the last few months Sir W. Armstrong has attempted an imitation of my 1855 gun for our navy. His new naval guns are 6½ inches in bore. The interior is of cast-iron, about 6 inches thick from the breech to just behind the terminus, where the thickness is suddenly increased to 8½ inches. I need hardly say they must break at this point. The weight is 98 cwt., and they cannot be depended on to fire the 70 lb. shells for which they were constructed. I mention them to point out the real cause of failure, which has been wrongly attributed to the circumferential strength obtained by the double layer of metal at the breech being sufficient. To rebut this, I need only say that a 10-inch gun built up of only two layers, but of better proportions, stood 10 rounds with 20 lbs. powder and 132-pound shot; 10 rounds with 20 lbs. powder and 264 lb. bolt; 10 rounds with 20 lbs. powder and 396-pound bolt; 9 rounds with 20 lbs. powder and 512-pound bolt.

That gun, though LIGHTER THAN THE NEW NAVAL GUN BY HALF A TON, would never have burst with 70 lb. shells!

I last year made a gun something like this in form, and only half the weight of the new naval gun, 48 cwt. instead of 98. From it I have thrown 58 lb. shells with a greater velocity than such shells have ever before been thrown. One of my objects in making this gun was to prove that the efficiency of a rifled cannon depended principally on its strength—strength which has yet been obtained in one way *only*—for cannon of any size, viz., by building them up in *at least* two layers. I fired Mr. Bashley Britten's shells, already described, and obtained such great velocity that they flew above a mile and a half (2670 yards) with only 5° elevation. It is but a short time since Sir W. Armstrong thought it much to do this with double the elevation. The range of Mr. Whitworth's 80-pounder, solid shot, with 5° elevation, is reported to have been less than that of the 58 lb. hollow shells I fired, but, as the wind may have favoured me, I have invited him to a friendly trial of our respective guns at the same time and place.

I have now endeavoured to show that no rifled cannon of considerable size have succeeded when made in one mass; that all French, Sardinian, Armstrong, Whitworth, and my own, have succeeded when built up, all except the new naval gun, which fails from obvious causes; and, lastly, that the success of successful rifled cannon has been due neither to their having thirty-six grooves, nor to their being polygonal in section, but to their *strength*.

DR. HART'S REMARKS, MADE AFTER THE READING OF CAPTAIN BLAKELY'S PAPER.*

Dr. Hart having been called on by Professor Haughton for an account of his investigations, said that his attention had been directed to the subject by Mr. Mallet, who, about the year 1854,† asked his opinion on a mechanical question, which he represented as an application of the principle of the lever to a cylinder by surrounding it with a series of blocks of a considerable thickness, and fastening on a hoop outside these blocks. Having expressed his dissent from this idea of converting such blocks into levers, he was reminded of the well-known fact, that, when a cylinder is submitted to a strong internal pressure the inner surface is more strained than the outer, and consequently yields, and is split before the outer surface has borne any considerable portion of the strain. Now, it is obvious that this inequality of strain depends on the ratio of the inner and outer diameters of the cylinder, and, therefore, that Mr. Mallet's outer hoop, being considered as a cylinder whose thickness bore a small ration to its diameter, would be more uniformly strained, and, therefore, stronger than it would have been if applied directly without the intervention of blocks.

As it appeared, however, that this construction would add so enormously to the weight of a gun as to render it quite unsuitable for the purpose of the Russian war, Dr. Hart endeavoured to find some other mode of equalizing the strain without introducing these large blocks, which merely transmitted the force, without bearing any part of it themselves.

The obvious suggestion of using concentric cylinders of materials which differed in elastic qualities having been rejected by Mr. Mallet, the next idea that occurred was that of fitting on successive cylinders of iron with different degrees of initial tension, so calculated that when the internal strain approached the bursting point, all portions of the cylinder should be equally strained.

Mr. Mallet having at once admitted the validity of this principle, Dr. Hart gave him a calculation of the requisite amounts of initial strain, deduced from a formula which was afterwards published by Mr. Mallet in the Transactions of the Academy; and it was believed to be in conformity with this suggestion that Mr. Mallet's monster mortar was constructed.

It is said, however, that there are many practical difficulties in the way of applying this principle of construction with the requisite accuracy, and that it is liable to lose its initial tensions by time, and by repeated shocks; and it, therefore, seems highly important that Mr. Mallet's original suggestion should not be neglected. The objection of weight, although conclusive against its application to field artillery, would probably be of no importance in the case of a fixed battery. The principle of this construction is sufficiently explained by one of Captain

* [These remarks, as also those at p. 324, are printed from a memorandum furnished by Dr. Hart.—Ed.]

† [We are requested by Dr. Hart to say, that he did not correctly state the date of this communication. It was made to him, not in 1854, but in the spring of 1855.—Ed.]

Blakely's diagrams, in which it is shown that the removal of some of the inner rings would add largely to the total strength; it is to be observed, however, that this removal of inner rings would also add in a still higher ratio to the interior diameter, and that the pressure which is proportional to this diameter would be increased more than the strength; but if the space now occupied by these inner rings was accurately filled by longitudinal bars or voussoirs analogous to Mr. Mallet's blocks, the inner diameter would be restored to its former magnitude, while the increased strength resulting from equalization of tension would be retained.

Robert Mallet, C.E., F.R.S., made some remarks on Major Blakely's paper.*

CAPTAIN BLAKELY'S REPLY.†

MR. CHAIRMAN,—I regret that the time of the Academy has been taken up this evening in hearing a discussion on a question which must be quite without interest for it,—that of the priority of discovery by Dr. Hart or myself of the method now almost universally adopted for making cannon. About three years ago, to the best of my recollection, I first heard of Dr. Hart's investigation; and, although two years had then elapsed since my actually making several cannons on the system in question, and the mortars made by Mr. Mallet on Dr. Hart's suggestions had not even then been fired, yet, hearing it stated that Dr. Hart had proposed the system before I did, I wrote to ask him whether this was or not so. I mentioned to him when I had discovered the thing, when I had first urged Government to try it, and when I had myself put it into practice. Dr. Hart's reply was, that he had not turned his attention to the matter till some months after I had actually made the guns. Not only, Sir, did Dr. Hart tell me this, but Mr. Mallet coroborated what he said. The date then given for Dr. Hart's discovery was, I think, July, 1855. If the date given to-night, namely, "early in 1854," is correct, he was in the field before me, and I shall cheerfully acknowledge that he was so, if on further reflection he is of opinion that, when the circumstances were recent, he was mistaken, and that he can now remember them enough to correct his mistake. This matter Dr. Hart alone can decide; I hope he will do so. I think, Sir, that, having finally communicated with him and Mr. Mallet on the subject of priority, and having received definitive confirmation from both three years ago, I have reason to be much surprised at the tone of Mr. Mallet's remarks to-night, from which it would be difficult to gather that, if I entertained mistaken notions about priority, I did so in consequence of having been misled by himself. In my paper to-night, I distinctly acknowledged that the principle was first *publicly* advocated in this room by Mr. Mallet in June, 1855. So much for priority of discovery and priority of publication: I shall be quite content to have carried out the system in practice on several cannon, not only years before Mr. Mallet made his mortar, but months before he

* [Mr. Mallet was unable, through absence, to furnish any memorandum of his remarks, which are, however, contained in his subsequent communication (June 11) to the Academy.—ED.]

† [This reply is here printed from a memorandum furnished by Captain Blakely.—ED.]

read his paper here. I made guns in March, 1855; he talked of them in June of the same year.

FURTHER REMARKS BY DR. HART.

A question of priority having arisen, and Captain Blakely having referred to a letter of Dr. Hart to him, in which he mentioned 1855 as the date of his investigations, Dr. Hart replied, that he had not intended to raise any question of priority; that in the letter referred to, he had said that he believed his investigations and Captain Blakely's had been simultaneous, as they were certainly independent, and that he had preserved no record of dates; but that Mr. Mallet, being in possession of the original letters which contained his calculations, could supply them if they were considered important. The fact was, that Captain Blakely's investigations were experimental, and resulted in a gun; Dr. Hart's were mathematical, and resulted in a formula. Both are presumed to be original; at all events they were distinct, and the question of priority or synchronism seems perfectly immaterial.

MONDAY, MAY 28, 1860.

GILBERT SANDERS, Esq., in the Chair.

MR. GEORGE J. STONEY read a paper "On the Propagation of Waves."

MR. DAVID MOORE, Curator of the Royal Dublin Society's Botanic Garden, Glasnevin, read the following—

RESULTS OF FARTHER PHYSIOLOGICAL EXPERIMENTS ON THE FORMATION OF WOOD IN DICOTYLEDONOUS PLANTS, MADE IN THE ROYAL DUBLIN SOCIETY'S BOTANIC GARDEN BETWEEN THE YEARS 1851 AND 1860.

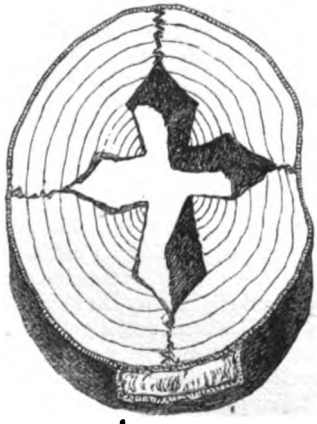
IN the year 1851 I had the honour to make known to the Academy the results of a series of physiological experiments which had then been made in the Botanic Garden, with a view to ascertain the nature of the formation of wood in dicotyledonous plants, which I detailed in a paper published in the "Proceedings" of the Academy, vol. v. p. 1. Those experiments had extended over twelve years (from 1839 to 1851), and were only in a progressive state at the time the paper was read. The object of the present communication is, therefore, to state some further results, which have been ascertained since that time, and also to notice other experiments of a different kind, though made for the same purpose, during the interval between 1851 and 1860.

On reference to the paper I have alluded to, it will be found the principal experiment made was on the bole of a large tree, nearly five feet in circumference, which was bored at right angles through the centre, each bore being seven inches wide,—thus occupying half the space of the circumference of the tree, which was then left standing on four pillars of wood, occupying the other half. The whole of the wood portion soon became dead, and served only the purpose of acting as supports for the bole, without any of the functions of vitality being carried on through its medium: consequently, the bark covering the pillars of dead wood were the only parts in that portion of the tree where

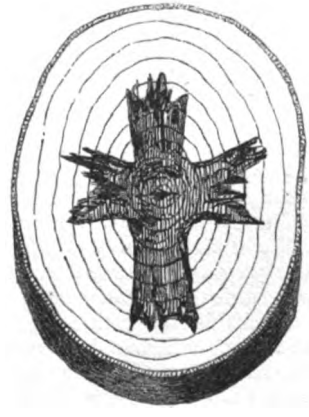
these functions could take place. They in turn were denuded of their bark covering, one after the other, at intervals, according as the newly formed wood on the pillar first laid bare had made a junction with the lower lip of the cut, thus keeping up communication for the circulation of the sap. In this way every organ of the tree, over nearly a foot of its bole, was destroyed and again renewed, without killing it, or even arresting growth to any visible extent. It continued to unfold its leaves at the proper season, and produce new wood as other trees of the same kind did, with this difference only, that about four feet of the apex of the stem died.

My object in continuing the experiment was two-fold:—First, to prove whether the tree would continue to live; and, if so, whether any visible effects on its growth would result. Secondly, to ascertain, if possible, how far the wood continued dead towards the apex of the bole from the spot where the operation took place.

With respect to the former, I can now state that the wounded portion of the stem is nearly healed over, with the exception of one hole, about two inches wide, which is partly filled with the debris of the decaying wood, and out of which moisture constantly oozes; but otherwise the tree is quite healthy, and the only visible effect produced by the mutilation is, that of causing it to leaf and flower a little earlier than other trees of the same kind near it do. I could not ascertain the second object without destroying the tree, which would have defeated the first, —consequently, similar experiments had to be made on other trees, the results of which I now proceed to lay before the Academy. The figures in Nos. 1 *a* and *b* of the diagrams correspond with the specimens operated on, and now on the table, which are transverse sections, cut at



No. 1 *a*.

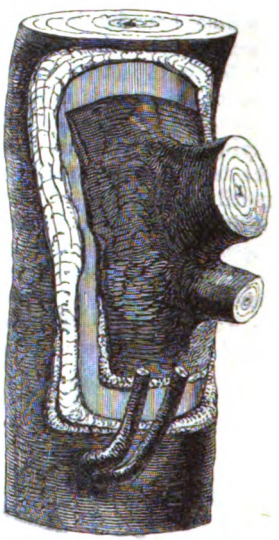


No. 1 *b*.

different heights above the place where the borings were made through the bole. No. 1 *b* was cut 5 feet above it, and where the dead wood had greatly decreased in diameter, but it continued so, still farther decreasing 3 feet higher up the stem, where it commingled with

living tissue, and at 10 feet disappeared altogether, after which the remaining portion of the stem was healthy, having pith and wood layers regularly formed. Such has the remarkable permeability of vegetable tissue been proved to be, that every organ of a large tree has been killed over a space of nearly eight inches in the centre of its stem without killing the plant, or impeding the circulation of sap to any great extent; and although the wood portion so destroyed continued dead through a space of ten feet, it was again renewed to living tissue through the remaining portion of the stem—every organ in regular order.

No. 2 diagram corresponds with specimens on the table, which were operated on for the purpose of showing how wood is formed when a growing branch is isolated on the stem of a tree. A similar experiment had been commenced by Mr. N. Niven before he left the Garden, but sufficient time had not elapsed for its completion.

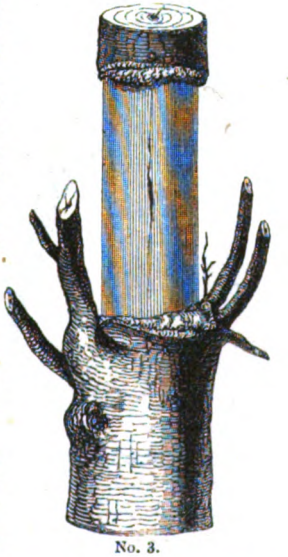


No. 2.

The present specimens have been under operation during the last seven years, and prove more incontestably what has long been held as an axiom in vegetable physiology, namely, that the principal formation of new wood in dicotyledonous plants takes place in a downward direction, from the apex to the base of the stem. It was in consequence of Dr. Schleiden, of Jena, impugning this theory, so lately as within the last ten years, that I was desirous to prove or disprove it. In my former paper I was inclined to adopt his views on this matter, to some extent, which further experience has shown me are erroneous. But his investigations on the origin of vegetable tissues, and his excellent definition of the true distinctions between the formation of the stems of monocotyledonous and dicotyledonous plants, are such as to claim for any theory he holds on this subject profound respect. Both he and Dr. Mohl have, through recent investigations, clearly proved that the vascular bundles of tissue which, combined, form so large a portion of the solid wood, grow in an upward direction, and enter the leaves from below upwards, which is the converse of the theory so long held by Du Petit Thouars and his followers, that the vascular bundles were prolongations from the bases of the leaves downwards to the roots; hence they accounted for the increase of wood taking place in a vertical direction. But all my specimens show that the new formation takes place in a horizontal plane from the axis, as well as it does in a vertical, thus proving that it is the alteration of tissue in the cambium layer towards the periphery of the stem which causes the increase in girth, and not so much owing to the growth of tissue downwards.

At this point, I am led to refer to an article on sap circulation in plants by M. Trecul, published in "Comptes Rendus," September,

1857, page 434, which, so far as I can judge, is a most able exposition. The author expresses his belief in a double circulation, or, in other words, a rise and descent of the sap, which he calls the great circulation, and also in a secondary or smaller circulation through the lactiferous vessels, which he calls the venous circulation. He further argues against the probability, amounting almost to impossibility, of the physical actions of endosmose and capillarity playing so important a part in sap circulation as they have been so generally believed to do by physiologists. But what chiefly concerns my present subject is, his account of the manner descending sap acts in forming the tissues which constitute wood. To quote a paragraph from M. Trecul's paper will enable me to make his views on the matter better understood than anything I can state, viz.:—"The sap, which on its way takes part in the nutrition of the organs first developed, arrives in the leaves, in the green parenchyma of which it is submitted to fresh elaboration, or in the chlorophyl cells of the stems of fleshy plants without leaves. The carbonic acid of the air is absorbed, and then decomposed during the day; its carbon is retained by the sap, and its oxygen is in great part rejected. The sap, thus modified under the influence of respiration, takes its course through the cortical cells, which it nourishes. It then aids in the multiplication of the cells of the generative layer, which are produced in horizontal series. A portion of these cells, thus horizontally multiplied, forms a new layer of bark, the woody fibres and medullary rays; the others are converted into vessels in the following manner—the excess of the descending sap, which is not employed in the nutrition of the newly formed cells, or in thickening those first developed, descends through certain of the newly-formed cells, it dilates them, perforates them, and makes them take all the characters of vessels, so that those cells which, during the first phase of their developement, resembled all the others, appear subsequently to be of a totally different nature." Now this appears to me to be a succinct statement of the true theory of the formation of vascular tissues in exogenous plants, one which all my experiments agree with, and that on which the circumstance of stocks on which plants are grafted not being covered with layers of the wood of the graft united to them, can be easily demonstrated.

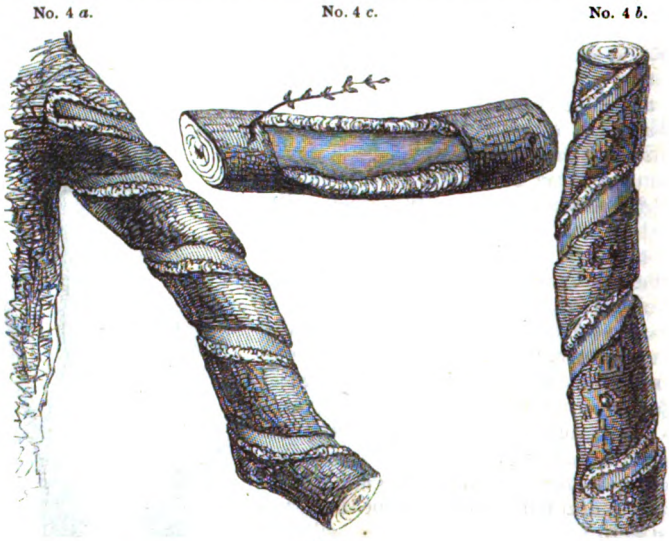


No. 3.

The specimens agreeing with diagram No. 3 were denuded of their bark, and had also the cambium layer scraped off; yet they have continued to grow during the last six years, and the parts denuded have increased slightly in circumference, though much slower than the portions, on

which the bark is, have done. They prove against the descending circulation being solely confined to the bark layers, and show that it possesses the power of diverging into the layers of young wood until it passes the decorticated parts; as much of it, at least, as enables the vital functions to be supported: but, no doubt, a great arrest of it takes place on the upper lip of the cut, or point of divergence from the bark cells to those of the cambium.

There is, however, one important feature exhibited by those specimens, and also by those of diagram No. 2, namely, wherever the upward flow of sap has been arrested, adventitious buds have formed and produced branches. It would thus appear that the peculiar kind of cells or lenticels, which form the basis of those elongating axes, are nourished and produced by the ascending sap, but whether that be truly the case, remains uncertain. The arrest of the upward flow of sap, and consequent greater accumulation of it at the lower lip of the cut, may cause a partial descent to take place, and thus give rise to the adventitious bud cells, but, certainly, I have never seen them produced above the upper lip of a partially decorticated stem, where roots will be produced if preparations be made to secure moisture and exclude light.



No. 4.

The specimens agreeing with diagram No. 4 are curious. No. 4 *a* is a portion of the branch of a weeping beech, which grew in a nearly downward vertical position from the bole of the tree to the earth, and was operated on to prove whether the denser sap would be affected by gravitation. It will, however, be seen, on examining the specimen, that this power has had very little influence. The newly formed tissue has increased for the most part in a vertical position from the apex to the

base of the branch, though in this case growing upwards, in consequence of the position of the branch being reversed.

No. 4 *b* is part of the stem of a holly-tree, which stood in its natural position when operated on. It shows, also, that the principal portions of newly formed wood have grown chiefly on the upper lips of the spiral denudations.

No. 4 *c* is part of a branch which grew as nearly as possible in a horizontal position from the axis of the tree. It was denuded of bark over the upper half of its circumference, the bark on the lower half next the earth being still attached. The cells forming woody tissues in this instance have been produced for the most part in horizontal series, having little preponderance to the part nearest the base of the branch, which favours the correctness of M. Trecul's views, as stated above.

I have now, in this and a former paper, laid before the Academy the results, such as they are, of twenty years' experiments on this subject, which may appear a long period; but we cannot force the operations of nature, and must, therefore, be content to wait assiduously on her if we desire to elicit trustworthy data, such as can be useful to future students following in the same path of investigations.

Sir William Rowan Hamilton, LL.D., M.R.I.A., read the following paragraphs in continuation of his paper—

ON ANHARMONIC CO-ORDINATES.

11. To myself it naturally appears as a *fourth advantage* of the anharmonic method, that it is found to harmonize well with the method of *quaternions*, and was in fact *suggested* thereby; though not without suggestions from other methods previously known.

12. Thus, if α, β, γ denote three given vectors, OA, OB, OC, from a given origin O, while a, b, c are three given and constant scalars, but t, u, v are three variable scalars, subject to the condition that their sum is zero,

$$t + a + v = 0;$$

then the equation,

$$\text{OP} = \rho = \frac{t^r a\alpha + u^r b\beta + v^r c\gamma}{t^r a + u^r b + v^r c},$$

in which r is any positive and whole exponent, expresses generally that the *locus* of the point P is a *curve of the r^{th} order*, in the given plane of ABC; which curve has the property, that it is met in r coincident points, by any one of the three sides of the given triangle ABC. But the coefficients t^r u^r v^r are examples here of what have been above called anharmonic co-ordinates.

Captain Blakely read the following:—

CAPTAIN BLAKELY'S REMARKS IN CONTINUATION OF HIS REPLY TO MR. MALLET AT THE MEETING OF THE ROYAL IRISH ACADEMY ON MAY 14, 1860.

Mr. Chairman,—At the last meeting of the Academy a question was raised by Mr. Mallet, between himself, Dr. Hart, and me, as to which

of us first invented the method of construction now universally employed for large rifled cannon. If I rightly understand Mr. Mallet, he considers himself to have been the original inventor, and he is under the impression that he only asked Dr. Hart to calculate exactly the degree of strain necessary for each consecutive layer of tubes. He also believes that Dr. Hart gave him this calculation in 1854.

Dr. Hart, on the contrary, told us most distinctly that Mr. Mallet came to him for advice about a plan for making mortars of thick longitudinal voussoirs surrounded by hoops, and that he, Dr. Hart, had proposed the use of the present system of concentric tubes, as giving much greater strength with less weight.

I expressed astonishment at the date of 1854 being assigned as that of Dr. Hart's investigation, because, when the matter was more fresh in our memories, both Mr. Mallet and Dr. Hart had mentioned July, 1855, as the date. As my first cannon was made in the spring of 1855, I had, therefore, always considered myself the first discoverer.

Nothing, Sir, could be more unsatisfactory than to leave the question in such an undecided state; as, although I should never have trespassed on your valuable time to raise such a question, yet, as it has been raised by Mr. Mallet, I venture to hope you will allow me to throw some further light on it. First, I will say that I have found two published letters from Mr. Mallet, corroborating my view of the dates. One is to "The Press" (Nov. 14, 1857), and in it he states that Dr. Hart first communicated with him on this subject on the 6th July, 1855. In the other letter to "The Mechanics' Magazine" (Dec. 12, 1857, page 563), he says—"My first communications from Dr. Hart were received very early in July, 1855."

Now, Sir, I hope to be able to show where the mistake has arisen, viz., in some confusion as to the exact date of Mr. Mallet's valuable and interesting paper on the construction of artillery. That was read to this Academy, June 25, 1855, but not published till the year after, *and I think the theory in question was communicated by Dr. Hart in the interim, and inserted in the paper.* I found, on examination, that some parts of the paper, as published, must have been written in September, 1855, at the earliest, for at page 232 Mr. Mallet alludes to a proposal to shrink hoops on a 13-inch mortar, and this proposal was, I know, made by Colonel Eardley Wilmot, on September 25, 1855, *and based on the success of a gun made by me in the spring of that year.*

I must, in consequence of the discovery of this error in the date ascribed to Mr. Mallet's publication, retract my former admission, that he was the first to publish the theory. Not only was I before him, but also Mr. James Longridge and Sir Charles Fox. The late Mr. Brunel, too, early in 1855, proposed to Sir William Armstrong to make cannon on the same principle.

In looking for Mr. Mallet's published letter in "The Mechanics' Magazine," I found one from Dr. Hart (page 176, Feb. 21, 1857), defending the theory against severe criticism, and calling it his own—"My proposal, on which Mr. Mallet has acted," are the words used.

That Mr. Mallet did not then interfere and defend the theory, is, to my mind, conclusive that Dr. Hart's memory of the facts is the more accurate, and that he, not Mr. Mallet, was an original and independent inventor.

In persuading any person of this truth of the theory of built-up cannon, I have found the greatest assistance from Dr. Hart's calculation; and I dare say that if he has tried to convince a person less conversant with mathematics than himself, he has found the task easier since he has been able to say, "Captain Blakely has made several cannon on this principle, and they have shown powers of endurance far beyond what even he himself anticipated."

Although, therefore, I believe I anticipated Dr. Hart, I can conceive no process of reasoning by which persons taught by him can transfer their gratitude to me. I, consequently, am unable to attach the same importance to the question of priority which others seem to have done.*

Mr. W. R. Wilde exhibited a medallion plaster bust of the late John M. Kemble, Esq., and presented the following antiquities:—

1. From Dr. Kelly, Mullingar, an ancient Irish skull; 2. from Mr. Richard Murray, Mullingar, two ancient shoes, found in turf bogs (see Catalogue, p. 349); 3. from Dr. O'Meara, Carlow, a bronze pin; 4. from the Corporation of Dublin, gutta-percha casts of the ancient seal of that body.

The Academy then adjourned.

MONDAY, JUNE 11, 1860.

James Henthorn Todd, D. D., President, in the Chair.

George Meyler, Esq., was elected a Member of the Academy.

The President drew the attention of the Academy to the beautiful electrotype model of the box of St. Molaise of Devenish Island, which had been presented to the Museum a few years ago by Mr. West. The original has recently become the property of a member of the Council, and great interest, therefore, attaches to any historical fact which may be found in our ancient literature respecting this valuable relic.

The following legend occurs in an ancient historical romantic tale, entitled Tannaire bec fola, a MS. of which is in the collection of Professor Curry, from whom the President received the following translation of the legend:—

"One Sunday morning when Diarmaid, son of Aedh Slaine, monarch of Ireland, was lying upon his couch, at or near Tara, he saw before him in the house four young clergymen. "What, is it possible," said Diarmaid, "that the clergymen are travelling upon the Sunday?" at the same time covering his head so that he should not see them. "It was

the advice of our superiors that has induced us," said the clergymen; "it was not our will; it is St. Molaise of Damh-Inis that has sent us to speak to thee, for the following reason:—

"As a farmer of Damh-Inis had been attending to his cows at early morning, he saw four armed men, with their shields down, passing over the island. He immediately saw four other men meet them, whereupon they struck at each other, so that the sound of the stricken shields could be heard throughout the island, until they all fell at both sides, but one man only, who escaped, mortally wounded.

"The seven slain men were burned by Molaise, and they left behind them as much gold and silver as would be a load for two of us; the gold and silver ornaments of their cloaks, their necks, their shields, their spears, their swords, their hands, and their tunics. 'And we have come,' said they, 'to know how much of that gold and silver you will claim for your share.' 'Not so,' said King Diarmaid, 'what God has sent to Molaise, I shall not share with him. Let him cover his relics with it.' This was verified. It was with that silver and that gold, St. Molaise's relics were ornamented, namely, his shrine, and his minister, and his crozier."

The President remarked that the reliquary here called the "Minister" of St. Molaise, was most probably the box, a model of which was before the Academy. It contained a MS. of the Gospels which ecclesiastics of that period (the seventh century) were wont to carry with them in their missionary travels. These volumes often contained, together with the Gospels, the ritual for the visitation and communion of the sick, as in some MSS. of this class in the Library of Trinity College, Dublin; and a valuable "Minister," or ornamental box of this description, although of a much later date, now in the possession of the Earl of Ashburnham, contains an ancient MS. missal, to which the President had some time ago called the attention of the Academy.

The legend is curious, as showing that valuable ornaments of gold and silver were worn generally by warriors upon their persons at the period to which it refers, and also that there was at that time a sort of law of *treasure trove* in Ireland, by which the king was entitled to the gold or silver found under the circumstances related in the foregoing narrative.

ROBERT MALLET, C. E., F. R. S., read—

SOME REMARKS UPON CAPTAIN BLAKELY'S, R. A., PRETENSIONS TO PRIORITY AS ORIGINAL DISCOVERER OF THE PRINCIPLES, AND INVENTOR OF THE METHODS, OF CONSTRUCTING ORDNANCE IN SUPERIMPOSED RINGS, WITH INITIAL TENSION.

Two distinct issues have been raised by Captain Blakely, in reference to right of priority, by his paper, read on the 14th of May last, and entitled, "On the Practical Application of a Principle announced to the Academy

by R. Mallet, Esq." &c., and by his continuation, read on the 28th of May last,* arising out of the discussion upon the former.

I regret that I was so engaged elsewhere since the meeting of 14th May, as to have been unable to supply, as I had intended, a written memorandum of what I said then in reply; and that I was unavoidably absent upon the last occasion, and therefore unable at the moment to reply to the statements by which, now for the third or fourth time since the year 1855, Captain Blakely has endeavoured to take from others rights of priority, as a discoverer and inventor, that I cannot admit ever belonged to him. I am now, however, enabled, by permission of the Academy, to place upon permanent record the facts by which those rights must be adjudged. I hope to do so in a clear and consecutive manner, and I challenge Captain Blakely to impugn the correctness of the statements I am about to make, in any way material to the issue.

The two issues raised are, first, Is Captain Blakely the true and original *inventor* of the *method* of constructing ordnance in superimposed rings, with initial tension,—the first man who had clearly grasped the *idea*, that by such construction a vast accession of strength might be given to the cylinder,—the first who comprehended its importance,—and the first who pointed out or invented the method by which the idea should practically be carried out or realized? This issue lies between Captain Blakely and myself, in the first instance.

The second issue lies between Captain Blakely and Dr. Hart, and arises on the question, Which of those two gentlemen first *investigated, in mathematical form, how much* additional strength this construction could give, *and what were the laws* that should regulate it?

The determination of both issues resolves itself into a question of dates.

It has been long recognised and understood all over Europe, as a principle, that *first publication establishes the right to priority in invention, investigation, or discovery;* hence the maxim of patent law, that "second inventors have no rights"—a maxim equally acted on throughout the world of science, as respects the rights of scientific investigators or discoverers, ever since the days of Newton and Leibnitz.

The dates, then, upon which Captain Blakely's claim to prior publication rests are as follow:—Upon the 27th of February, 1855, he applied for a patent for improvements in ordnance, lodging a provisional specification. This patent was specified on the 14th of August, 1855. Its claims, as specified, are for "the forming guns of an internal tube, enclosed in an external casing. The latter may be formed in rings, which may be driven on upon the internal tube, made conical to receive them; or may be heated and shrunk on. Two or more plies of such rings may be used; and old guns, i. e. guns cast on the then ordinary plan, may be strengthened by such rings." This specification (No. 431, for A. D. 1855, in Patent Records), therefore, contains the idea and invention of increasing the strength of guns by superimposed rings, with initial tension; although it is remarkable that no allusion whatever is made throughout to the

* [Mr. Mallet was not present on this occasion.—Ed.]

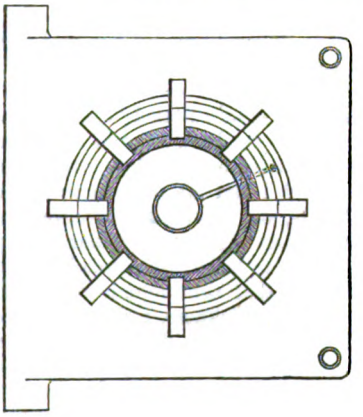
principle upon which such increase of strength depends. Provisional specifications, being merely part of the machinery of the Patent Office, remain buried in its archives for six months; the lodgment of the full specification is the date of first publication of any patented invention. Captain Blakely's publication of this invention, therefore, *through the intervention of his patent*, dates from the 14th of August, 1855. He can claim otherwise an earlier date, however. In 1855 he published a pamphlet, in which the method of construction is described, and in which, for the first time, his mathematical investigation of the law of increased strength, due to it, appears. The preface to the first edition of this pamphlet is dated the 27th of June, 1855; it must, therefore, have been first circulated at a later date, and, upon inquiring personally at the publisher's (Ridgeway, Piccadilly, London), I was informed that it was not issued before the end of July or beginning of August, 1855—in fact, not until within a few days before the date of the specification of his patent; and this is the earliest period at which, in any way whatsoever, he has *ever hitherto* attempted to show that he had published or communicated either the method of construction, with a knowledge of its principles, or the mathematical investigation of it. All Captain Blakely's other proceedings subsequent in date we may pass over as immaterial to the issue before us.

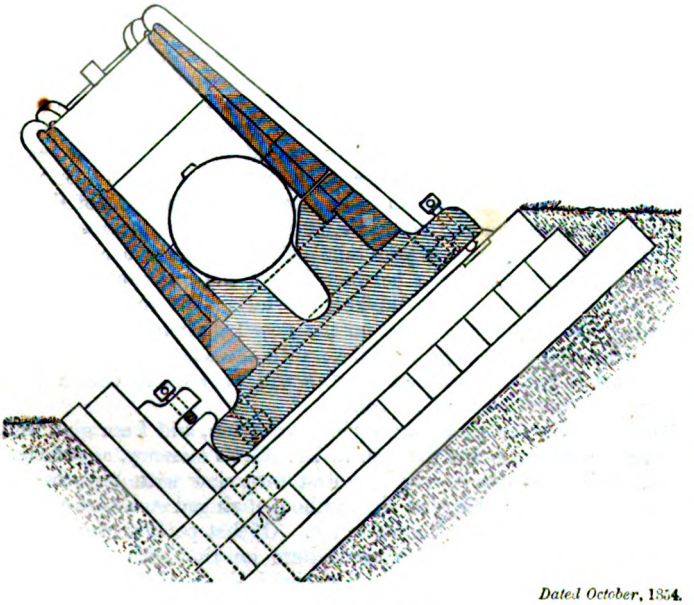
The 9-pounder—the achievements of which have been so often referred to—was not brought to Woolwich, nor fired, until very late in the year 1855 and early in 1856, and hence has nothing to do with the matter before us. A previous gun, an 18-pounder, of cast-iron, hooped with wrought-iron rings, which appears to have been the very earliest produced by Captain Blakely, was burst on trial at Woolwich on the 25th of May, 1855,—as stated in his own pamphlet, on "A proposed new method of constructing cannon," &c., p. 28, published in 1858 by Ridgeway, London. If we take the production of this gun to be equivalent to the first publication of the method of construction by initial tension by Captain Blakely, then his claim dates from the 25th of May, 1855, to the *method of construction*, and, as already stated, from July or August, 1855, for the *mathematical investigation* of its laws.

Now as to the dates of my own proceedings. The general principles of the construction of built-up guns—the fact that an enormous accession of strength could be attained by external rings, with initial tension—were known to me from about the year 1850, and were first suggested to my mind by reading certain passages in Mr. Edwin Clarke's book on the Britannia Bridge, where (vol. i., p. 306, and note to p. 311) facts may be found containing the germ of the whole theory. I, however, gave no publicity to my notions until the year 1854. In October, 1854, I made my original design for the 36-inch mortars, since constructed by Government. That design, made and then dated by my own hand, lies now before the Academy, as exhibited by me here on the 14th of May last. (See p. 335.)

In December, 1854, that identical design was exhibited to the Ordnance authorities at Woolwich, and to many other persons; amongst others,

Mr. Mallet's original Design for 36-inch Mortars.





Dated October, 1854.

Scale of original Design, 1-12.

to Captain Boxer, Superintendent of the Laboratory Department, Woolwich, and to General Portlock, at that time Commandant of the Royal Military Academy. The design, as may be seen, shows the whole chase of the mortar, constructed in plies of two thicknesses of superimposed rings, arranged conically, so as to admit of producing the initial tension either by driving on, or by shrinking on hot, and the cast-iron chamber, hooped externally with wrought iron. This, then, is the date of my first publication of this method of construction—*seven months prior* to the earliest date assignable to Captain Blakely's first publication *in print*, and nearly *six months before he produced his first experimental gun.*

The 36-inch mortars were ordered by Government to be constructed early in April, 1855, and I had my designs and specifications for them in the contractor's hands, and the work in progress, on the 11th of June, 1855. Speed in their completion was at that time primary to all other considerations to bring them before Sebastopol and Sweaborg; and with that view, having found that contractors were ready to undertake to forge the chases in a single thickness, I abandoned the more tedious construction in superimposed rings. Within a short time, however, the bankruptcy of the contractor (Mare, of Blackwall), and the sudden peace with Russia, afforded an opportunity for going back to the original principle of construction, and so these two great mortars have been constructed in rings, superimposed with initial tension, as in principle in the first instance designed.

Early in May, 1855, I, for the first time, visited, in company with Professor Downing, and conversed on the subject of ordnance construction, with Dr. Hart. On that occasion I stated to him my views of the increase of strength that might be attained by external hoops, and illustrated to him my conviction that these would be more effective, as they were removed further from the axis, by reference to the hoop upon a common tub (as stated by me in discussion here on the 14th of May last, and on that occasion admitted by Dr. Hart, as still in his remembrance). My illustration was, that if you take off a hoop from a common tub, interpose a number of blocks between it and the exterior of the staves (or, what is the same thing, thicken the latter, the internal diameter remaining the same), and drive on the now lengthened hoop over the blocks with the same tightness, i.e., with the same strain per unit of section that it had before, then the tub will be able to bear a greater internal fluid pressure than before.

This involves the whole principle in question, and I am glad to find that the circumstance is still fresh in Dr. Hart's memory, as sufficiently proving that, previous to my very first interview with him, both the method and the importance of the method, of ringed structure with initial strain were generally known to me. Of that portion of our conversation to which Dr. Hart recurred here on the 14th of May last, namely, "that I referred him to a mechanical question, which I represented as an application of the principle of the lever to a cylinder, by surrounding it with a series of blocks, and fastening a hoop round these blocks," he has retained a less accurate recollection as to what took

place. I referred to the lever only, as one common-sense mode of illustrating the effect of the removal of the hoop further from the axis, on the assumption that the tub or gun burst by opening at one side only, and turning round the opposite one at the internal surface, both parallel to the axis. This, however, is at present immaterial.

At the date of this, my first visit to Dr. Hart, my designs for the 36-inch mortars, as actually contracted for, and substantially as finally carried out, had been completed. They were made throughout without either assistance or help of any sort from Dr. Hart or any one else, as I am sure he is ready to testify, so far as he is concerned. I leave the Academy to form its own opinion of Captain Blakely's renewed attempt, in his paper read here on the 28th of May last, to make it appear by an extract from Dr. Hart's letter in "The Mechanic's Magazine" (February 21, 1857, p. 176), and otherwise, that Dr. Hart was in fact the real designer of those mortars, and "that he, and not Mr. Mallet, was an original and independent inventor." This suggestion was first broached in December, 1857, through "The Press" London newspaper, and, though then formally refuted by me in that paper and in "The Mechanic's Magazine," has been again produced by Captain Blakely. I trust Dr. Hart is here to give this his own contradiction, once for all.

That for which I was, and have always acknowledged myself, indebted to Dr. Hart was his mathematical investigation of the precise amount of increase of strength producible by annular construction with initial tension, and of the law regulating the theoretically exact proportioning of the superimposed tensions. His investigation was communicated to me in a letter dated the 6th of July, 1855, and in one of explanatory detail a few days later, and is contained in the Note W to section 282 of my paper "On the Physical Conditions involved in the Construction of Artillery," read to this Academy on the 25th of June, 1855. The equation (4) for solid made guns, i.e., guns made on the old or common plan (given at section 274 of the *text* of my paper as Dr. Hart's), was communicated to me by him on the 17th of May, 1855. It was the only communication I had from Dr. Hart previous to the reading of my paper to this Academy; it has nothing to do with the matter before us; and I only allude to it as accounting for Dr. Hart's name thus appearing in the *text* of my paper read on the 25th of June, 1855; while his investigation, contained in the Note W, and referring to the question now before us, was not, as I have stated, communicated to me until the 6th of July, 1855. The notes to my paper were added as the text was passing through the press, and it is so stated in the preface to the separate issue of the paper, published without alteration from the Transactions of the Academy.

Dr. Hart's investigation enabled me to know the precise tension at which each ring should be shrunk on upon the 36-inch mortars then in progress, and gave exactitude to my previous general notions on ringed construction; but I saw that the method he proposed for regulating this, viz., by difference of temperature only, could not be practically car-

ried out. For this and other reasons dependent upon the molecular properties of iron, I did not employ his mode of regulating the tensions, but reverted to the method of boring out each successive ring as much too small to go over the preceding one when both were cold, as should give the tension required by his calculus, and heating them all *red* hot, before superimposing them, as proposed in the text of my paper, sections 289 to 293.

I mentioned this to Dr. Hart in a hasty conversation (some time in 1856, I believe), and he appears to have quite misapprehended me, and supposed that I had neglected all regard to the relative tensions of the superimposed rings, for in a letter of his, addressed to Captain Blakely, and published by the latter, Appendix E of his pamphlet on Constructing Cannon, of 1858 (Ridgeway, London), already referred to, Dr. Hart does the unintentional injustice to say of me—"This caution," namely, the proportioning the tensions of the successive rings to calculation, "Mr. Mallet has, I believe, utterly neglected." In this same letter, in a previous paragraph, Dr. Hart, by a looseness of expression, I am sure equally unintentional, has also given ground for misapprehension; he says—"The construction which I proposed to Mr. Mallet when he was about to make his large mortars, and which, I am sorry to see, he did not fully adopt, was," &c. Now, Dr. Hart never proposed anything to me on the subject until long after those mortars had been designed, had far progressed towards completion, and after everything relating to their construction had been already settled by myself.

Dr. Hart's communication enabled me to determine the exact strain that each successive ring should have when in place, but did not even modify the practical method of obtaining such proportioned strains, which I had anteriorly devised, and adopted, much less suggest or determine anything relative to their constructive detail.

Dr. Hart has informed me that this letter was addressed as an ordinary private reply to a note from Captain Blakely, and that he gave him no authority to publish it.

My paper "On the Principles involved in the Construction of Artillery" was read to the Academy on the 25th June, 1855, leave of Council having been had for its reading on the 18th of that month. Its publication, therefore, dates from that time. Everything contained in the text which refers to the question before us, except words of reference in two or three places to Dr. Hart's investigation in Note W added in the printing, was in manuscript at the time, and laid upon the table of this Academy; and this was substantially the case with regard to every part of the paper, except the notes. Captain Blakely, however, in attempting to make out a later date for it, states in his second communication, read here on the 28th May last, that "some parts of Mr. Mallet's paper of 25th June, '55, must have been written in September, '55, at the earliest, for at p. 232 reference is made to a proposal to shrink hoops upon 13-inch mortars at Woolwich—which proposal, he says, was made by Colonel Wilmot on the 25th of September, '55." Now, the numbering of the page to which he refers proves that it was a copy

of the separate edition, and not of our Transactions, from which he quoted, and the passage referred to is *not in the text at all, but in one of the notes* to the paper, which I specially mention in the Preface to that separate issue—all take date after the reading of the paper, and were added as it was being printed, viz., in April and May, 1856. Yet he proceeds to say—"In consequence of the error in the date ascribed to Mr. Mallet's publication, I retract my former admission, that he was the first to publish the theory," &c. I leave the Academy to form its own judgment as to the value of a conclusion *based on such grounds*.

Again, in Captain Blakely's paper, read here the 14th May last, he says—"I wrote to Dr. Hart to know the date of his researches, and his reply was, that he had not turned his attention to the matter until some months after he (Blakely) had made the guns,"—namely, the 18-pounder and the 9-pounder burst at Woolwich in 1855–56. Now, the issue between Dr. Hart and Captain Blakely is simply which of them first published the mathematical investigation, and has nothing to do with the date at which Captain Blakely made his guns. The date of these guns would be an argument in point as against me, as proving a prior general knowledge of a *method* of *construction*, if it could be shown that they were made anterior to the date, December, 1854, at which, as I have already shown, I exhibited designs for ordnance involving the same method of construction; but it does not touch the question as between Dr. Hart and Captain Blakely; and is made to appear to bear upon it only by wilfully confounding the two issues of this controversy.

I am astonished at, but cannot comprehend, his adding to this reasoning, that "Mr. Mallet corroborated what he said." I deny the fact.

In this same paper, Captain Blakely says—"He received definite information three years ago" from both Dr. Hart and myself (as to those rights of priority, namely), and that "if he entertained mistaken notions, he was misled by myself."

I never saw Captain Blakely, nor knew anything about him beyond a note of introduction which he sent me, until October, 1857, the same month in which the 36-inch mortars were first fired. On the morning of the day on which those mortars were first fired at Woolwich (October 19, 1857), I received the following note from Captain Blakely (not dated, but its last words fix the date):—

"10, *Bolton-street, Piccadilly* [*Oct.**], *Monday.*

"My dear Mr. Mallet,—I enclose you a number of 'The Mechanics' Magazine,' criticizing my pamphlet on guns, and saying you have forestalled me. A disclaimer of this would come much more gracefully from you than from me, and I could add, that only in that one point

* Erased in Captain Blakely's original MS.

had I forestalled you, which cannot in any way lessen the merit of your proposals, and I hope I may say, *accomplishments*. As you will see by the cover that I printed only for private circulation. My patent is dated February, 1855. I wish you would buy a share, and let me get abroad. I will call on you before eleven [o'clock next day, namely], as any letter to the Magazine must be written by Tuesday, and it would not do to wait for your success before writing. I long to hear about to-day's firing.

"Yours very truly,

"T. A. Blakely."

The next day after, I accordingly received a visit from him at my office in London, when he produced a copy of his earliest pamphlet of July or August, 1855; observed that those mortars were constructed on the principles he had therein developed, and which he had patented; claimed priority, and, in fact, gave me to understand that he would deal very leniently with me as a patentee, and "make it square," if I would share with him the credit of constructing those huge pieces of ordnance. To this I, on the instant, replied by turning up a copy of the separate issue of my paper read to this Academy, and pointing out to him that, even upon the face of the two printed documents, my own priority was obvious, by the dates in each, and I declined to connect myself or my projects in any way with him, or to admit his priority.

Finally, I offered, on my immediate return to Ireland, to give him all other dates that might be material to the question.

A few days after, I received the following note from him:—

"*Oct.* 25.

"My dear Mr. Mallet,—I regret that you have decided to underrate that part of your method of manufacturing cannon, which seems to me to be its chief feature, and which I am personally anxious to have duly appreciated, as I myself proposed to Government a similar plan about the same time as yourself. I really think it would be more *judicious* for both of us to concede to each other a fair share of the credit of the invention—to put the affair even on that footing—for if you run down what most will think the *only new* feature, but little will remain.

"However, I put it to you in another shape, viz., that I request you will not underrate the importance of 'forming the guns of concentric laminæ, of which the outer have an initial tension,' as I particularly wish it to be recognised for my own sake, I feel sure you will gratify me in this.

"Believe me, yours truly,

"T. A. Blakely."

How far these are the letters of a man who felt strong in the consciousness of his own right of priority, I leave the Academy to judge. I gave them no reply, and, without waiting for the dates I had offered him, or making any prior communication to me, he published a letter in the next

month's "Mechanic's Magazine" (November, 1857), in which he states that *I had informed him that I could not say which of us had the right of priority* in the proposition to construct built-up guns, and of the principles upon which they depend. His own notes above will prove whether I left the matter in doubt.

That statement I forthwith replied to, and corrected, by a letter published in "The Mechanic's Magazine," 12th December, 1857, in which I have given the principal dates, and other circumstances, upon which this question rests; and that letter ought to have settled the controversy. I found myself compelled, however, in the very same month to go over the same ground in the pages of "The Press" London newspaper.

There has been, therefore, no misleading on my part. I have from the outset denied Captain Blakely's pretensions, and now thrice justified my denial by simple appeal to dates.

I shall not waste the time of the Academy by following Captain Blakely through the confusion that he has created by his second paper here of 28th of May last, all resting upon the supposition that Dr. Hart's calculations were made and communicated to me in 1854, in place of July, 1855. The mistake as to this date is Captain Blakely's own.* I never made any such statement here on the evening of the 14th of May last. I could not have done so, for I read out the dates from the paper (a list of dates referring to this subject) which I now hold in my hand; and in any case I am ready to produce Dr. Hart's original notes to me, the first dated 6th July, 1855, at any time; and thus Captain Blakely's conclusion "that Dr. Hart's memory is more accurate than mine, and that he, not Mr. Mallet, was an original and independent inventor," resolves itself simply into a blunder of his own in adopting 1854 for 1855.

Fortunately, I have never trusted to memory; I have sustained all that I have here or elsewhere brought forward by appeal to documents or credible witnesses, and I can only regret, for the sake of his own scientific rights, that Dr. Hart did not apply to me, for the sight again of his own notes, and so have got their exact dates, before he replied from memory to any of Captain Blakely's questions on this subject, and so prevented much of the confusion in which his own right to priority in publication of the mathematical investigation has been involved by that gentleman.

And now to recapitulate. The result of the evidence I have adduced upon the two issues before the Academy is:—Upon the first, between Captain Blakely and myself, as respects priority in the *invention of the method* of constructing ordnance in superimposed rings with initial tension, and *clear grasp of the idea* of increased strength so obtained. I exhibited the design for ordnance constructed on this method in December, 1854. I published to this Academy a full exposition of the method and of its principles on the 25th of June, 1855. Captain Blakely's earliest evidence of either his *knowledge or use* of the method is that of his gun, burst at Woolwich on the 25th of May, 1855; and his first *exposition of*

* Or Dr. Hart's, if the latter uttered the date as 1854, and not 1855, on the 14th May.

the principles of the method by his pamphlet of 1855 was not before the public earlier than the end of July, 1855 (though dated in his Preface 27th of June, 1855), nearly a month after my paper had been read to this Academy.

His earliest evidence of having made public either his knowledge or use of the method, therefore, takes date between five and six months posterior to mine, and the right of priority rests with me.

Upon the second issue, between Captain Blakely and Dr. Hart, as respects priority in *mathematical investigation* of the strength of ordnance made according to this method and the law of tensions of the rings; Dr. Hart published his investigation by communicating it to me (and I to others), on the 6th of July, 1855. Captain Blakely published his investigation in his earliest pamphlet, which was not issued before the end of July or the beginning of August, as stated to me by his own publisher.

Dr. Hart's publication, therefore, takes the earlier date by about a month, and the right of priority remains with him.

These verdicts are substantially in agreement with a formal report of the Ordnance Select Committee, made by direction of the Minister of War, at Captain Blakely's own desire, dated 15th of January, 1858, and drawn up by Colonel Eardly Wilmot, R. A., an officer whose scientific abilities are known to some of this Academy, and to whose gentlemanly impartiality I can myself bear witness. That Report decides that, whoever was the first inventor of the method of ringed construction, Captain Blakely was not.

After this marshalling of facts and dates, the Academy will receive, for what it is worth, Captain Blakely's assurance to them in his paper of the 14th of May last, that "he had taken such precautions to keep his proceedings secret, that it is utterly impossible Mr. Mallet could have learnt anything from him"—rather so truly—inasmuch as, without any secrecy in question, my learning was at least five months in advance of his own.

As respects myself, I will only venture to say this: that, in the text of the paper on the Construction of Artillery, read by me to this Academy in 1855, I believe the clearest and most complete enunciation of the general principles and methods of construction of built-up guns, published up to this day, are to be found. I have been assured by the renowned artillerist, Colonel Cavalli, of the Sardinian Army, and by officers of the army of the United States, that that paper is looked upon in Europe and in America as the foundation from which much of the improvement of ordnance since the date of its publication has originated. Its views, antecedent in time, are the same as those upon which the much-talked-of Armstrong guns, are constructed. For this we may take Captain Blakely's own words, who, in the celebrated gun discussion of this year at the Institution of Civil Engineers, London, is reported (Minute of Proceedings, Ins. C. E., Sess. 1859–60, p. 60) to have said:—"The barrel of the Armstrong gun was an example of the mode of construction recommended by Mr. Mallet. Any person following the

instructions contained in his 'Treatise on Artillery' (Trans. R.I.A.) could scarcely fail to make a barrel like that of the Armstrong gun." I will add that the peculiarities in the mounting or equipment of those guns for field service, by which the recoil is absorbed by elastic resistance, in place of dead weight in the gun, &c., are clearly described in Note T, and elsewhere in that paper.

The Academy will, therefore, recognise that the rights of priority in principles and methods, the applications of which are now changing the artillery and armaments of the world, offer a temptation to plagiarism proportionate to the magnitude of the results arising from them; and they will, I trust, excuse the length at which, in consequence of Captain Blakely's first paper, read here 14th May (which, without once asserting boldly his own priority, left it to be inferred hereafter, and assumed it tacitly throughout), I have been compelled to assert the principle of "suum cuique."

While I assert my own rights in this matter, however, I will not follow Captain Blakeley in ignoring those of others. As respects himself, I have always admitted that I believed him an independent second inventor and discoverer, and that he deserved whatever merit or rights such can carry. He has, however, studiously and at all times avoided reference to the claims of M. Thiéry, to whom I believe justly belongs the merit of having been the first person in point of date who proposed the ringed structure with initial tension, and pointed out its advantages in increasing the strength of artillery, in words that show that he possessed a general notion of the principles upon which such increment of strength depends. In his work, entitled, "Applications du fer aux Constructions de l'Artillerie, par A. Thiéry, Capitaine d'Artillerie," published at Paris, by D'Anselin, 4to, in 1834, he has in chap. ix. p. 153, *et seq.*, headed "Canons en fonte avec enveloppe en fer forgé," distinctly described and figured in a large lithographed plate, the application of external rings of wrought-iron shrunk on hot upon a cast-iron tube, to form a built-up gun.

Any one who reads his pages, 155 and 156, of this chapter (in which he discusses the causes of the failure of certain guns, which it appears had been already tried in France, formed of a cast-iron barrel, round which the bronze envelope was cast in a fluid state, and traces it to the fact that the cast-iron, thus becoming heated and expanded in the casting, was left (when the gun was completed and cold) without any initial tension upon it, will see that Thiéry clearly recognised this principle, and he puts it beyond doubt in the following passage:—

"*Le moyen qui s'offre naturellement premiere, pour fretter un canon de fonte, en fer forgé, serait de le recouvrir d'une série de cercles superposés a chaud; les uns a coté des autres, et qui adhéreraient ainsi a cette bouche a feu de toute la force du restrait; force qui peut devenir excessive en portant á un tres haut degré la temperature du cercle en fer forge*" (p. 156). In fact, as respects the method and knowledge of the principle of ringed construction, Thiéry's publication of 1834 embraces

everything that Captain Blakely's specification of his patent of August, 1855, does, even to the general similarity of the lithographs accompanying each respectively, and to the preference of a cast-iron interior instead of one of wrought-iron, upon which Captain Blakely lays so much stress, though erroneously, as Whitworth, Armstrong, and every other practical engineer have proved.

There have been three epochs in the use and knowledge of ringed structure in artillery: the earliest, which goes back to the "bombards" and "serpentines" of the early part of the fifteenth century, was that of the *use* of external rings shrunk on with initial tension, but *without any knowledge* whatever of the theory, or of the value of their being in initial tension, and the staves or tube that they enveloped being in compression, the construction being one of manipulative necessity only, and not of choice.

Thiéry (though not fully or completely) inaugurated the second epoch by showing publicly that, although the manipulative necessity was long past, it would be advantageous to return to the method, because of the principle of increased strength that it contained.

The third and last epoch was that in which I myself placed for the first time in a clear, descriptive light the general conditions and methodic principles of ringed construction, and in which Dr. Hart investigated and developed mathematically the laws by which such conditions and methodic principles are governed; both of these tasks were also more or less completely performed independently by Captain Blakely; but, as I have proved in this paper, at periods posterior to myself and to Dr. Hart, respectively.

Captain Blakely made some remarks in reply (June 14, 1860), of which he has since supplied the following memorandum:—

Mr. President,—If I rightly understand Mr. Mallet, he this evening bases his claim to priority over me, firstly, on his having laid a plan for constructing mortars before Government in December, 1854; and, secondly, on his having published the theory in a paper read to this Academy in June, 1855. He withdraws his statement, made here on the 14th ultimo, that he had a letter from Dr. Hart, discussing the whole question, and dated July, 1854, and tells us he meant to say, and believes he did say, 1855, not 1854.

Now, Sir, I made proposals on the subject to Government in September, 1854, and was so thoroughly convinced of the correctness of my views, and of the possibility of constructing very powerful cannon on the plan, that I went out immediately afterwards to Constantinople and Balaclava, and communicated with the Ambassador, the Commander-in-Chief of the fleet, and the officer commanding the artillery; and had guns been then strengthened on the plan I suggested, I feel confident many thousands of lives would have been saved, and the siege of Sevastopol much shortened.

So much for priority of suggestions to the authorities.

With respect to publication, the question is more intricate. We must first determine what is publication—telling thirty or forty persons of a discovery, or printing a description of it for the public.

Mr. Mallet claims to have informed this Academy of the matter on the 25th of June, 1855. Whether he did so or not, I will discuss presently. But, Sir, he acknowledges that one of my guns burst in May, 1855. Surely, before bursting, it must have been made; and before being made, its construction must have been explained to many! Such was the case. Not only did the manufacturers know of it, but they consulted some eminent men* on the practicability of my plan; and, acting on their advice, offered, early in 1855, to contract to supply the Government with 16-inch mortars, made in three layers of consecutive tubes. Mr. Mallet's paper was printed for the public in June, 1856; but what I printed the year before, for private circulation, was advertised for public sale immediately on the cessation of the war with Russia.

On the question of priority of putting our theory into practice, Mr. Mallet has told us that his mortars were commenced after June, 1855, and that afterwards they were completed, on a different design, in 1857. I made five guns before he commenced his first.

Having now proved that I forestalled Mr. Mallet, in suggestions to Government, in communicating my views to a number of persons, in printing them for public information, and in putting them into practice, I cannot be suspected of any personal motive in stating, as I did at our last meeting, and as I do again now, that I believe Mr. Mallet is not an independent discoverer of the principle of construction in question, but that he learned it from Dr. Hart.

All who heard Dr. Hart's lucid explanation of the matter on the 14th ultimo, must have been convinced that his memory on the point is accurate. Mr. Mallet, he told us, came to him for advice about a plan for constructing mortars of very thick longitudinal voussoirs, fitted together like the staves of a tub, and surrounded by a single ply of wrought-iron rings, greater strength than usual to be obtained by increasing the thickness of the voussoirs, thus removing the wrought-iron rings from the centre, and obtaining the advantage of leverage. Dr. Hart saw clearly how heavy such a mortar would be, *and himself suggested the plan now universally used.*

Mr. Mallet has read to us one letter, in which Dr. Hart gave the same account. I will, with your permission, read an extract from another. It is from Dr. Hart to the Editor of "The Mechanic's Magazine," and published in No. 1760 of that periodical (February 21, 1857):—"My proposal, on which Mr. Mallet has acted," are the words here used by Dr. Hart in speaking of the plan in question; and I implicitly believe that

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* Amongst others, Sir Charles Fox was consulted. He had made the discovery quite independently, and his advice was of great value. For him, therefore, I must persist in claiming priority of discovery over Dr. Hart and Mr. Mallet, as I did at our last meeting.

the proposal was Dr. Hart's, or he would not three times have said so. It clearly, then, could not have formed part of the paper actually read here on June 25, 1855,* as Dr. Hart only communicated the details to Mr. Mallet in July; and it is equally clear that Mr. Mallet's first suggestion to Government must have differed from that ultimately acted on.

With respect to M. Thiéry's plans, I will only quote some words I find at page 152 of Mr. Mallet's work on Artillery,—words written when Mr. Mallet was probably more cool than he is this evening:—

"Solid reinforce rings have been repeatedly proposed and frequently applied to various projects and forms of cannon, but the author believes that the peculiar advantages of their application in thin concentric lamina, the internal ones of which shall be compressed by an *initial extension* of the external ones, *have never before been distinctly pointed out*, and their adoption proposed and urged; the essential and radical distinction being this, that by no arrangement or variation of design can a gun be formed of a single ply of rings, whose strength to sustain an internal pressure shall be greater than the cohesive power of the material per square inch of section; whereas by the subdivision of the rings into a number of superimposed plies, *each compressing those within it*, the strength of the gun may be increased so as to bear an internal pressure any required number of times greater than the ultimate cohesive powers of the material, in fact, may be increased *ad infinitum*."

I cannot believe, Sir, that this "essential and radical distinction" has disappeared since 1855. Indeed, M. Thiéry tried to make guns in the way he thought best, and failed utterly.

I will not follow Mr. Mallet on irrelevant questions. I regret much that I am obliged to take up your time at all in discussing what can be of so little interest.

The following donations of antiquities were presented to the Academy:—

By the Rev. W. Reeves, for the Rev. John Hamilton, a curious candlestick, found in a crannoge near Manorhamilton.

By the President, for Mr. Parke, of Dunally, a large cinerary urn, highly ornamented, found, with two others, near Ballymote, county of Sligo, in the year 1827.

MONDAY, JUNE 25, 1860.

JAMES HENTHORN TODD, D.D., President, in the Chair.

The PRESIDENT announced that the Academy was called upon that evening to elect a member of the Council, in consequence of the resignation of Mr. Haliday on the Committee of Antiquities. Ordinarily he

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* This view is corroborated by what Mr. Jellett says, viz., that Mr. Mallet's original paper was not more than one-fifth part of the size of his published one.

did not make any observations on an occasion of this kind, but in the present instance he felt it to be his imperative duty to state to the Academy the facts of the case, because he had reason to think that there was some misapprehension on the subject. It was probably in the recollection of the Academy that the gentleman recommended to them by the Council was particularly mentioned in the Annual Report of the Council presented and adopted at the last Stated Meeting of the Academy, on the 16th of March last. He was then publicly thanked as having conferred special benefit on the Academy; but the reward he received for that benefit was, that at the very same meeting his name was struck off the Council. That was done, it was true, by a majority of one only; and no doubt there was some very great mistake on the subject in the minds of the members who were induced to vote against him. But, having reason to think that the same feelings still continued, he (the President) felt it his duty to state that the reason why the Council had recommended him to them for election now was their sense of the injustice done him on the 16th of March last. For himself, he (the President) had no hesitation in saying that, in his long experience as a Member of Council, and during his long official connexion with the Academy, he did not think that they ever had a more useful Member of the Council than that gentleman was. He would not occupy their time by any any further remarks; but he would be wanting in his duty as President of that Academy if he did not express the very strongest disapproval of one of the means used to prejudice this election. It was not only unfair, but unconstitutional, and most injurious to the best interests of the Academy, to print anonymous letters in the newspapers against any particular individual, and that on the very morning of the election, when no reply could, in the nature of things, be made until it was too late. If there were any objection to the gentleman, let it be boldly stated before the Academy. That was the fair and honourable course; and the Academy, no doubt, would listen with great attention to anything which might be so advanced. But it was neither fair nor right for a Member of the Academy to impugn anonymously in a newspaper the motives of the Council in the recommendations which it was their duty to make to the Academy. It gave the public a wrong idea of the Academy, and lowered the Society in public respect. Who would wish to belong to any body whose practice it was to tolerate anonymous attacks in the newspapers upon its Members? He trusted the Academy would not tolerate such a practice; to do so would be suicidal. And, therefore, for himself, as the President of the Academy, he felt that he could not be silent on such an occasion as that. Let any Member who thought the Council to be in error in the recommendation they had made, stand up there in his place and say so. An explanation might then be given, and the truth brought forth; it was only fair and just to hear both sides; but an anonymous attack was never fair or just: it was stabbing an adversary from behind, and in the dark.

William Henry Hardinge, Esq., was elected a Member of the Committee of Antiquities in the room of Charles Haliday, Esq., who had resigned his place on that Committee.

Professor Jellett read to the meeting the following paper, describing—

A NEW ANALYZING PRISM.

In determining the plane of polarization of a ray by means of the ordinary Nicols' prism, the observer is required to arrest the rotation of the prism at the point at which the intensity of the transmitted light is a *minimum*. But it is difficult to do this with very great accuracy, inasmuch as the observer is obliged to compare a shade of colour, not with any other shade which is before his eyes at the same instant, but with his recollection of a shade observed at the previous instant. To insure any tolerable degree of accuracy, the observation must be made very rapidly, so that the eye may receive the new impression while the former one is still quite fresh in the memory. The difficulty of doing this with accuracy in any case is obvious, but it is most felt in experimenting on light reflected or transmitted by fluids. For here it is impossible to touch the instrument without producing a tremulous motion in the fluid, and, therefore, in the image reflected or transmitted; and this motion, while it lasts, renders accurate observation very difficult. But if the rotation of the analyzing prism be stopped for a sufficient length of time to allow this motion to cease, the recollection of the previously existing tint will no longer be so fresh as to allow the comparison to be made with any very great exactness. The difficulty will be increased, as is easily seen, when there is any amount of elliptic polarization in the light which is to be examined.

The remedy for this difficulty is to be sought in the construction of an analyzer in which the tints compared shall be *simultaneous*, not consecutive, and the double quartz plate of M. Arago is an attempt to realize this conception. It is not necessary to examine particularly this instrument, which is wholly different in principle and (the author believes) very inferior in accuracy to that which is now laid before the Academy, and which is constructed as follows :—

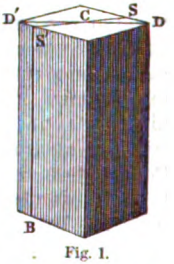


Fig. 1.

A rhombic prism of Iceland spar, whose longitudinal edges should have a length of about two inches, or a little more, is cut by two planes perpendicular to those edges, so as to form a right prism, as in Fig. 1. This prism is divided by a plane parallel to the edges, and making a small angle with the longer diagonal of the base; one of the two parts into which the prism is thus divided is then reversed, so as to place the base uppermost; the

two parts are cemented together, as in Fig. 2, with the surfaces of section in contact, and the ends of the prism thus formed are then ground and polished.

Fig. 2.

Now, it is evident from the construction of the prism, that if two rays of light parallel to the axis be made to traverse the two parts of the prism respectively, the lines of separation of the ordinary and extraordinary images in these two parts will be CA, CA′, Fig. 3, and as the angle between the plane of section and the longer diagonal is small, the angle ACA′ is nearly 180°. Hence the extraordinary refractions in the two parts are in nearly opposite directions, and if the end at which the light is admitted be so chosen that these refractions shall be *from* the plane of section, the separation of the images will be nearly doubled.

Now, suppose a circular beam of plane-polarized light to traverse the prism in a direction parallel to the sides, and so as to be equally divided by the plane of section, the emergent beam will consist of three separate parts, viz.: 1, a circular beam, OCO′, Fig. 3, formed by the union of the two ordinary beams; 2, two semi-circular extraordinary beams, E, E′. If then the size of the incident beam be suitably determined, these latter may be completely separated from the ordinary beam, so as to admit of their being stopped by a diaphragm which allows the ordinary beam to pass; the instrument will then transmit a single beam of plane polarized light.

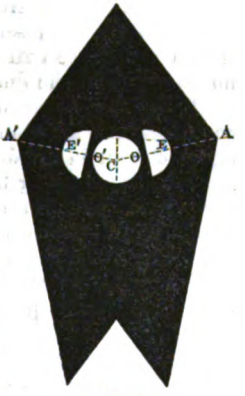


Fig. 3.

Now, it is easy to see that the planes of polarization of the two parts into which the beam is divided by the plane of section are inclined to each other at an angle somewhat less than double the angle DCS, Fig. 1. Suppose, then, that the plane of the paper being perpendicular to the beam, the traces of these planes of polarization are represented by AB, A′B′, and let CP, CP′ be perpendicular to these lines respectively. Let C*p* be the plane of polarization of the ray to be examined. Then, so long as there is any difference between the angles PC*p*, P′C*p*, the intensities of the two parts of the beam will be different, and conversely, if these intensities be equal, it is evident that the required plane of polarization will bisect the angle PCP′. The prism must, therefore, be turned on its axis until the equality of tints be established, and when this is done, the position C*p* of the plane of polarization is known. It is not, however, necessary to determine the position of the planes PC, P′C. The observer commences by transmitting a beam whose plane of polari-

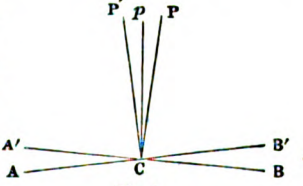


Fig. 4.

zation is known, and turning the analyzing prism until the tints become equal. The beam whose plane is required is then introduced, and when the equality of tints has been re-established, the angle through which the prism has revolved, read off on a graduated circle, gives the inclination of the required plane to the known plane. This mode of determining the zero, a process which for perfect accuracy ought to be repeated with each new set of observations, possesses the advantage of eliminating the personal equation of the observer. In examining a beam of any considerable magnitude, there will be found in different persons a tendency to think one part of the image darker than another, even when there is no real difference. With different observers, and even in the same person at different times, the part of the image thus preferred may be different, and if the zero were determined once for all, this might occasion sensible error. But as, in the method here given, such a preference will equally affect the position of the zero, it can have no influence on the final result.

In the first prism which the author procured to be constructed, the angle between the planes CP, CP′ was about 7°. With this prism the range of error in the determination of a plane of polarization was 7′, the light employed being the diffused light of the sky. Although this was a very much smaller range than the author had ever been able to attain with a Nicol's prism, it seemed that a greater amount of accuracy might be obtained, and as the brightness of the image appeared to be too great, a prism was constructed in which this angle was but half of its former value. With this prism, and with the same kind of light, the author finds that he can determine the position of the plane of polarization to 1′.

With direct solar light, and a prism in which the planes are still closer, a greater degree of accuracy may certainly be obtained; in fact, it can be shown that by diminishing this angle and increasing the brightness of the light, so as to preserve unchanged the intensity of the image, the sensibility of the prism will vary as $\cot \frac{\theta}{2}$, θ being the angle in question.

The author has given direction for the construction of an instrument in which this angle shall be one-half of that last mentioned, but as the polarimeter at his disposal is not made to measure an angle less than 1′, a greater degree of accuracy would not be of any practical advantage.

The prisms here described were executed by Mr. J. Bryson, of Prince's-street, Edinburgh, in a manner which left nothing to be desired.

Professor Kinahan read a paper, entitled, "Descriptions of Crangonidæ and Galatheidæ inhabiting the Irish seas, with Observations on the general homologies of the groups, and the propriety of subdividing the Britannic species of the former."

Sir William Rowan Hamilton, LL. D., M. R. I. A., communicated the following portion of his paper—

13. Proceeding to *space*, let A, B, C, D be the four corners of a given triangular pyramid, and let E be any fifth given point, which is not on any one of the four faces of that pyramid. Let P be any sixth point of space; and let $xyzw$ be four positive or negative numbers, such that

$$\frac{x}{w} = (\text{BC. AEDP}), \frac{y}{w} = (\text{CA. BEDP}), \frac{z}{w} = (\text{AB. CEDP});$$

the right-hand member of these equations representing *anharmonics of pencils of planes*, in a way which is easily understood, with the help of the definition (5) of the symbol (ABCD). Then I call x, y, z, w (or any numbers proportional to them), the *Anharmonic Co-ordinates* of the *Point* P, with respect to what may be said to be the *Unit-Pyramid*, ABCD, because its corners may (on the present plan) be thus denoted,

$$\text{A} = (1, 0, 0, 0); \ \text{B} = (0, 1, 0, 0); \ \text{C} = (0, 0, 1, 0); \ \text{D} = (0, 0, 0, 1);$$

and with respect to that fifth given point E, which may be called the *Unit-Point*, because its symbol, in the present system, may be thus written:—

$$\text{E} = (1, 1, 1, 1).$$

And I denote the general or variable point by the symbol,

$$\text{P} = (x, y, z, w).$$

14. When we have thus five given points, A . . . E, of which no four are situated in any common plane, we can connect any two of them by a right line, and the three others by a plane, and determine the point in which these last intersect each other, deriving in this way a system of ten lines, ten planes, and ten points, whereof the latter may be thus denoted:—

$$\begin{aligned}
&\text{A}' = \text{BC}\cdot\text{ADE} = (0, 1, 1, 0), \ \text{B}' = \&\text{c.}, \ \text{C}' = \&\text{c.}; \\
&\text{A}_1 = \text{AE}\cdot\text{BCD} = (0, 1, 1, 1), \ \text{B}_1 = \&\text{c.}, \ \text{C}_1 = \&\text{c.}; \\
&\text{A}_2 = \text{AD}\cdot\text{BCE} = (1, 0, 0, 1), \ \text{B}_2 = \&\text{c.}, \ \text{C}_2 = \&\text{c.}; \\
&\text{D}_1 = \text{DE}\cdot\text{ABC} = (1, 1, 1, 0),;
\end{aligned}$$

and the harmonic conjugates of these last points, with respect to the ten given lines on which they are situated, may on the same plan be represented by the following symbols:—

$$\begin{aligned}
&\text{A}'' = (0, 1, -1, 0), \ \text{B}'' = \&\text{c.} \ \text{C}'' = \&\text{c.} \\
&\text{A}'_1 = (2, 1, \ \ 1, 1), \ \text{B}'_1 = \&\text{c.} \ \text{C}'_1 = \&\text{c.} \\
&\text{A}'_2 = (1, 0, 0, -1), \ \text{B}'_2 = \&\text{c.} \ \text{C}'_2 = \&\text{c.} \\
&\text{D}'_1 = (1, 1, 1, \ \ 2);
\end{aligned}$$

so that

$$(\text{BA}'\text{CA}'') = \ldots = (\text{EA}_1\text{AA}'_1) = \ldots = (\text{DA}_2\text{AA}'_2) = \ldots = (\text{ED}_1\text{DD}'_1) = -1.$$

15. Let any plane Π intersect the three given lines DA, DB, DC in points Q, R, S; and let *lmnr* be any positive or negative numbers, such that

$$\frac{l}{r} = (\mathrm{DA'_2AQ}), \frac{m}{r} = (\mathrm{DB'_2BR}), \frac{n}{r} = (\mathrm{DC'_2CS});$$

then I call *l*, *m*, *n*, *r*, or any numbers proportional to them, the *Anharmonic Coordinates* of the *Plane* Π; which *plane* I also denote by the *Symbol*,

$$\Pi = [l, m, n, r].$$

In particular the four faces of the unit pyramid come thus to be denoted by the symbols,

$$\mathrm{BCD} = [1, 0, 0, 0],\ \mathrm{CAD} = [0, 1, 0, 0],\ \mathrm{ABD} = [0, 0, 1, 0],\ \mathrm{ABC} = [0, 0, 0\ 1];$$

and the six planes through its edges, and through the unit point, are denoted thus:—

$$\mathrm{BCE} = [1, 0, 0, -1];\ \mathrm{CAE} = [0, 1, 0, -1];\ \mathrm{ABE} = [0, 0, 1, -1];$$
$$\mathrm{ADE} = [0, 1, -1, 0];\ \mathrm{BDE} = [-1, 0, 1, 0];\ \mathrm{CDE} = [1, -1, 0, 0];$$

in connexion with which last planes it may be remarked that we have, generally, as a consequence of the foregoing definitions, the formulæ,

$$\frac{n}{m} = (\mathrm{BA''CL}), \frac{l}{n} = (\mathrm{CB''AM}), \frac{m}{l} = (\mathrm{AC''BN}),$$

if L, M, N be the points in which a variable plane Π intersects the sides BC, &c., of the given triangle ABC: as we have also, generally,

$$\frac{z}{y} = (\mathrm{AD.\ CEBP}), \frac{x}{z} = (\mathrm{BD.\ AECP}), = \frac{y}{x}\ (\mathrm{CD.\ BEAP}).$$

16. If a *point*, P = (*xyzw*), be situated *on a plane*, Π = [*lmnr*], then I find that the following relation between their co-ordinates exists, which is entirely analogous to that already assigned (6) for the case of a *point* and *line* in a given plane, and is of fundamental importance in the application of the present *Anharmonic Method* to *space*:

$$lx + my + nz + rw = 0;$$

or in words, "*the sum of the products of corresponding co-ordinates*, of point and plane, *is zero*."

For example, all planes through the unit point (1, 1, 1, 1) are subject to the condition,

$$l + m + n + r = 0,$$

as may be seen for the six planes (15) already drawn through that point E; and the six points A'' B'' C'' A'_2 B'_2 C'_2 (14), in which the six edges BC, CA, AB, DA, DB, DC, of the given or unit pyramid ABCD, intersect the six corresponding edges of the inscribed and homologous pyramid $A_1B_1C_1D_1$, with the unit point E for their centre of homology, are all ranged

on one common plane of homology, of which the *equation* and the *symbol* may be thus written,

$$x + y + r + w = 0, \ [\mathrm{E}] = [1, 1, 1, 1],$$

and which may be called (comp. 4) the *Unit-Plane*.

17. Any four collinear points, P_0, P_1, P_2, P_3, have their anharmonic symbols connected by two equations of the forms,

$$(\mathrm{P}_1) = t\ (\mathrm{P}_0) + u\ (\mathrm{P}_2), \ \mathrm{P}_3 = t'\ (\mathrm{P}_0) + u'\ (\mathrm{P}_2).$$

each including four ordinary linear equations between the co-ordinates of the four points, such as

$$x_1 = tx_0 + ux_2, \ y_1 = ty_0 + uy_2, \ \&c.;$$

and the anharmonic of their *group* is then found to be expressed by the formula,

$$(\mathrm{P}_0, \mathrm{P}_1, \mathrm{P}_2, \mathrm{P}_3) = \frac{ut'}{tu'}.$$

And similarly, if any four planes $\Pi_0 \ldots \Pi_3$ be collinear (that is, if they have any one right line common to them all), their symbols satisfy two linear equations of the corresponding forms,

$$[\Pi_1] = t\ [\Pi_0] + u\ [\Pi_2], \ [\Pi_3] = t'\ [\Pi_0] = u'\ [\Pi_2];$$

and the anharmonic of the *pencil* is,

$$(\Pi_0\Pi_1\Pi_2\Pi_3) = \frac{ut'}{tu'}.$$

18. If $\phi(xyzw)$ be any *rational fraction*, the numerator and denominator of which are any two given homogeneous and linear functions of the co-ordinates of a *variable point*; and if we determine a *line* Λ, and *three planes* Π_0, Π_1, Π_2 through that line, by the four *local* equations,

$$\phi = \frac{0}{0}, \ \phi = \infty, \ \phi = 1, \ \phi = 0;$$

then I find that the function ϕ may be expressed as the anharmonic of a *pencil of planes*, as follows:—

$$\phi(xyzw) = (\Pi_0\Pi_1\Pi_2\Pi);$$

where Π is the variable plane $\Lambda\mathrm{P}$, which passes through the fixed line Λ, and through the variable point $\mathrm{P} = (xyzw)$.

19. And in like manner, as the *geometrical dual* (9) of this last theorem (18), if $\Phi(lmnr)$ be any rational fraction, of which the numerator and denominator are any two given functions, homogeneous and linear, of the co-ordinates of a *variable plane*; and if we determine a *line* Λ, and *three points* P_0, P_1, P_2 on that line, by the four *tangential* equations,

$$\Phi = \frac{0}{0}, \ \Phi = \infty, \ \Phi = 1, \ \Phi = 0;$$

I find that the proposed function Φ may then be thus expressed as the anharmonic of a *group of points*.

$$\Phi(lmnr) = (\mathrm{P}_0\mathrm{P}_1\mathrm{P}_2\mathrm{P});$$

r here denoting the variable point $\Lambda \cdot \Pi$, in which the fixed line Λ intersects the variable plane $\Pi = [lmnr]$.

20. All problems respecting *intersections of lines with planes*, &c., are resolved, with the help of the Fundamental Theorem (16) respecting the relation which exists between the anharmonic co-ordinates of point and plane, as easily by the present method, as by the known method of *quadriplanar* co-ordinates (10); and indeed, by the very *same mechanism*, of which it is therefore unnecessary here to speak.

But it may be proper to say a few words respecting the application of the anharmonic method to *Surfaces* (7); although here again the known mechanism of *calculation* may in great part be preserved unchanged, and only the *interpretations* need be *new*.

21. In general, it is easy to see (comp. 7) that, in the present method, as in older ones, the *order* of a curved surface is denoted by the *degree* of its *local equation*, $f(xyzw) = 0$; and that the *class* of the same surface is expressed, in like manner, by the degree of its *tangential equation*, $F(lmnr) = 0$: because the *former* degree (or dimension) determines the *number of points* (distinct or coincident, and real or imaginary), in which the surface, considered as a locus, is *intersected* by an arbitrary right *line*; while the *latter* degree determines the *number of planes* which can be drawn *through* an arbitrary right line, so as to touch the same surface, considered as an *envelope*. It may be added, that I find the *partial derivatives of each* of these two functions, f and F, to be proportional to the *co-ordinates* which enter as variables into the *other*; thus we may write

$$[D_x f,\ D_y f,\ D_z f,\ D_w f],$$

as the symbol (15) of the *tangent plane* to the *locus* f, at the point $(xyzw)$; and

$$(D_l F,\ D_m F,\ D_n F,\ D_r F),$$

as a symbol for the *point of contact* of the *envelope* F, with the plane $[lmnr]$: whence it is easy to conceive how problems respecting the *polar reciprocals* of *surfaces* are to be treated.

22. As a very simple *example*, the surface of the *second order* which passes through the *nine points*, above called ABCDEA′A_2C′C_2, is easily found to have for its *local* equation, $0 = f = xz - yw$; whence the co-ordinates of its tangent plane are, $l = D_x f = z$, $m = D_y f = -w$, $n = D_z f = x$, $r = D_w f = -y$, and its *tangential* equation is, therefore, $0 = F = ln - mr$, so that it is also a surface of the *second class*. In fact it is the *hyperboloid* on which the gauche quadrilateral ABCD is superscribed, and which passes also through the point E; and the known *double generation*, and *anharmonic properties*, of this surface, may easily be deduced from either of the foregoing forms of its anharmonic equation, whereof the first may (by 13, 15) be expressed as an equality between the anharmonic functions of two *pencils of planes*, in either of the two following ways:— (BC. AEDP) = (DA. BECP); (AB. CEDP) = (CD. BEAP).

ERRATUM.—In line 5 of Art. 12, for a read u.

R. MALLET, Esq., C. E., read the following—

REMARKS OCCASIONED BY CAPTAIN BLAKELY'S WRITTEN VERSION OF HIS VERBAL REPLY TO MR. R. MALLET'S PAPER OF JUNE 11, 1860.

AT the last meeting of the Academy permission was given to Captain Blakely to transmit, in writing, for publication, his reply, then verbally delivered by him, to my communication as to priority in ordnance with initial tension, read by me on that occasion. Presuming that such writing would be a faithful transcript of the words actually spoken by Captain Blakely, I did not then consider they contained anything worthy of further remark—an opinion entertained, I believe, by nearly all the Members of the Academy who were present.

Having, however, been permitted to read the MS. since sent in for publication by Captain Blakely as the transcript of what he then spoke, it appears to me to differ so much from what he actually did utter, and contains statements so contrary to the facts to which they profess to allude, that I have felt compelled to ask the President's permission to record this in the face of the Academy, and to refute the statements and inferences now brought forward by Captain Blakely in a new form, as if having been given verbally by him in reply here on the 11th instant. I am glad to find that the President has given notice of this to Captain Blakely, that he may be present; and I appeal to every Member of the Academy here, who was then present, in support of my denial that Captain Blakely's MS. version of his reply sent in is a true or accurate transcript of what he actually uttered, or even in any respect like it. In a word, his MS. contains several statements, as injurious as they are contrary to fact, which he never uttered at all, or which could be inferred from anything he did utter; and upon these novel and purely imaginary grounds he has proceeded to raise a new argument, not one particle of which was ever uttered by him in this room. It is for the Academy to express its sense of such an abuse of the privilege it gives each Member, *suo periculo*, upon his own *honour*, to transmit an exact statement, in writing, of what he actually uttered, when intended for publication in our Proceedings; and I leave it to form its own opinion upon the probable validity of claims that require such a course to prop them up.

I shall contrast, in one or two passages, what Captain Blakely *writes as having said* with what *he actually did say*, and with the facts of the case.

He writes:—"He" (Mr. Mallet) "withdraws his statement, made here on the 14th ultimo, that he had a letter from Dr. Hart, discussing the whole question, and dated July, 1854; and tells us he meant to say, and believes he did say, 1855, not 1854." Now Captain Blakely, to my recollection, did not make such a statement, or anything like it, here on the 11th instant; and, had he done so, I should have at once referred him back to my paper, just read, in which, so far from withdrawing anything whatever, I affirmed that Captain Blakely himself originated his own error of the date of 1854 for 1855, and confirmed this by showing that I *had read out* the dates on the 14th of May last from a written list

of dates, and not from any letter of Dr. Hart's. I have read no letter whatever, nor any part of any letter, from Dr. Hart throughout this controversy; and I appeal to you, Mr. President, as having occupied the Chair on the 11th instant, whether my own first words addressed to you, after Captain Blakely sat down, were not these:—"Sir, I have heard what Captain Blakely has said in reply, and have nothing to withdraw, nothing to alter, in the facts or statements which I have laid before you"? Yet, in face of that, Captain Blakely writes, as words uttered by him in my presence, but never said, that I withdrew a statement as to a letter and a date, both being purely imaginary as matters of fact, and never having had any existence outside his own mistake. To those who were present on the occasion, this is beyond need of comment; but I could not permit it to pass uncontroverted to those who, hereafter and elsewhere, may read our Proceedings.

I shall not follow Captain Blakely through what he has written as having been stated by him on the 11th instant, but nothing like which he uttered, with reference to Dr. Hart himself, in which he expresses his belief that "Mr. Mallet is not an independent discoverer of the principle of construction in question, but that he learned it from Dr. Hart," nor comment upon his affecting to take credit for absence of "personal motive," on his own part, in seeking now to make it appear that there is some question at issue between Dr. Hart and myself. I trust I have placed the facts and dates so truly and clearly before the Academy in my communication of the 11th instant, that no confusion of expressions referring to one thing, and made to appear to refer to another—no use of words in loose or doubtful senses, will confuse or contravene the following plain facts:—That I knew the general principles of increased strength by ringed construction, with initial tension, and had practically applied them to the design of 36-inch mortars before October, 1854, and brought that design publicly forward in December, 1854—several months before I knew Dr. Hart personally, or ever had had any communication with him on any subject; and that, as he first communicated to me the mathematical theory and laws of ringed construction by letter, dated the 6th of July, 1855, and *never communicated to me anything on the subject but his mathematical results*, it is impossible I could have derived my knowledge, anterior in point of date, from him, or derived from him any constructive details of a design, embracing these principles, made in October, 1854—months before I first had the advantage and pleasure of his acquaintance.

I have endeavoured fully and circumstantially to accord to Dr. Hart, in my paper here of the 11th instant, what exactly were my obligations in respect of communication received from him; and I believe Dr. Hart himself to be entirely satisfied with the correctness of every statement I have made with respect to him in this matter, as I am equally so with the substantial correctness of what he has stated in regard to myself. Captain Blakely's "belief" is therefore a matter of indifference to both of us, and equally so that his arguments on this point, as contained in his professed transcript of his reply of the 11th instant, were never, as I believe, uttered at all upon that occasion.

Captain Blakely, in his verbal reply, announced a new claim to priority of his knowledge of the general principles or method of ringed construction never previously mentioned by him, and which attempted to carry back the date to September, 1854. His written statement upon this part of the matter is, however, very different from what he then actually stated. What he said was, "That in the year 1854—it must have been about September"—he proposed to certain authorities in Turkey to strengthen the old bronze kamerlicks of the Dardanelles, and fit them to throw 27-inch shells into Sebastopol, by lapping them round with wire-rope rigging, or, he hesitatingly added, with iron rings; and upon this he left it to be inferred that his claim to knowledge of this principle dated from that time, and so before my design for the 36-inch mortars was first made and brought forward, viz., in October and December, 1854. To that statement I replied that so crude and unpractical a project argued nothing whatever as to any knowledge of the principle of ringed construction with initial tension; that it would occur to any one who proposed to apply those kamerlicks to vertical fire that they must be strengthened in some way, and lapping round with wire rope, just as the Chinese wooden guns are wrapped round with silk, might be to any one a very obvious mode of attempting this without any knowledge of the principles in question; that the method itself was practically useless and valueless, as the wire rope would get "open-jawed" at the first discharge, and cease to grip the outside of the kamerlick; and that, as to the wrought-iron rings, I must express my doubt that any man upon the spot, and having seen those old pieces of ordnance, could have proposed them, as the construction of the kamerlicks rendered it impossible to apply iron rings shrunk on hot, even if the rings themselves could have been obtained, and to the exact size, from England,—the whole idea, also, as described, being that of the use of extemporaneous stores then upon the spot, i. e., the old Turkish kamerlicks, and the wire ropes of the English ships of war in the Bosphorus.

Now, Captain Blakely's *written* version cautiously avoids repeating everything that suggested those difficulties. It merely alleges that "in September, 1854, he made proposals on this subject to Government," and "immediately afterwards" went out to Constantinople and Balaklava, and communicated with the Ambassador, &c.; "and had guns been then strengthened on the plan he suggested, he feels confident," &c., &c. He writes nothing as to what his "proposals" were; he does not even give the meagre details he uttered on the 11th instant; but flourishingly concludes: "So much for priority of suggestion to the authorities." It is a curious fact, in relation to the date (September, 1854) assigned to this "suggestion" by Captain Blakely, that in his later pamphlet ("An Improved New Method of Constructing Cannon," &c., Ridgeway, London, 1858) his chapter iii., p. 37, commences with the following words:—"Having early in January, 1855, informed the Minister of War that I knew of a mode of constructing cannon whereby howitzers could be made large enough to bombard Sebastopol," &c. The proposals seem really the same; how is it the dates so differ?

I remarked, however, on the 11th inst., and again repeat, that, even assuming the earlier date, a crude proposal of this nature, not even in writing, for anything that is affirmed, much less accompanied by any drawings, and not necessarily inferring any knowledge whatever beyond the mere fact (known to every schoolboy) that wrapping rope round a cannon must make it harder to burst than before, without the slightest cognizance of the principle of ringed construction with initial tension, is a very different thing from the substantive design, drawn to scale, in October, 1854, and brought before government officers in December, 1854, and having internal evidence on the face of it, proving incontestibly a knowledge on the part of the designer of *principles*, by which increased strength is so obtained. My appeal is, therefore, still to the design of October—December, 1854—which the Academy have done me the honor to require being reproduced as part of its Proceedings.

In my paper read here the 11th inst., I accorded to Captain Blakely as the earliest date, at which he could show any evidence of knowledge, of method and principle together, of construction with initial tension, that of the bursting of his first gun at Woolwich (the 18-pounder) on the 25th May, 1855. Captain Blakely objects to this, that the gun had to be made before it was burst, and demands to move back the date of his priority, as evidenced by this gun, to the rather indistinct epoch of "early in 1855," and invokes the name of Sir Charles Fox to sustain him.

Sir Charles's own letter, however, which he has published in his pamphlet of 1858, Appendix C, p. 48, unfortunately fixes this date to April, 1855, and at p. 28 of the pamphlet we find stated (by quotation from their Report) that on the 25th of April, 1855, the O. S. Committee was directed to place itself in communication with Captain Blakely relative to fabrication of guns upon his principle," which is obviously the date of his first communication with them.

Suppose we grant Captain Blakely, then, even two months anterior to this, for the concoction of his plan (and assume concoction to be equivalent to publication), it will only bring him back to the 25th February, 1855, which is the date of his provisional specification of his patent, and he is still two months, and better, posterior to the date at which my 36-inch mortar design was publicly exhibited to various persons, besides Captain Boxer and General Portlock.

It would be waste of time after this to discuss the claim *now set up* (in his written statement) *for the first time*, although the word *persist* is used, for the priority of Sir Charles Fox (who never produced a line upon the subject) over Dr. Hart and myself, beyond remarking that Sir Charles Fox's name was not so much as once uttered by Captain Blakely in his spoken reply of the 11th inst. here.

In a word, Sir Charles Fox's name is most illogically introduced into this controversy at all by Captain Blakely, because, whatever may have been that gentleman's private information on the subject of ringed construction of ordnance prior to April, 1855, we have his own assurance, as printed by Captain Blakely, that "he had never

taken any step to publish his discovery" (Appendix C, p. 49, Blakely's second pamphlet "On proposed New Method of Constructing Ordnance," &c. Ridgeway: London, 1858), up that date, which is long after my design of 1854; and I am not aware that Sir Charles Fox has himself ever publicly claimed to be a discoverer in the matter at all.

It is not necessary for me to refer to what Captain Blakely has *written*, as to my communication with Dr. Hart, further than to remark that, as I recollect his spoken reply, he *said* nothing whatever like what he has penned on the subject, and that his written words—"Mr. Mallet has read to us one letter in which Dr. Hart gave the same account," &c.—were never uttered by him, or I should have at once required him to name the letter he referred to, as I never read any letter whatever from Dr. Hart throughout this matter.

Those who will peruse my paper read here on the 11th inst., observing the dates, &c., will have no difficulty in clearing up the confusion introduced by Captain Blakely's reference to Dr. Hart's letter to the "Mechanics' Magazine" (February 21, 1857), and seeing its total irrevelance, to which I must add, that nothing of this was alluded to, much less uttered by Captain Blakely in his spoken reply of the 11th inst.

It was remarked here on the last evening by Mr. Jellett, that my paper read here on the 25th June, 1855, was not all read at the time, and that, so far as he could judge, only about one-fifth of its printed matter was then written.

The text of the paper consists of 172 pages, and the notes in close type of 110 pages. If the latter be reduced to the type of the text, they occupy an equal volume very nearly with the text, and as none of the notes were written until the paper was printing, the above estimate of one-fifth becomes two-fifths, even assuming the original fraction of the whole, as in type, correct, which I cannot admit.

I brought the original MS. to the Council, of which I was then a Member, while the paper was being printed, and showed its members that not thirty-five pages (which would be one-fifth), but rather more than 120 pages of the whole 172, were written in full, and that a synoptic statement of all the remainder of the paper, which I exhibited to Council, was also written and upon the table of the Academy on the 25th June, 1855, and I have the MS. now by me; the occasion of this was an objection raised to the cost of printing the large bulk of the notes.

I remarked, in reply to Mr. Jellett on the 11th inst., that, whether this were so or not, was immaterial to the question of priority before us, inasmuch as this does not rest upon my paper of the 25th June, 1855, only (nor necessarily at all), but upon my design of October, 1854.

I further recalled your own recollection, and that of other members of the Academy, to the circumstance that my paper of the 25th June, 1855, had, in fact, not been *read* at all—that, the occasion being that of a visit from the Lord Lieutenant, there was not time to do so, and that I was only permitted to give a *vivâ voce* account of one or two portions of it, and that one of those parts which I then chose for illustration, viz., my explanation of the causes of liability to bursting of cannon

when firing red-hot shot, &c., depends upon the very same principles of initial tension and compression, upon which the construction of ringed ordnance depends, and which were then clearly pointed out by me, and, with the aid of large diagrams, exhibited to the Academy.

It is not necessary I should incumber further this already too long controversy, by making any observations upon what Captain Blakely writes referring to his quotation from section 288 (p. 152 of separate edition) of my paper of 25th June, 1855, upon M. Thiery's claims in this matter, further than to say that "the essential and radical distinction" referred to by me in the passage quoted, which must be read in connexion with the preceding section 287, is one between the effects of increased strength, due to construction in *one* extended and *one* compressed ring, and those of construction in *several* superimposed extended and compressed rings, which give still greater or even unlimited strength; but the very same principles are common to both, only carried out more fully in the latter. Captain Blakely uses the passage to make it appear to assert "an essential and radical distinction," not between two *methods*, based upon the same common principle, not of degrees of strength obtained by more or less fully carrying out principles the same in both cases, but as if there were some distinction between the principle itself, which is identical in both.

The object is, of course, to suggest that Thiery's one ply of rings did not anticipate Captain Blakely's self-alleged priority in proposing "one, or more than one." There is nothing, however, to show that Captain Blakely saw any value in more than one upon any principle more recondite than mere increase of thickness, at the date of the specification of his patent, August, 1855, nor until after he had read my paper of 25th June, 1855, and Dr. Hart's investigation printed in the notes to it. Nor does it touch the question of Thiery's priority, whether he failed in practice or not (of which, however, there is no proof whatever), no more than the bursting of Captain Blakely's own guns touches the question of his own originality in respect to time.

Mr. Mallet exhibited simultaneously and explained to the Academy, after reading this paper, his original sheets of designs for the 36-inch mortars in the several phases of their progressive improvement, in proof of the statements as to them, made in his paper of the 11th inst.

The first (that reproduced in the Proceedings—see Plate, page 335), and dated October, 1854, shows the original crude design; the chase and chamber, each constructed in two superimposed rings, one extended and one compressed, that design having been made and exhibited to Captain Boxer, General Portlock, and others, before he had ever had the honour of Dr. Hart's acquaintance, or ever heard of Captain Blakely.

The second is the original contract design for these mortars, with the signature of Mr. Charles Mare, the contractor, upon it, showing the partial abandonment of the construction in plies, the chase being forged in a single thickness, but the compressed and extended construction of the chamber still continued. This was the design as being acted on at the period when Mr. Mallet first called upon Dr. Hart, in company

with Professor Downing, and conversed on guns, &c., in April or May, 1855.

The third shows the design in accordance with which the mortars were completed subsequently to the bankruptcy of the first contractor in December, 1855, and in which Mr. Mallet reverted fully to the principle of the original design; and having in the interval had his ideas on the subject of construction with initial tension enlarged and made exact by the mathematical investigations communicated to him by Dr. Hart, 6th July, 1855, was enabled to develop the principle completely in both the chase and chamber, by constructing both in several successive plies extended and compressed.

A. S. Hart, LL. D., Professor Jellet, and Rev. S. Haughton, made some remarks on Mr Mallett's and Captain Blakely's communications.

The Academy then adjourned.

MONDAY, NOVEMBER 12, 1860.

James Henthorn Todd, D. D., President, in the Chair.

Mr Hennessy, F. R. S., read a paper—

ON A THEOREM RELATING TO CONICAL SURFACES.

The Theorem is announced as follows:—"If a cone of maximum volume, under a given conical surface, roll on a plane with its vertex constantly touching a point in the plane, the interior envelope of the cone will be a second cone which possesses the property of containing a maximum volume under its total surface."

If we denote by θ_1 the angle at the summit of the cone of maximum volume under conical surface, and by θ_2 the corresponding angle for the cone of maximum volume under total surface, we shall have

$$\sin \tfrac{1}{2}\theta_1 = \frac{r_1}{l_1}, \qquad \sin \tfrac{1}{2}\theta_2 = \frac{r_2}{l_2},$$

r_1, r_2, being the respective radii of the bases, and l_1, l_2, the respective slant heights of the cones.

By the usual methods we easily find

$$r_1 = \frac{1}{\sqrt{3}}\, l, \qquad r_2 = \frac{1}{3} l.$$

Whence

$$\sin \theta_1 = \frac{2\sqrt{2}}{3} \qquad \cos \tfrac{1}{2}\theta_2 = \frac{2\sqrt{2}}{3}$$

Consequently, if β represent the angle at base of the cone of maximum volume under total surface, we shall have

$$\sin \theta_1 = \sin \beta.$$

The angle at the summit of the cone of maximum volume under its conical surface is, therefore, equal to the angle at the base of the cone of maximum volume under its total surface, and the theorem announced immediately follows. It also readily appears that upon the same base the cone of maximum volume under total surface is double that of maximum volume under conical surface.

Rev. William Reeves, D. D., read the first part of a paper "On the Ancient Order of Culdees in Ireland."

Robert M'Donnell, M. D., read a paper—

ON THE ORGANS WHICH IN THE COMMON RAY ARE HOMOLOGOUS WITH THE ELECTRICAL ORGANS OF THE TORPEDO.

The very beautiful structures which exist in the electric as well as the non-electric rays, as appendages of the anterior branches of the fifth pair of nerves, were regarded by Geoffroy St. Hilaire and others as the representatives of the electric organs of the torpedo. The fact, however, of their existence in the torpedo along with, although not united with, the electric organs, is sufficient to render this view untenable.

1. Savi, who has given an accurate description of them in the torpedo, as well as a beautiful drawing, considers them as an apparatus for the secreting of mucus. For reasons, however, not to be entered on at present, the view taken by Jacobson, Treviranus, and, more recently, by Leydig, that these are organs of sensation, seems the correct one.

2. The existence of the true so-called "system of the lateral line" in the electric, as well as the non-electric fishes, enables us also to set aside this apparatus as not being homologically related to the electric organs, as has been supposed by some authors.

3. The organ described by its discoverer, Dr. Stark, of Edinburgh, as an electrical apparatus, in the tail of the flapper skate and other rays, on account of its form and position, can hardly be considered the true homologue of the electric organ of the torpedo; nor am I aware that any of the authors who have examined it have, in their subsequent researches concerning this tail-organ, put forth such a notion. Possibly the pseudo-electric tail-organs of the rays may yet be shown to be homologically related to the electric organs of the *Gymnotus electricus*.

I believe, however, that I have lately discovered in the non-electric rays the organs which are the true homologues of the batteries of the torpedo; and it is the object of the present communication to indicate the anatomical relations of these organs, and briefly to state how I have been led to make them out.

If the skin be carefully removed from the upper surface of the head

and the anterior half of the back of a common skate, the following parts at once come into view:—

1st. The dorsal aspect of the branchial chambers.

2nd. A band of tubes filled with crystalline jelly (a bundle of the muciferous tubes of Savi), running from a centre, external to the gills, inwards, and a little backwards, but a little way behind the temporal orifice.

3rd. A muscle arising from the cartilage close to the posterior branchial arch, but nearer the middle line, and running forwards underneath the bundle of tubes just mentioned, to terminate in a long, delicate tendon, passing to the extremity of the snout.

If this bundle of tubes be raised, and drawn forwards, and the little fleshy belly of the snout-muscle drawn outwards, in the angle formed between them will be found the organ sought for; but probably it may remain invisible until a drop or two of tolerably strong acetic acid being brought in contact with it, it is thus revealed as distinct from the gelatinous tissue which surrounds it. Thus brought into view, we find a little mass, varying in length from $\frac{3}{4}$ of an inch to $1\frac{1}{2}$ inches, wedged in between the occipital muscles internally, and the branchiæ and their thin muscular coverings externally, covered superficially by the tubes and snout-muscle, already mentioned, and dipping downwards so as to reach the nerve-branches of the vagus going to the gills.

Viewed with the naked eye, this mass seems to consist of a number of quadrangular and pentangular bodies of somewhat irregular form and size, united together by areolar texture, and packed beside one another in a vertical position. Seen in the microscope, it is found to be composed of granular, nucleated substance, and larger cells of a peculiar character, seemingly more or less immediately connected with the nervous ramifications, the whole entangled in a very abundant areolar tissue. But it is to the nerves of this little body that I wish to direct special attention: its small size makes it at once obvious that its supply of nerves cannot be very large; yet, on careful dissection of large skates, I have found that it gets minute nerve-twigs from the branches of the vagus supplying the gills, and that it also receives a larger and more easily discovered branch from the fifth, which, on close examination, proves to be closely related to that which constitutes the first electric nerve of the torpedo.

Thus, as I have satisfied myself by dissection, as well as from Savi's beautiful plate and description, that the posterior branch of the fifth pair in the torpedo, passing out from the cranium, immediately behind the temporal orifice, divides into four branches:—

1. For the muciferous tube system (of Savi).
2. For the mucous membrane of the mouth.
3. For the muscles of the jaws.
4. For the electric organ.

The same nerve in the skate, also to be discovered just behind the temporal orifice, gives off, immediately after escaping from the cranial cavity, similar branches, supplying—

1. A very large branch to the muciferous tube system (Savi).
2. The mucous membrane of mouth.
3. One to the muscles of the jaws from which the small branch,
4. Going to the organ just described, is derived.

On the following grounds, therefore, is based the opinion, that this little organ is truly the homologue of the electric organ of the torpedo: its position and relative anatomy, its structure, its nervous supply; and, moreover, that I have not found it present in the torpedo, which, through the kindness of Dr. E. Perceval Wright, I have had an opportunity of dissecting.

Let me state, however, with reference to this last assertion, that I am unable to say positively that the organ in question does not exist in the torpedo; for, in those which are to be found in the museums of Dublin, it is possible that they may have been removed in the dissections already made, which may also have been the case in that placed in my hands by Dr. E. Perceval Wright.

If further research shall show that these organs co-exist in the torpedo with the electric batteries, then, of course, the idea of them being homologous organs falls to the ground.

It may occur to some, also, as it did at first to myself, that the bodies which I have described may be related to the "follicular nervous apparatus" ("appareil folliculaire nerveux" of Savi), existing in the torpedo, but not in the non-electric rays; but I conceive that the consideration of the structure and nervous supply is sufficient to negative such a notion.

In that chapter of Mr. Charles Darwin's book on the "Origin of Species," in which he speaks of those difficulties on the theory of descent with modification, some of which are so grave, that he tells us that to this day he cannot reflect on them without being staggered, and which have much more than staggered many of his readers, the learned author mentions the electric organs of fishes as a case of special difficulty.

Here was a case, indeed, of special difficulty, obvious to every reader. How, on the view of common descent, could we conceive, that while these wondrous organs were brought to such a condition of development and power in the torpedo, that in the immediate members of the same family, no trace of such structures was known to exist?

It seemed impossible, or at least in the highest degree improbable, that if the Raiidæ had, in even countless ages past, sprung from a common ancestor, the electric batteries of the torpedo should be without their homological representatives in other rays. Yet no candid inquirer could grant that either the mucous tube apparatus, the lateral line system, or indeed the pseudo-electric tail-organs, fulfil the necessary conditions.

Considering, then, the great size and peculiar origin of the nerves going to the electric organs of the torpedo, it seemed that a very close and accurate dissection of the corresponding nerves of the skate was likely to afford some clue to any atrophied or modified electrical apparatus, if any such existed in that animal: by following this course, I have made out the organs already described.

The following donations were presented to the Academy :—

By Arthur B. Cane, Esq.: a large, white cedar chest, ornamented in front with the royal arms and the letters "I. R.," supposed to have been part of the baggage of King James II.

By Rev. John Hamilton: a silver coin of Elizabeth, and another of Philip and Mary, both found near Manorhamilton.

By Mrs. Thomas Townsend: part of the upper stone of a quern, rudely ornamented with a cross; found at Smithville, Castle-Townsend.

By Rev. C. P. Meehan: a copper axe-head, $4\frac{3}{4}$ inches long, and another, made of bronze, $7\frac{1}{4}$ inches long, both found in the county of Louth; some fragments of four different bronze swords; a cannon-ball, weight $2\frac{3}{4}$ lbs., found near the Obelisk, on the bank of the Boyne.

Thomas Devine, Esq., of the Crown Lands Department, Canada, presented a collection of 45 different specimens of timber, all of native growth, and used in the arts; also, two copies of his map of Canada.

William P. Pike, Esq., presented a collection of autographs.

Sir Thomas Deane presented Hogan's head of Minerva, carved in wood, his first attempt at classic art.

STATED MEETING, FRIDAY, NOVEMBER 30, 1860.

JAMES HENTHORN TODD, D. D., President, in the Chair.

READ,—The following letter, addressed to the President of the Academy :—

Ordnance Survey Office, Dublin, 29th November, 1860.

SIR,—I am directed by Colonel Sir Henry James, Royal Engineers, Superintendent of the Ordnance Survey, in compliance with the request contained in your letter of the 4th August, 1857, to his Excellency the Lord Lieutenant, and in accordance with the authority of the Right Honorable the Secretary of State for War, to forward to you, for presentation to the Royal Irish Academy, 103 volumes of MS. papers, containing information relating to the local history and antiquities of Ireland, collected during the progress of the Ordnance Survey; together with 11 volumes of sketches of various objects of antiquarian interest.

A list of the volumes is enclosed.

I am also to state, that the delay which has occurred in presenting these papers has been caused by the necessity which existed for arranging, indexing, and otherwise preparing the volumes for binding, which has been a work of very considerable labour, and could only progress as the other avocations of those competent to the task would permit.

I am further to inform you that a considerable number of additional volumes are now ready for binding, and will very shortly be presented to the Academy.

I have the honour to be, Sir,
your obedient servant,
GEORGE A. LEACH, Lieut.-Colonel, R. E.

The Secretary of the Academy briefly explained the great value and importance of this collection of MSS. to all persons interested in the history and antiquities of Ireland; and moved the following resolution, which was seconded by Lord Talbot de Malahide, and carried by acclamation:—

"That the special thanks of the Academy are due, and hereby presented, to Sir Henry James, R.E., Superintendent of the Ordnance Survey, and to Lieut.-Colonel Leach, for this most valuable donation; and that the Academy desire to acknowledge, on this occasion, the importance of the services rendered to the history and antiquities of Ireland by Major General Sir Thomas A. Larcom, under whose superintendence the plan of collecting materials for the illustration of the ancient topography of Ireland was organized and successfully carried into effect."

Lord Talbot de Malahide, on the part of the Rev. Greville Chester, presented to the Museum an artificially-wrought flint celt, found at Hoxne, in Suffolk.

Dr. Tufnell, on the part of Captain O'Hara, presented a curious bronze crucifix, found on the Island of Turlough, Barony of Moycullen, County Galway.

Rev. Dr. Reeves, on the part of John Stuart, Esq., Secretary of the Society of Antiquaries, and of the Spalding Club of Scotland, presented copies of the following books:—"Registrum Episcopatus Aberdonensis;" a "Genealogical Deduction of the Family of Kilravock;" "Fasti Aberdonenses;" "Records of the University of King's College, Aberdeen;" "Registrum Episcopatus Brechonensis;" and the "Book of the Thanes of Cawdor."

Rev. Joseph Galbraith called attention to a vote of the Council, passed on 11th inst., by which £11 12s 6d was granted for the purchase of a collection of casts of antiquities, and moved—

"That it be recommended to the Council, that the sum of £11. 12*s*. 6*d*. voted by the Council for the purchase of casts of antiquities, bought by Mr. Wilde, in Mayence, be defrayed out of the sum of £50, voted for such purposes by the Academy, on the 14th May, 1860."

The proposition was seconded by Rev. J. H. Jellett; and a division having been called for, it appeared that there were for the motion 12, and against it, 21. The motion was therefore negatived.

The Academy then adjourned.

MONDAY, DECEMBER 10, 1860.

JAMES HENTHORN TODD, D. D., President, in the Chair.

IT WAS RESOLVED, on the recommendation of the Council, that the Academy do co-operate with the Royal Dublin Society in receiving the Association for the promotion of Social Science, on the occasion of its next congress in Dublin, in 1861.

The Rev. Dr. Reeves read the conclusion of his paper "On the Ancient Order of Culdees in Ireland."

The PRESIDENT communicated the following—

OBITS OF EMINENT INDIVIDUALS, AND OTHER NOTICES, CONNECTED WITH NAVAN AND ITS NEIGHBOURHOOD.

IN the Bodleian Library, Oxford, there is a fragment of the Roman Martyrology, which formerly belonged to the Monastery of the B. V. Mary at Navan. It is a MS. of the thirteenth century, and is now marked *Rawlinson*, No. 486.

The following facts and obits are entered, in various hands, of the fourteenth, fifteenth, and sixteenth centuries. These entries were evidently made at the time when the events recorded took place:—

4 *Kal. Sept.* Obiit Thomas Devenys, abbas de Navane, A°. M°. ccc°. LXX°.

Hic obiit Magr. Martinus White, quondam rector de Lascartan, cujus anime propicietur Deus. A°. Dñi. M° ccc°. tricesimo octavo,* qui reliquit Monasterio beate Marie de Nouan unum librum Decretorum et unam unam [*sic*] bibliam.

9 *Kal. Junii.* Obitus felicis memorie Patricii Cantwell, Abbatis de Navan, A°. Dñi. M°. cccc°. xxxvi°. [Archdall reads 1536] cuius anime propicietur Deus.

vij. Id. Junii. Hic recepimus Thomas Cusak confratrem nostrum in orationibus nostris.

vi. Id. Junii. Hic recepimus Henricum Warying cuius anime propicietur Deus.

Hic recepimus Margaretam Kypper iuniorem in orationibus nostris.

v. Id. Junii. Hic recepimus Matildam Gernown uxorem Johannis Haddesors militis, et Elizabeth Gernoun sororem eius et Johannem Flemyng in orationibus nostris.

iv. Id. Junii. Hic recepimus Isabellam Cristofyr in oracionibus nostris.

Hic recepimus Walterum Wotwn confratrem nostrum in orationibus nostris.

xiii. Kal. Julii. Commemoratio parentum.

x. Kal. Julii. Hic recepimus Rogerum Kalynsam et Olivam Randolf uxorem eius in orationibus nostris.

Eodem die recepimus Isabellam Savage in orationibus nostris.

viii. Kal. Julii. Hic recepimus Jacobum Boteler comitem Ormonie, in confratrem nostrum, et in orationibus nostris.

iiii. Kal. Julii. Hic recepimus Johannem Fforrster in orationibus nostris.

Obitus Margarete Nangyll, uxoris Thome Cauley de Novan A° X^{i} M° quadringentesimo nonagesimo primo, cuius anime propicietur Deus.

vi. Kal. Julii. Memorandum quod isto die Barnabas de Angulo [now Nangle] quondam Baro de Novan interfectus fuit, apud Balibardan, cuius anime propicietur Deus. Anno Domini Millesimo cccc° xxx° quinto.

* Archdall says 1438, quoting "Ex Antiquo Martyrologio Mon. de Navan (War. MSS.)"

The Secretary of the Academy having laid upon the table the second part of Mr. Wilde's Catalogue of the Antiquities in the Museum of the Academy, containing a description of the articles composed of animal materials and of bronze, it was—

Resolved—That the special thanks of the Academy are due and hereby returned to Mr. Wilde, for having employed his time and learning with so much profit to the Academy, in the production of the work.

Mr. Wilde, on the part of Wm. Young, Esq., of Island Bridge, presented some ancient iron weapons, &c., and a beautifully-finished pair of bronze scales, found in an excavation near Kilmainham.

Rev. Dr. Abeltshauser, on the part of Charles Frizelle, Esq., of Castle Kevin, presented an original wax impression from an ancient seal, which the President described as that of the University of St. Andrew's, in Scotland.

MONDAY, JANUARY 14, 1861.

JOHN FRANCIS WALLER, LL. D., in the Chair.

Lord Viscount Monck, Henry Cusack, Esq., Richard H. Frith, Esq., C. E., Rawdon Macnamara, M. D., Alexander Mac Ilveen, Esq., James Moore, M. D., and Sir Thomas Wyse, K. C. B., were elected Members of the Academy.

On the recommendation of the Council, it was

RESOLVED—That the samples of wood from Canada, and the osteological specimens now in the Museum of the Academy, be deposited with the Royal Dublin Society, under similar regulations to those required by the Society in the deposit of their antiquities with the Academy.

Dr. Wilde exhibited and described the gold lunette ornaments in the Museum of the Academy.

W. H. HARDINGE, Esq., in the absence of the Rev. Dr. Reeves, read a communication from Charles Mac Donnell, Esq.

ON A MANUSCRIPT OF THE TRACT INTITULED—"TIPICUS AC TROPOLOGICUS JESU CHRISTI GENEALOGIÆ INTELLECTUS QUEM SANCTUS AILERANUS SCOTTORUM SAPIENTISSIMUS EXPOSUIT," PRESERVED IN THE IMPERIAL LIBRARY AT VIENNA.

In the Imperial Library, at Vienna,* there is a valuable vellum manuscript, intitled "Sedulii Junioris Scoti Catena, sive Collectanea ex Patrum sententiis et dictis in Evangelium S. Mathaei." This once popular work on the Gospel of St. Matthew is by our fellow-countryman, Sedulius, that is, *Siedhuil*, or *Shiel*. Denis, in his Catalogue,† says that this manuscript is as old as the tenth century. It now consists of 157 folia, of large quarto form, written in a fair and uniform hand, in two columns, with red initial letters.

It contains a complete copy of the Commentary of St. Aileran, a writer of the seventh century, on the Genealogy of our Lord, according to St. Matthew. In Fleming's posthumously published "Collectanea Sacra,"‡ the tract was first printed, from a St. Gall MS., at Louvain, in 1667; but, as he says in his preface, "*proh dolor! imperfectum.*" It was copied thence into the "Bibliotheca Patrum" of De la Bigne.§ The copy in this Vienna manuscript has thirty-six lines to the end, from the place where Fleming's exemplar breaks off.

There are very great variations between the text in Fleming and that in this manuscript; and it is evident, on a comparison of the two, that

* Cod. Membr. Theol., cix. (nunc vi., c. i.).
† Cod. MSS. Theol. Bibl. Imp. Vindobon., vol. i., p. 294.
‡ Preface, p. 182; text, pp. 185–192.
§ Max. Bibl. Patr., tom. xii., fol. 37, Lugduni, 1677.

the St. Gall manuscript was considerably fuller than ours. I leave it to better critics to decide which is the more genuine text of this work of the "sagest of the Scots."

Among the most venerable writers of the Irish Church, St. Aileran, regent of the great school of Clonard, in the seventh century, has always been reckoned. Our domestic writers, and foreigners as well, have known him by the name of "Aileranus Sapiens," and "Aileranus Scottorum Sapientissimus." His death is recorded, in the Annals of Ulster, on the 29th of December, 664, which corresponds both with our earliest martyrology—that of St. Ængus Ceile-de—and with that of Suben (Martyrologium Subense) in Bavaria.* The former notes his feast on the 29th of December, in his metrical martyrology, thus—

La hAiperan mbecnai,
'With Aireran the Wise.'†

The latter concordantly sets down—"iv. Kal. Januarii, *In Hibernia S. Arerani, Confessoris.*"

He wrote the *Gesta* of St. Patrick, a Life of St. Brigid, and is said to have been the author of a life of his contemporary, St. Fechin of Fore, whom he survived for about a year. We may conclude from Ussher,‡ that these works were no longer to be found in his day; and the only part of the writings that are known to us, of him to whom early ages gave the title of the "Sagest of the Scots," in days when it was our country's lot to be foremost in ecclesiastical learning in Northern Europe, is that short but marvellous fragment on the genealogy of our blessed Saviour, of which the two copies which I have mentioned are all that remain.

The following is the concluding portion, the want of which Fleming deplored, but which is fortunately preserved in the Vienna manuscript.§ He ends with "et illic resuscitati in sancto et spiritali vivamus corpore. In Azor, ut adjuvante Domino," where the perfect copy continues the exposition in the words now, for the first time, made public.

In Azor, ut adjuvante domino aereas potestates devincamus atque in

---

* Now in Austria, on the east bank of the Inn, south of Passau. It was a monastery of Regular Canons of St. Augustin. See "Monumenta Boica," vol. iv., p. 513.

† The Mart. Taml. has simply Ailepan at this day. Marian Gorman has Ailepan, with the note Pepleżinn Cluana hEpaipd, "Lector of Clonard." This is copied into the Martyrology of Donegal, with the change of the name to Epeapan. Another Aipepan is commemorated at Aug. 11, in the Irish Calendars; but he was of Teach Aipepain, or Tyfarnham, in Westmeath, and of a later date, inasmuch as he was successor to Maelruain at Tamhlacht.

‡ Primordia, p. 996; or Brit. Ecc. Ant., cap. 17, Works, vol. vi., p. 538. Ussher seems to have known of this, or a similar MS.; for, treating of the author, he writes:—"Cujus ingenii unicum, atque illud perexiguum, monimentum adhuc habemus reliquum: Sedulii junioris collectaneo in Matthæum insertum, atque ita prænotatum: Incipit typicus ac tropologicus genealogiæ Christi intellectus: quem sanctus Aileranus Scottorum sapientissimus exposuit." A similar notice appears in Ware's Irish Writers.

§ Fol. 9 *a*, col. 1, to 9 *b*, col. 1.

deo solo confidentes cum psalmista dicamus, Auxilium meum a domino qui fecit caelum et terram.

In Sadoc, ut justificemur ab eo qui justificat impium.

In Achim, ut fratres Christi existamus qui, inquit, fecerit voluntatem patris mei ipse est meus frater et mater et soror.

In Eliud, ut nullum alium preter unum habeamus Deum, cujus dono dii fieri promereamus. Ego, inquit, dixi dii estis et filii excelsi.

In Eliazar, ut confidentes dicamus adjuva nos Deus salutaris noster, quod est dicere Jesu noster. Nam qui confidit in Domino s. m. s. n. c. i. æternum.

In Mathan, ut multiplicibus sancti Spiritus donis nos ditemur.

In Jacob, ut rectores tenebrarum harum, et principem potestatis hujus aeris, ipsam etiam carnem cum vitiis et concupiscentiis ejus in virtute domini per arma justitiæ a dextris et a senistris supplantemus.

In Joseph, ut si exterior homo noster corrumpatur de die tamen in diem interior renovetur et spiritalium incrementorum profectibus augeatur, donec de unoquoque nostrorum spiritaliter dici possit filius accrescens. Crescamus itaque in caritate donec occurramus omnes in virum perfectum, in mensuram aetatis plenitudinis Christi, quatenus de virtute in virtutem transeuntes, ac de timore Dei, qui est initium sapientiae, per gradus perfectionis ad caritatem quae totius præcepti finis est ascendentes, Deum deorum in Sion contemplari feliciter mereamur.

Illud postremo sciendum est quod hanc Salvatoris nostri genealogiam quatuor species attingunt quæ sunt Figura, Profetia, Demonstratio, Convenientia. Figura, ut liber generationis Adæ hic est. Profetia, ut in capite libri scriptum est de me. Demonstratio, ut est illud, Vidi librum signatum. Convenientia vero est, quod ejusdem genealogiae spiritalis interpretatio juxta medicinales lineas morales ceu praediximus intelligentiae cunctis credentibus et electis in domino conveniat.

W. H. Hardinge, Esq., in the absence of Dr. Reeves, also read the following—

Notice of some of the lives which seem to have been ready, or in preparation, for the continuation of the "Acta Sanctorum Hiberniæ," at the death of Colgan. By Charles Mac Donnell, Esq.

I copied the following list of biographies of our Irish saints from a catalogue of the MSS. and printed books found, after Colgan's death, in his room in the Convent of St. Anthony of Padua, Louvain. There are in Rome, in the muniment-room of the Irish Franciscan Convent of St. Isidore, several coeval copies of catalogues of what was found on that occasion in the poor cell of our venerable hagiographer. They do not all contain this list of Saints' lives at length; and there are slight differences between them otherwise, which induce me to believe they were drawn up by different members of the community, deputed, perhaps separately, to examine what Colgan had left behind him.

I presume the lives, here enumerated in the order of the months, were those which Colgan had ready prepared, or was preparing, for the press, when death stayed his hand, and left the great monument of the "Acta Sanctorum Hiberniæ" incomplete. Almost all these collections have perished; and, except some collectanea in the Burgundian Library, and a MS. of Saints' lives, copied by Father Goold, of the Franciscan convent of Cashel, in 1629, in the margin of which Colgan had made some divisions into chapters, I doubt if there be any unpublished matter of Colgan's now remaining in St. Isidore's, or in the Burgundian Library, to which places the MSS. that belonged to the convent of Louvain, where he died, were transferred eventually.

Brenan, an Irish Franciscan, published an Ecclesiastical History of Ireland, in two volumes, 8vo, in Dublin, in the year 1840. He had access to the archives of St. Isidore's during a residence in Rome, and has made some, but not sufficient, use of the valuable materials for Irish church history that are lying there. He asserts, vol. ii., p. 271, with reference to the "Acta Sanctorum Hiberniæ," that "the remaining parts of this work, enriched with notes, critical and topographical, had been prepared for the press, when the death of the author prevented their publication;" and refers to Wadding's "Scriptores Ordinis Minorum," p. 210, as his authority for the statement. This reference is not calculated to convince me of his accuracy as an investigator. For, on examining the passage at the page to which he refers, I find that Wadding's statement is considerably different. It is to the effect that the *fourth volume* of the "Acta SS. Hiberniæ," comprising the months of April, May, and June, was under the press at the time when he (Wadding) was writing this passage, which was in 1648 or 1649; and that Colgan promised to give to the world, in a short time, the fifth and sixth volumes, embracing the remaining months of the year. Moreover, all that I have been able to discover leads me to doubt that Colgan had much of the volume for April, May, and June, in the press. He certainly had the paper and copy to a considerable amount ready for the printers; but, at such a distance as Rome was from Louvain, and considering the slowness of communication then, it is very probable that Wadding may have been mistaken about the advanced state of the work.

CATALOGUS ACTUUM SANCTORUM QUÆ MS. HABENTUR, ORDINE MENSIUM ET DIERUM.

MENSIS APRILIS.

Vita S. Osmannæ, Virginis et Martyris, 1 Aprilis.
S. Cadoci, Præsbyteri, eodem die.
S. Adriani, Præsbyteri, eodem die.
S. Fechuonis, Abbatis, 3 Aprilis.
Vita S. Tighernachi, Episcopi, 4 Aprilis.
S. Celsi, Archiepiscopi Ardmachani, 6 Aprilis.
S. Finani, Abbatis, 7 Aprilis.
S. Brogani, Episcopi, 9 Aprilis.

Vita S. Waldetrudis, 9 Aprilis.
S. Paterni, Martyris, 10 Aprilis.
S. Maidoci, Abbatis, 11 Aprilis.
S. Heliæ, Abbatis, 12 Aprilis.
S. Thassachi, Abbatis, 14 Aprilis.
S. Paterni, Episcopi, 15 Aprilis.
S. Ruadani, Abbatis, eodem die.
S. Mariani, Monachi, 16 Aprilis.
Vita S. Moluani de Druim Sneachda, 17 Aprilis (et 4 Augusti).
S. Landrici, eodem die.
S. Molassij, Episcopi Lethglenn, 18 Aprilis.
S. Egberti, Abbatis, 24 Aprilis.
S. Obodij, 25 Aprilis.
S. Trudperti, 26 Aprilis.
S. Cronani, 28 Aprilis.
S. Forannani, 30 Aprilis.

Mensis Maii.

Vita S. Vltani, primo Maij.
S. Germani, 2 Maij.
S. Juvenalis, 3 Maij.
S. Wironis, 8 Maij.
S. Gibriani, 8 Maij.
S. Comgelli, 10 Maij.
S. Florentij, 10 Maij, et 7 Novemb.
B. Michomeris, 13 Maij.
S. Carthagij, qui et Mochudda, dicitur, 14 Maij.
Vita S. Dympnæ, 15 Maij.
S. Carantoci, 16 Maij.
S. Bertuini, 16 Maij, vel 11 Novemb.
S. Brendani Cluainfertensis, 16 Maij.
S. Merorilani, 18 Maij.
S. Ronani, 20 Maij.
S. Aldelmi, 25 Maij.
S. Magdelgisili, 30 Maij.
S. Silay, 30 Maij.

Junius.

Vita S. Algissi, 2 Junij.
S. Coemgeni, 3 Jun.
S. Glunsalachi, 3 Jun.
S. Alphini, 3 Jun.
S. Cassani, 4 Jun.
S. Petroci, 4 Jun.
S. Nennocæ, V., 4 Jun.
S. Deochari, 6 Jun.
Vita S. Colmani, 7 Jun.
S. Baithini, 9 Jun.
S. Cuneræ, V., 12 Jun.
S. Molingi, 17 Jun.
S. Deodati, 19 Jun.
S. Adalberti, 23 Jun.
S. Erentrudis, V., 30 Jun.

Julius.

Vita S. Olcani, 4 Julij.
S. Moduennæ, 5 Jul.
S. Darercæ, quæ et Moninna, 6 Jul.
S. Dissibodij, 8 Jul.
S. Ethonis, 10 Jul.
Vita S. Hidulphi, 11 Jul.
S. Mochullæi, 12 Jul.
SS. Mauræ et Brigidæ, 13 Jul.
S. Maldegarij, cognomento Vincentij, 14 Jul.

Vita S. Plechelmi, 15 Jul., habentur et quædam ibi de S. Otgero, qui 10 Septembris colitur.
S. Cranatæ, V., 17 Jul.
Vita S. Fredigandi, cod. 17 Jul.
S. Arbogasti, 21 Jul.
S. Declani, 24 Jul.
S. Sampsonis, 28 Jul.

AUGUSTUS.

Vita S. Peregrini, 1 Augusti.
S. Moluani, 4 Aug. (et 17 Aprilis).
S. Oswaldi, 5 Aug.
S. Lughidij, 6 Aug.
S. Vltani, eod. die.
S. Malchi, 10 Aug.
S. Athractæ, V., 11 Aug.
S. Maccretij, 11 Aug.
S. Wigberti, M., 12 vel 13 Aug.
S. Maccarthini, 15 Aug.
Vita SS. Marini et Aniani, 16 Aug.
S. Jeronis, 16 Aug.
S. Dagæi, 18 Aug.
S. Guniforti, 22 Aug.
S. Andreæ, 22 Aug.
S. Eugenij, Ep., 23 Aug.
S. Cuthberti, Translatio, 24 Aug.
S. Fiacrij, 30 Aug.
S. Aidani, Ep., 31 Aug.

SEPTEMBER.

Vita S. Sebaldi, 1 Septembris.
S. Macnessij, 3 Sept.
S. Mansueti, 3 Sept.
S. Orbiliæ, V., 4 Sept.
S. Magni, 6 Sept.
S. Kierani, Abbatis, 9 Sept.
S. Bertellini, 9 Sept., vel 12 Aug.
S Finani, 10 Sept.
S. Otgari, 10 Sept., habentur, ibidem de S. Plechelmo qui colitur 15 Julij.
S. Albei, 12 Sept.
Vita S. Molassij al. Lasreni, 12 Sept.
S. Rodingi, 17 Sept.
S. Richardis Imperatricis, 18 Sept.
S. Egbini, 19 Sept.
SS. Cunialdi et Gislarij, 24 Sept.
S. Ruperti Translatio, 24 Sept.
S. Barrij, 25 Sept.
S. Firmini, 25 Sept.
S. Colmani, 26 Sept.

OCTOBER.

Vita S. Wasnulphi, 1 Octob.
S. Ewaldi, 3 Octob.
S. Keynæ, V., 8 Octob.
S. Cannechi, 11 Octob.
S. Colmani, M., 13 Octob.
S. Galli, 16 Octob.
S. Eliphii, M., eodem die.
S. Lulli, eodem die.
S. Mononis, 18 Octob.
S. Ethbini, 19 Octob.
S. Vitalis, 20 Octob., pauca ibi de S. Lullo.
Vita S. Vrsulæ cum sociis, 21 Octob.
S. Munni seu Mundi 21 Octob.
S. Maxentiæ, V. et M., 24 Octob.
S. Abbani, 26 Octob., vide 16 Martij.
S. Egbini, 29 Octob.
S. Foilani, 31 Octob.

NOVEMBER.

Vita S. Benigni, 3 Novemb.
De S. Malachia pauca, 5 Nov.
S. Emiliani, 6 Nov.
S. Euflanei, 6 Nov.
S. Willibrordi, 7 Nov.
S. Kebij, 8 Nov.
S. Grellani, 10 Nov.
De S. Bertuino, pauca 11 Novemb., ibidem et pauca de S. Kiliano.
S. Livini, 12 Novemb.
S. Kiliani, 13 Nov.
S. Lassaræ, V., 13 Nov.
S. Sidonij, Abb., 14 Nov.
S. Machutis, 14 Nov.
Vita De miraculis S. Laurentij parum eodem die.
S. Finţani seu Findani, 15 Nov.
S. Momboli, 18 Nov.
S. Odæ, eodem die.
De S. Maxentia, V. et M. parum. 20 Novemb. *Vide* 24 *Octob.*
S. Obodij, 21 Nov.
S. Osmannæ, V., 22 Nov. *Vide* 1 *Apr.*
De S. Virgilio pauca, 27 Nov.
De S. Brendano Birrensi parum, 29 Nov.

DECEMBER.

Vita S. Virgilij, 1 Decemb.
S. Eloquij, 3 Decemb.
S. Boetij, 7 Decemb.
S. Finniani, 12 Dec. *Vide* 23 *Febr. aliam Vitam.*
S. Columbæ de Tirdaglas, 13 Decemb.
Vita S. Flannani, 18 Dec.
S. Samthannæ, V., 19 Dec.
S. Maccarij, 19 Dec.
S. Lucharij, 23 Dec.
S. Mochuæ, 24 Decemb.

Notæ in plures ex prædictis vitis manent supra easdem in cesta.

Denis H. Kelly, Esq., presented alphabetic indexes to the two volumes of the Catalogue of the Betham Collection of Manuscripts, made by Eugene Curry, Esq. It was

RESOLVED,—That the special thanks of the Academy are hereby presented to Mr. Kelly for this valuable addition to the Library.

Portions of two small bomb-shells or grenades were presented by Dr. S. L. Bigger, to whom they had been given by Mr. J. M'Veigh, who communicated the following information relating to the more perfect specimen :—

"The shell about which you wish to obtain information was found by one of my workmen, when ploughing a field on the south side of the Hill of Aughrim, and next field to the one containing the mound called 'St. Ruth's Grave.' This was in the year 1851. The other shell was found on the property of Sir Thomas Redington, situate on the west of Aughrim River, and on the north side of the stream which runs at the foot of the hill on the south side, and in the townland of Aughrim.

"I can find no mention made of any *shells* being used at Aughrim in any work which I have met with, except in O'Callaghan's 'Green Book,' in which it is stated that, on Ginkell's preparation for the attack, 'the grenadiers were drawn up at the head of each regiment, *with two shells apiece !*' "

MONDAY, JANUARY 28, 1861.

JAMES HENTHORN TODD, D. D., President, in the Chair.

READ a letter from George M. Miller, Esq., announcing a donation of some osseous remains and antiquities, found in the works of the Great Southern and Western Railroad, near the King's-Bridge Terminus.

Parke Neville, Esq., C. E., presented an ancient sword, spear-head, and some human remains, found under the street opposite to St. Bride's Church.

It was moved by the Rev. S. Haughton; seconded by the Rev. Joseph Carson, D. D., and

RESOLVED,—That it be recommended to the Council to lay a Report before the Academy with respect to the Cunningham Fund, including,—

1. A history of the fund from its origin to the present time;

2. A list of the recipients of the proceeds of that fund, and Cunningham Medallists; with a statement of the purposes for which they received such fund or medal: and that the Council be requested to lay before the Academy its views with respect to the best mode of appropriating the Cunningham Fund in future.

MONDAY, FEBRUARY 11, 1861.

JAMES HENTHORN TODD, D. D., President, in the Chair.

James Foulis Duncan, M. D., Wyville Thomson, LL. D., and David Walker, M. D., were elected members of the Academy.

The REV. ROBERT CARMICHAEL, F. T. C. D., read a paper—

ON THE GENERAL THEORY OF THE INTEGRATION OF NON-LINEAR PARTIAL DIFFERENTIAL EQUATIONS.

A COMPLETE theory of the genesis and solution of non-linear partial differential equations of the second and higher orders, in two or more independent variables, has been long a desideratum; and any considerable addition to our knowledge in this department of science can only be expected from the combined labours of those who have devoted some attention to this branch of the Integral Calculus. The following paper is intended as a small contribution towards the formation of such a theory. The solutions of non-linear partial differential equations are sought in the form of what are denominated 'complete primitives,' exhibiting arbitary constants, as contradistinguished from 'general primitives,' exhibiting arbitrary functions. It is allowed that solutions in the latter form are more general; but then they are theoretically unattainable, unless in certain cases which, the equations being linear, admit of symbolic treatment, or which are susceptible of reduction by methods not universally applicable. The importance of the subject, partly in

connexion with the Calculus of Variations, and partly with the higher branches of mathematical physics, cannot well be overrated. It is well known that in the more advanced departments of mathematical physics one of the principal obstacles to our progress arises from the difficulty of integrating the partial differential equations which represent the conditions of the problem investigated; that these integrals have been sought in form of general primitives, which are in most cases unattainable; and that, if such forms of solution are attainable, a fresh difficulty arises upon our seeking to determine the forms of the arbitrary functions introduced. It is impossible now to determine what may be the physical value of the integrals of such differential equations, when stated in the form of complete primitives; but, in the default of better, such solutions may afford us, at least, *some* information. The following remarks are offered in the hope of being thus beneficial:—

1. If we are given any equation, including two arbitrary constants α, β, and two independent variables x, y,

$$f(x, y, z, \alpha, \beta) = 0, \qquad (I)$$

we may differentiate this equation with respect to the independent variables x and y, thus obtaining

$$\left(\frac{df}{dx}\right) = 0, \left(\frac{df}{dy}\right) = 0;$$

and, by eliminating α, β between the three equations stated, we get a partial differential equation, in general non-linear,

$$F\left(x, y, z, \frac{dz}{dx}, \frac{dz}{dy}\right) = F(x, y, z, p, q) = 0,$$

of which (I) is said to be a *complete primitive*.

2. Again if, u being any function of known form in x, y, z, we were given an equation of the type

$$f_1\{x, y, z, \varphi(u)\} = 0, \qquad (I')$$

ϕ being any arbitrary function, we might differentiate as before, and eliminate φ, φ', thus again arriving at a partial differential equation

$$F_1\left(x, y, z, \frac{dz}{dx}, \frac{dz}{dy}\right) = F_1(x, y, z, p, q) = 0,$$

of which (I′) is said to be the *general primitive*.

3. Similarly, if we are given any equation including three arbitrary constants α, β, γ, and three independent variables x, y, z,

$$f(x, y, z, w, \alpha, \beta, \gamma) = 0, \qquad (II)$$

we may differentiate this equation with respect to the independent variables x, y, z, thus obtaining

$$\left(\frac{df}{dx}\right) = 0, \left(\frac{df}{dy}\right) = 0, \left(\frac{df}{dz}\right) = 0;$$

and, by eliminating α, β, γ between the four equations stated, we would get a partial differential equation in three independent variables, in general non-linear,

$$\mathrm{F}\left(x, y, z, w, \frac{dw}{dx}, \frac{dw}{dy}, \frac{dw}{dz}\right) = 0,$$

of which (II) would be said to be a complete primitive.

If, instead of differentiating with respect to the independent variables, we had differentiated with respect to the arbitrary constants, thus getting

$$\frac{df}{d\alpha} = 0, \frac{df}{d\beta} = 0, \frac{df}{d\gamma} = 0,$$

and then eliminated the arbitrary constants between the given equation and these three, we would obtain a result of the form

$$\mathbf{F}\ (x, y, z, w) = 0,$$

which will, in general, satisfy the partial differential equation, previously derived,

$$\mathrm{F}\left(x, y, z, w, \frac{dw}{dx}, \frac{dw}{dy}, \frac{dw}{dz}\right) = 0,$$

and, as it exhibits no arbitrary constants, may be denominated its singular solution.

4. Again if, u and v being any functions of known form in x, y, z, w, we were given an equation of the type

$$f_{//}\{x, y, z, w, \phi(u, v)\} = 0, \qquad \text{(II')}$$

ϕ being any arbitrary function, we may differentiate with respect to the independent variables x, y, z, and eliminate

$$\phi, \frac{d\phi}{du}, \frac{d\phi}{dv},$$

thus again obtaining a partial differential equation

$$\mathrm{F}_{//}\left(x, y, z, w, \frac{dw}{dx}, \frac{dw}{dy}, \frac{dw}{dz}\right) = 0,$$

of which (II') may be said to be the general primitive.

5. Proceeding by analogy, being given any equation in two independent variables, but exhibiting *five* arbitrary constants,

$$f(x, y, z, \alpha, \beta, \gamma, \delta, \epsilon) = 0, \qquad \text{(III)}$$

we may differentiate this equation twice successively with respect to x

and y, and eliminate the arbitrary constants between the given equation and

$$\left(\frac{df}{dx}\right) = 0, \left(\frac{df}{dy}\right) = 0, \left(\frac{d^2f}{dx^2}\right) = 0, \left(\frac{d^2f}{dxdy}\right) = 0, \left(\frac{d^2f}{dy^2}\right) = 0.$$

Thus we should obtain a partial differential equation of the second order, in general non-linear, of the form (adopting the ordinary notation),

$$F_0(x, y, z, p, q, r, s, t) = 0, \qquad \text{(IV)}$$

of which (III) may be said to be a complete primitive.

6. It does not follow, however, (as is known), that, in general, from a given finite equation exhibiting *two arbitrary functions*, we can pass to a partial differential equation of the second order. For if, u and v being any two functions of known form in x, y, z, we were given any equation of the type

$$f(x, y, z, \varphi u, \psi v) = 0,$$

differentiating this equation twice successively with respect to x and y we only get six equations, which, ordinarily, are *not* sufficient to enable us to eliminate *the six* quantities

$$\varphi, \varphi', \varphi'', \psi, \psi', \psi''.$$

It is true indeed that, in the case of *linear* partial differential equations of the second order, *which admit of treatment by symbolic methods*, we do, in most cases, obtain the solutions, in the form of general primitives, by direct procedures, and exhibiting two arbitrary functions. But the fact, which has just been alluded to, would appear to show that in the case of *non-linear* partial differential equations of the second and higher orders, which do not admit in general of treatment by symbolic methods, the species of solution which we should seek to obtain, should be, not the general primitive exhibiting arbitrary functions, but the complete primitive exhibiting arbitrary constants; and the mode of integration which we should seek to perfect, should be that by which the complete primitives of such partial differential equations are sought, and not their general primitives.

7. Moreover, we may differentiate the equation

$$f(x, y, z, \alpha, \beta, \gamma, \delta, \epsilon) = 0$$

with respect to the arbitrary constants, and between the five equations thus found, namely,

$$\frac{df}{d\alpha} = 0, \frac{df}{d\beta} = 0, \frac{df}{d\gamma} = 0, \frac{df}{d\delta} = 0, \frac{df}{d\epsilon} = 0,$$

and the given equation, eliminate α, β, γ, δ, ϵ, thus obtaining a resulting equation of the form

$$F_1(x, y, z) = 0. \qquad \text{(V)}$$

It may be interesting to inquire what relation this equation bears to the corresponding partial differential equation (IV); in other words, whether there is any such relation between the two, as would justify us in denominating (V), *in any case*, the singular solution of (IV): what analytical conditions would be requisite in order that the former equation should satisfy the latter: and what may be the geometrical significance of singular solutions of partial differential equations of the second order, if such singular solutions are admissible or conceivable.

As regards the analytical conditions specified, they may be investigated thus. Differentiating the equation

$$f(x, y, z, \alpha, \beta, \gamma, \delta, \epsilon) = 0$$

with respect to all the variables, we get identically

$$\left(\frac{df}{dx}\right)dx + \left(\frac{df}{dy}\right)dy + \frac{df}{d\alpha}d\alpha + \frac{df}{d\beta}d\beta + \frac{df}{d\gamma}d\gamma + \frac{df}{d\delta}d\delta + \frac{df}{d\epsilon}d\epsilon = 0,$$

which, in consequence of the relations supposed, reduces to

$$\left(\frac{df}{dx}\right)dx + \left(\frac{df}{dy}\right)dy = 0,$$

or, as dx and dy are independent, we have the first two of the relations stated in the fifth article, namely,

$$\left(\frac{df}{dx}\right) = 0, \left(\frac{df}{dy}\right) = 0.$$

So far all is plain; but when we proceed to differentiate these equations again with respect to all the variables, we get

$$\left(\frac{d^2f}{dx^2}\right)dx + \left(\frac{d^2f}{dxdy}\right)dy + \left(d\alpha\frac{d}{d\alpha} + d\beta\frac{d}{d\beta} + d\gamma\frac{d}{d\gamma} + d\delta\frac{d}{d\delta} + d\epsilon\frac{d}{d\epsilon}\right)\left(\frac{df}{dx}\right) = 0$$

$$\left(\frac{d^2f}{dy^2}\right)dy + \left(\frac{d^2f}{dxdy}\right)dx + \left(d\alpha\frac{d}{d\alpha} + d\beta\frac{d}{d\beta} + d\gamma\frac{d}{d\gamma} + d\delta\frac{d}{d\delta} + d\epsilon\frac{d}{d\epsilon}\right)\left(\frac{df}{dy}\right) = 0,$$

which are not equivalent to the remaining relations of the fifth article, namely,

$$\left(\frac{d^2f}{dx^2}\right) = 0, \left(\frac{d^2f}{dxdy}\right) = 0, \left(\frac{d^2f}{dy^2}\right) = 0,$$

unless, simultaneously,

$$\left.\begin{aligned}\left(d\alpha\frac{d}{d\alpha} + d\beta\frac{d}{d\beta} + d\gamma\frac{d}{d\gamma} + d\delta\frac{d}{d\delta} + d\epsilon\frac{d}{d\epsilon}\right)\cdot\left(\frac{df}{dx}\right) = 0\\ \left(d\alpha\frac{d}{d\alpha} + d\beta\frac{d}{d\beta} + d\gamma\frac{d}{d\gamma} + d\delta\frac{d}{d\delta} + d\epsilon\frac{d}{d\epsilon}\right)\cdot\left(\frac{df}{dy}\right) = 0\end{aligned}\right\}$$

8. It is known that, if we are given any system of surfaces exponible by the partial differential equation of the first order

$$F(x, y, z, p, q) = 0,$$

we can, in general, determine the character of this system by finding the integral of the differential equation, either in the form of a complete primitive, or a general primitive.

Again, if we are given any system of surfaces exponible by the partial differential equation of the second order

$$F(x, y, z, p, q, r, s, t) = 0,$$

we may, in general, determine the character of this system by finding, if we can, the integral of the differential equation, either in the form of a complete primitive, or a general primitive.

If the solution, in either of these two cases, be obtained in the form of a general primitive, the form of the arbitrary function or functions introduced is, in general, determined by supposing the surface to pass through a given curve or curves. The difficulty of applying this principle, in practice, is well known.

If, on the other hand, the solution, in either case, be obtained in the form of a complete primitive, everything required by the solution is determined if, in the former case, *two points* upon the surface represented by the partial differential equation be given, and, in the latter case, *five points*. More generally, if the given non-linear partial differential equation be of the first order and include n independent variables, it is sufficient, for the determination of the function represented, in the form of a complete primitive, that we be given n systems of correspondent values of the variables. If the given non-linear partial differential equation be of the second order, and include n independent variables, it is sufficient for the complete determination of the function represented, that we be given $\frac{n(n+3)}{2}$ systems of correspondent values of the variables.

9. I now proceed to discuss certain examples with the view of showing the *feasibility* of obtaining solutions, in the form of complete primitives, of non-linear partial differential equations of the second order, and, in the following article, a general method for deriving such solutions will be indicated: the completion of the subject is reserved for a supplementary communication.

Examples.

(1). Let it be proposed to determine the solution, in the form of a complete primitive, of the non-linear partial differential equation

$$\frac{1}{p} + \frac{1}{q} = 1. \tag{1}$$

The auxiliary system, adopting the method of Lagrange and Charpit, gives

$$dp = 0,$$

since

$$\frac{dq}{dx} = 0, \frac{dq}{dz} = 0.$$

Hence, c being any arbitrary constant,

$$p = c \quad , \quad \text{and} \quad q = \frac{c}{c-1};$$

and substituting these values in the general equation

$$dz = pdx + qdy$$

we get, writing $\frac{1}{a}$ for c,

$$z = \frac{x}{a} + \frac{y}{1-a} + \beta. \tag{2}$$

This then is a complete primitive of the given equation, and it is at once seen to satisfy it. But, moreover, if we examine the other equations of the auxiliary system in this case, namely,

$$(p-1)^2\, dx = dy = \left(\frac{p-1}{p}\right)^2 dz,$$

we see that no other complete primitive is deducible. In other words, equation (2) is *the* complete primitive of (1).

If β be made an arbitrary function of a, we get as the general primary of (1)

$$\left.\begin{aligned} z &= \frac{x}{a} + \frac{y}{1-a} + \phi(a) \\ 0 &= \frac{x}{a^2} - \frac{y}{(1-a)^2} - \phi'(a) \end{aligned}\right\}.$$

(2). If it be now proposed to integrate the higher differential equa-

tion in three independent variables (and a corresponding method will apply generally)

$$\frac{1}{\frac{dw}{dx}} + \frac{1}{\frac{dw}{dy}} + \frac{1}{\frac{dw}{dz}} = 1,$$

let us assume for w the linear form

$$w = \frac{x}{\alpha} + \frac{y}{\beta} + \frac{z}{\gamma} + \kappa,$$

where α, β, γ, κ are arbitrary constants. Then, by substitution, we find that this will be the solution required, if the arbitrary constants be connected by the relation

$$\alpha + \beta + \gamma = 1.$$

Hence the complete primitive of the given equation is, writing γ for κ,

$$w = \frac{x}{\alpha} + \frac{y}{\beta} + \frac{z}{1-(\alpha+\beta)} + \gamma,$$

and the general primary

$$\left.\begin{aligned} w &= \frac{x}{\alpha} + \frac{y}{\beta} + \frac{z}{1-(\alpha+\beta)} + \phi(\alpha,\beta) \\ 0 &= \frac{d}{d\alpha}\left\{\frac{x}{\alpha} + \frac{y}{\beta} + \frac{z}{1-(\alpha+\beta)} + \phi(\alpha,\beta)\right\} \\ 0 &= \frac{d}{d\beta}\left\{\frac{x}{\alpha} + \frac{y}{\beta} + \frac{z}{1-(\alpha+\beta)} + \phi(\alpha,\beta)\right\} \end{aligned}\right\}.$$

I have ventured to denominate the system of equations just written, the 'general primary' solution of the given partial differential equation, instead of, as it is usually denominated, the 'general primitive.' It would seem to be right to distinguish between the two cases, where one arbitrary constant is made an arbitrary function of one or more others, and where an arbitrary function of the variables is introduced. It is true, indeed, that in some cases these duplicate solutions coincide, as, for instance, in the case of the general functional equation of surfaces of revolution, namely,

$$lx + my + nz = \phi(x^2 + y^2 + z^2)$$

which may be readily identified with the general primary, obtained from the complete primitive

$$(x - c\cos\lambda)^2 + (y - c\cos\mu)^2 + (z - c\cos\nu)^2 = \gamma^2,$$

by putting $c = \psi(r)$; but such identification does not appear to be generally possible.

It is easy to see how the following non-linear partial differential equations are but modifications of the simple examples treated, namely,

$$\left.\begin{aligned} \frac{1}{p} + \frac{1}{q} &= \frac{k}{z} \\ \frac{x}{p} + \frac{y}{q} &= kz \\ \frac{x^m}{p} + \frac{y^m}{q} &= kz^m \end{aligned}\right\}; \text{ or } \left\{\begin{aligned} \frac{1}{\frac{dw}{dx}} + \frac{1}{\frac{dw}{dy}} + \frac{1}{\frac{dw}{dz}} &= \frac{k}{w} \\ \frac{x}{\frac{dw}{dx}} + \frac{y}{\frac{dw}{dy}} + \frac{z}{\frac{dw}{dz}} &= kw, \\ \frac{x^m}{\frac{dw}{dx}} + \frac{y^m}{\frac{dw}{dy}} + \frac{z^m}{\frac{dw}{dz}} &= kw^m, \end{aligned}\right.$$

the solutions being, respectively,

$$\left.\begin{aligned} \log z &= \frac{1}{k}\left(\frac{x}{a} + \frac{y}{1-a} + \beta\right) \\ z^2 &= \frac{1}{k}\left(\frac{x^2}{a} + \frac{y^2}{1-a} + \beta\right) \\ z^{m+1} &= \frac{1}{k}\left(\frac{x^{m+1}}{a} + \frac{y^{m+1}}{1-a} + \beta\right) \end{aligned}\right\}$$

and

$$\left.\begin{aligned} \log w &= \frac{1}{k}\left(\frac{x}{a} + \frac{y}{\beta} + \frac{z}{1-(a+\beta)} + \gamma\right) \\ w^2 &= \frac{1}{k}\left(\frac{x^2}{a} + \frac{y^2}{\beta} + \frac{z^2}{1-(a+\beta)} + \gamma\right) \\ w^{m+1} &= \frac{1}{k}\left(\frac{x^{m+1}}{a} + \frac{y^{m+1}}{\beta} + \frac{z^{m+1}}{1-(a+\beta)} + \gamma\right) \end{aligned}\right\}.$$

(3). If it were proposed to integrate the non-linear partial differential equation of the second order, in two independent variables,

$$\frac{1}{r} + \frac{1}{t} = \frac{1}{\frac{d^2z}{dx^2}} + \frac{1}{\frac{d^2z}{dy^2}} = 1,$$

we would assume, by analogy, the solution to be

$$z = \frac{x^2}{2a} + \frac{y^2}{2(1-a)} + \frac{xy}{\beta} + \frac{x}{\gamma} + \frac{y}{\delta} + \epsilon;$$

and it is instantly evident that this is a complete primitive of the given equation, since it satisfies it, and exhibits five arbitrary constants.

Similarly, the solution, in the form of a complete primitive, of the non-linear partial differential equation of the second order, in three independent variables,

$$\frac{1}{\frac{d^2w}{dx^2}} + \frac{1}{\frac{d^2w}{dy^2}} + \frac{1}{\frac{d^2w}{dz^2}} = 1,$$

is

$$w = \frac{x^2}{2\alpha} + \frac{y^2}{2\beta} + \frac{z^2}{2(1-\alpha+\beta)} + \frac{yz}{\gamma} + \frac{zx}{\delta} + \frac{xy}{\epsilon} + \frac{x}{\zeta} + \frac{y}{\eta} + \frac{z}{\theta} + \kappa,$$

since, as before, it satisfies the given partial differential equation, and exhibits nine arbitrary constants.

It is readily seen that if the former of the two partial differential equations now treated, had been

$$\frac{1}{r} + \frac{1}{s} + \frac{1}{t} = \frac{1}{\frac{d^2z}{dx^2}} + \frac{1}{\frac{d^2z}{dxdy}} + \frac{1}{\frac{d^2z}{dy^2}} = 1,$$

we should have, for a complete primitive, the obvious modification

$$z = \frac{x^2}{2\alpha} + \frac{y^2}{2\beta} + \frac{xy}{1-(\alpha+\beta)} + \frac{x}{\gamma} + \frac{y}{\delta} + \epsilon.$$

(4). It follows readily from the forms of solution arrived at in the examples just discussed, that the complete primitive of any non-linear partial differential equation of the type

$$f(p, q) = 0,$$

is the linear expression

$$z = ax + by + c,$$

where a and b are connected by the equation

$$f(a, b) = 0.$$

Thus the complete primitive of the partial differential equation

$$\frac{1}{p^m} + \frac{1}{q^m} = k$$

is

$$z = \frac{x}{\alpha^{\frac{1}{m}}} + \frac{y}{(1-\alpha)^{\frac{1}{m}}} + \beta.$$

More generally, the complete primitive of the partial differential equation in three independent variables

$$\frac{1}{\left(\frac{dw}{dx}\right)^m} + \frac{1}{\left(\frac{dw}{dy}\right)^m} + \frac{1}{\left(\frac{dw}{dz}\right)^m} = 1$$

is

$$w = \frac{x}{\alpha^{\frac{1}{m}}} + \frac{y}{\beta^{\frac{1}{m}}} + \frac{z}{(1-\alpha+\beta)^{\frac{1}{m}}} + \gamma.$$

Similarly, the integral of the partial differential equation

$$\frac{1}{r^m} + \frac{1}{t^m} = \frac{1}{\left(\frac{d^2z}{dx^2}\right)^m} + \frac{1}{\left(\frac{d^2z}{dy^2}\right)^m} = 1,$$

in the form of a complete primitive, is

$$z = \frac{x^2}{2\alpha^{\frac{1}{m}}} + \frac{y^2}{2(1-\alpha)^{\frac{1}{m}}} + \frac{xy}{\beta} + \frac{x}{\gamma} + \frac{y}{\delta} + \epsilon;$$

and the solution of

$$\frac{1}{\left(\frac{d^2w}{dx^2}\right)^m} + \frac{1}{\left(\frac{d^2w}{dy^2}\right)^m} + \frac{1}{\left(\frac{d^2w}{dz^2}\right)^m} = 1$$

is

$$w = \frac{x^2}{2\alpha^{\frac{1}{m}}} + \frac{y^2}{2\beta^{\frac{1}{m}}} + \frac{z^2}{2(1-\alpha+\beta)^{\frac{1}{m}}} + \frac{yz}{\gamma} + \frac{zx}{\delta} + \frac{xy}{\epsilon} + \frac{x}{\zeta} + \frac{y}{\eta} + \frac{z}{\theta} + \kappa.$$

So, again, the complete primitive of the partial differential equation

$$\frac{1}{r^m} + \frac{1}{s^m} + \frac{1}{t^m} = 1,$$

is

$$z = \frac{x^2}{2\alpha^{\frac{1}{m}}} + \frac{y^2}{2\beta^{\frac{1}{m}}} + \frac{xy}{(1-\alpha+\beta)^{\frac{1}{m}}} + \frac{x}{\gamma} + \frac{y}{\delta} + \epsilon.$$

(5.) It may be interesting to compare for a particular case the solution in the form of a complete primitive with the solution in the form of a general primitive. Thus let us take the equation

$$r + 2s + t = \frac{d^2z}{dx^2} + 2\frac{d^2z}{dxdy} + \frac{d^2z}{dy^2} = 1.$$

The solution of this equation by the symbolic method, in the form of a general primitive, is readily found to be

$$z = \frac{xy}{2} + \frac{x+y}{2} \cdot \phi(x-y) + \psi(x-y).$$

The solution of the same equation, in the form of a complete primitive, is

$$z = \tfrac{1}{3}\{ax^2 + \beta y^2 + (1 - \overline{\alpha + \beta})\, xy\} + \gamma x + \delta y + \epsilon.$$

These solutions may be readily identified by assuming

$$\phi(x-y) = A(x-y) + A',$$
$$\psi(x-y) = B(x-y)^2 + B'(x-y) + B'',$$

whence, by substitution in the former, we get

$$z = \frac{xy}{2} + \tfrac{1}{3}\{A(x^2 - y^2) + A'(x+y)\} + \{B(x-y)^2 + B'(x-y) + B''\}$$

and, by comparison of co-efficients,

$$\tfrac{1}{3}A + B = \tfrac{1}{3}\alpha,\ B - \tfrac{1}{3}A = \tfrac{1}{3}\beta,\ 2B = \tfrac{1}{3}(\alpha + \beta),$$
$$\tfrac{1}{3}A' + B' = \gamma,\ \tfrac{1}{3}A' - B' = \delta,\quad B'' = \epsilon.$$

A similar identification may be performed upon the solutions, in the two forms, of the equation

$$r + t = 1.$$

Thus it appears that the general primitive may be reduced to the complete primitive, but not *vice versâ*.

(6.) The following will serve as examples of the latter portion of the third article. Let the partial differential equation proposed for solution be

$$x\frac{dw}{dx} + y\frac{dw}{dy} + z\frac{dw}{dz} = \left\{a^m\left(\frac{dw}{dx}\right)^m + b^m\left(\frac{dw}{dy}\right)^m + c^m\left(\frac{dw}{dz}\right)^m\right\}^{\frac{1}{m}},$$

where a, b, c are given constants: then the solution of this equation, in the form of a complete primitive, is

$$w = \alpha x + \beta y + \gamma z - \{a^m\alpha^m + b^m\beta^m + c^m\gamma^m\}^{\frac{1}{m}} = 0,$$

and the singular solution is

$$\left(\frac{x}{a}\right)^{\frac{m}{m-1}} + \left(\frac{y}{b}\right)^{\frac{m}{m-1}} + \left(\frac{z}{c}\right)^{\frac{m}{m-1}} = 1.$$

Thus, if $m = 3$, the singular solution of the partial differential equation

$$x\frac{dw}{dx} + y\frac{dw}{dy} + z\frac{dw}{dz} = \left\{a^3\left(\frac{dw}{dx}\right)^3 + b^3\left(\frac{dw}{dy}\right)^3 + c^3\left(\frac{dw}{dz}\right)^3\right\}^{\frac{1}{3}}$$

is

$$\left(\frac{x}{a}\right)^{\frac{1}{2}} + \left(\frac{y}{b}\right)^{\frac{1}{2}} + \left(\frac{z}{c}\right)^{\frac{1}{2}} = 1.$$

Again, if $m = \frac{1}{3}$, the singular solution of

$$x\frac{dw}{dx} + y\frac{dw}{dy} + z\frac{dw}{dz} = \left\{\left(a\frac{dw}{dx}\right)^{\frac{1}{2}} + \left(b\frac{dw}{dy}\right)^{\frac{1}{2}} + \left(c\frac{dw}{dz}\right)^{\frac{1}{2}}\right\}^2$$

is

$$\frac{a}{x} + \frac{b}{y} + \frac{c}{z} = 1.$$

Finally, it is easily proved that the singular solution of the partial differential equation

$$a\frac{dw}{dx}\left\{x\frac{dw}{dx} + y\frac{dw}{dy} + z\frac{dw}{dz}\right\} + b^2\left(\frac{dw}{dy}\right)^2 + c^2\left(\frac{dw}{dz}\right)^2 = 0$$

is the paraboloid

$$\frac{y^2}{b^2} + \frac{z^2}{c^2} = \frac{4x}{a}.$$

Generalisation of Charpit's Method.

10. Let us suppose that the given non-linear partial differential equation is reduced to the form

$$s = f(x, y, z, p, q, r, t).$$

Then we have the two conditions

$$\left(\frac{dr}{dy}\right) = \left(\frac{ds}{dx}\right), \quad \left(\frac{dt}{dx}\right) = \left(\frac{ds}{dy}\right).$$

Now on supposition that r is expressed generally as a function of x, y, z, p, and q, we have

$$\left(\frac{dr}{dy}\right) = \frac{dr}{dy} + \frac{dr}{dz}q + \frac{dr}{dp}s + \frac{dr}{dq}t,$$

and

$$\left(\frac{ds}{dx}\right) = \frac{ds}{dx} + \frac{ds}{dz}p + \frac{ds}{dp}r + \frac{ds}{dq}s + \frac{ds}{dr}\left(\frac{dr}{dx} + \frac{dr}{dz}p + \frac{dr}{dp}r + \frac{dr}{dq}s\right) + \frac{ds}{dt}\left(\frac{dt}{dx} + \frac{dt}{dz}p + \frac{dt}{dp} + \frac{dt}{dq}s\right).$$

Hence, equating and arranging terms, we get a linear partial differential equation in r and t as dependent variables, and x, y, z, p, q as independent variables, namely,

$$\left.\begin{aligned} &-\frac{ds}{dr}\cdot\frac{dr}{dx}+\frac{dr}{dy}+\left(q-p\frac{ds}{dr}\right)\frac{dr}{dz}+\left(s-r\frac{ds}{dr}\right)\frac{dr}{dp}+\left(t-s\frac{ds}{dr}\right)\frac{dr}{dq}\\ &-\frac{ds}{dt}\left(\frac{dt}{dx}+p\frac{dt}{dz}+r\frac{dt}{dp}+s\frac{dt}{dq}\right)=\frac{ds}{dx}+\frac{ds}{dz}p+\frac{ds}{dp}r+\frac{ds}{dq}s \end{aligned}\right\}(\alpha)$$

in which, of course, the co-efficients $\frac{ds}{dx}, \frac{ds}{dy}, \frac{ds}{dz}, \frac{ds}{dp}$, &c., are all known functions of x, y, z, p, q, r, and t.

The second condition gives the corresponding equation

$$\left.\begin{aligned} &\frac{dt}{dx}-\frac{ds}{dt}\cdot\frac{dt}{dy}+\left(p-q\frac{ds}{dt}\right)\frac{dt}{dz}+\left(r-s\frac{ds}{dt}\right)\frac{dt}{dp}+\left(s-t\frac{ds}{dt}\right)\frac{dt}{dq}\\ &-\frac{ds}{dr}\left(\frac{dr}{dy}+q\frac{dr}{dz}+s\frac{dr}{dp}+t\frac{dr}{dq}\right)=\frac{ds}{dy}+\frac{ds}{dz}q+\frac{ds}{dp}s+\frac{ds}{dq}t \end{aligned}\right\}(\beta)$$

in which, as before, the co-efficients $\frac{ds}{dy}, \frac{ds}{dz}$, &c., are known functions of x, y, z, p, q, r, and t.

This system of simultaneous partial differential equations may be much simplified by writing

$$\frac{d}{dx}+p\frac{d}{dz}+r\frac{d}{dp}+s\frac{d}{dq}=X,$$

$$\frac{d}{dy}+q\frac{d}{dz}+s\frac{d}{dp}+t\frac{d}{dq}=Y,$$

$$\frac{ds}{dx}+p\frac{ds}{dz}+r\frac{ds}{dp}+s\frac{ds}{dq}=f_1(x, y, z, p, q, r, t)$$

$$\frac{ds}{dy}+q\frac{ds}{dz}+s\frac{ds}{dp}+t\frac{ds}{dq}=f_2(x, y, z, p, q, r, t)$$

$$\frac{ds}{dr}=R, \frac{ds}{dt}=T.$$

By making these substitutions, the given system of simultaneous partial differential equations becomes, simply,

$$\left.\begin{aligned} &Y.r-RX.r-TX.t=f_1\\ &X.t-TY.t-RY.r=f_2 \end{aligned}\right\}$$

Hence, in general, we have a system of two simultaneous linear partial differential equations to determine r and t in terms of p, q, x, y, z. Supposing these found, it remains to substitute their values in

$$dp = rdx + sdy$$
$$dq = sdx + tdy$$

and integrate again. The values of p and q thus found are to be substituted, finally, in the equation

$$dz = pdx + qdy,$$

and by a third integration the solution required is, in general, determined. It will be evident that in the processes of successive integration indicated, five arbitrary constants are introduced.

Joseph Huband Smith, Esq., read a paper—

ON THE ANCIENT NORSE AND DANISH GEOGRAPHY OF IRELAND.

After some observations upon communications made to the Academy by the late Mr. George Downes, in the years 1838–9 and 1841, and having referred also to the labours of Dr. William West, who had died in 1837, while engaged in preparing an Essay on the Ancient Geography of Gaul and the British Isles, intended to be laid before the meeting of the British Association, then approaching, Mr. Smith proceeded to read some passages from recently-discovered copies of our ancient annals, illustrative of the military occupation of Ireland by the Vikings, who arrived from Scandinavia at various periods, commencing towards the close of the eighth century of our era, and continued a long series of contests with the aboriginal inhabitants of Ireland, and subsequently with each other, during the four succeeding centuries.

From passages in the Icelandic and other Sagas, he showed that a constant intercourse had been maintained at first by the Norwegian sea rovers, who had gained a footing in the Orkneys, and afterwards by others, described in the Irish annals by the names of Lochlanns, Gentiles, and Finn Ghaoill, and Dubh Ghaoill, not only of a warlike nature, but also of a trading or mercantile character. The names of various localities which he instanced,—beginning with the Orkneys, the Faro-Islands, and the Hebrides,—all, he contended, indicated the progress of the war vessels of the various tribes; and he pointed out the harbours and islands along the eastern coast of Ireland, whose names (some as recorded in the Sagas, and others preserved to the present day) were unmistakeably of Norwegian and Icelandic origin, and quite distinct from the Celtic names by which these places were known to the Irish writers of the same period. Among others, Mr. Smith instanced Strangford bay, Carlingford, the little islands of Lamb-ey, and Ireland's-ey; the harbour of Bullock or Blowyck, and the adjacent island and sound of Dalkey; the headlands of Wicklow, or Wykynge-lo, and Arc-lo; the harbours of Wexford and Waterford, as well as that of Smerwick, on the western coast, not far from the River Shannon,—in all of which the Norwegian or Danish Vikings had sheltered successive fleets, and in most cases erected on their shores military fortresses of considerable strength. Some other places named in the Sagas,—for example, Gunvallsborg,—Mr. Smith admitted he was as yet unable to identify satisfactorily with any modern localities. He then adverted to the modern names of three of

the four provinces of Ireland as clearly indicative of Scandinavian occupation. It had been suggested that the suffix *ster*, added to the Irish names of those three, had been by some scholars held to be of Saxon origin, derivable from a root in that language implying *government*, or rule; but Mr. Smith showed that this opinion was incorrect; and adduced proofs from the writings of eminent Norse and Danish philologists, as well as from a comparison with cognate terms in the Irish or Celtic language.

In speaking of the permanent settlement which the Northmen, or Easterlings, as they were often termed, had effected in Dublin—or, as they called it, Dyflinar-shire,—and where they maintained the state of *reguli* or kings, he described its extent, not only inland, but also including a long line of coast, from the little river called the Nanny Water, in the county of Meath, to Arklow Head, which (upon the authority of Mr. Charles Halliday, who had devoted much attention to matters connected with the port of Dublin and its commercial interests), Mr. Smith stated to be coextensive with, and, as nearly as possible, occupying exactly the same length of sea-shore as that along which the mayor and corporation of Dublin, under the government of England, have for the last seven hundred years exercised jurisdiction. He commented on the fact, that, while native authorities all showed that the Irish retained in their own language distinct names for the harbours and islands occupied by the Northmen,—thus exhibiting an inextinguishable feeling of hostility,—the Norse names had been adopted and preserved by the English and Norman invaders of Ireland in the twelfth century, who had continued the same line of policy towards the aborigines as that which had been pursued by the Norsemen and the Danes: thus giving the clearest evidence of a remarkable identity of language and of race.

Various passages from our annalists were read by Mr. Smith, in evidence of their impartiality and adherence to truth, as shown in their admissions that many of the native Irish united with the Lochlanns, the Norwegians, and the Danes, in their expeditions and forays into the interior of the country, for the purposes of plunder and taking preys.

In a brief reference to the celebrated battle of Clontarf in the eleventh century, in which the Northmen of Dublin sustained a signal defeat, Mr. Smith pointed out the circumstance that one of the most distinguished of the Norwegian leaders was Sichfrith mac Lodair, Jarl of Orkney, who was slain in that battle. The narrative of a still later engagement, towards the close of the twelfth century, between Miles De Cogan and Asgall, son of Ragnvald, or Reginald, King of Dublin, in which the Danes of Dublin sustained a signal defeat, showed that the Danish power was not till then totally overthrown.

In conclusion, Mr. Smith called attention to the important assistance which would be given to the elucidation of the entire of this period of our history, from the geographical identification of the various places mentioned in the Norse accounts of Ireland, and in the Sagas, without which the records of the time, during which they maintained a military occupation of so many places on our coasts—will still require much investigation; and finally suggested that there was reason to think

that the trading spirit and skill in navigation which had been then imparted by the Northmen to the inhabitants of Ireland of the Celtic race, had exercised a much greater, and perhaps more beneficial, influence on the subsequent destinies of this country than had been usually supposed.

Mr. Smith further intimated an intention of submitting to the Academy, on some future occasion, the results of his investigation of the Norse geography of the Faroe and Shetland islands, and other islands on the western coast of Scotland and the Isle of Man.

The Rev. Joseph A. Galbraith communicated an abstract of the "Barometrical Observations made at the Magnetical Observatory, Dublin, before and during the Storm of the 7th and 8th February, 1861."

MONDAY, FEBRUARY 25, 1861.

Rev. George Salmon, D. D., Vice-President, in the Chair.

The Rev. J. A. Galbraith laid before the Academy the following

TABLES AND DIAGRAMS RELATIVE TO THE RAIN-FALL AS OBSERVED IN THE MAGNETIC OBSERVATORY OF TRINITY COLLEGE.

Table I. gives the annual and monthly rain-falls for the last ten years, 1851–1860.

Table II. gives the monthly rain-falls of the ten years (1841–1850) as compared with those of the last ten years (1851–1860).

The numbers for the first ten years are taken from Dr. Lloyd's account of the Meteorology of Ireland, vol. xxii. of the Transactions of the Academy.

From this Table it appears that the mean rain-fall at Dublin for twenty years (1841–1860) = 29·02 inches.

Table III. gives the distribution of the rain-fall, according to the seasons, for ten years (1851–1860), from which the following mean values are obtained:—

Spring (March, April, May), ...	6·33
Summer (June, July, August), ...	7·81
Autumn (September, October, November), .	7·73
Winter (December, January, February), . .	6·76

In computing these mean values, the rain-falls for January and February, 1861, as taken from the day-book of the Observatory, were used as follows:—

January, ...	2·18
February, ...	3·67

It may be observed that the month of February, 1861, has been the wettest February for the last twenty-one years, the rain-fall being more than double the average amount.

Table IV. gives the number of dry days in each month for the last ten years (1851–1860). In this Table a day is counted dry if the rain-fall is less than a hundredth of an inch.

Average number of dry days in the year = 191·6
Average number of wet days in the year = 173·4

During the last ten years there have been only twenty-three days on which the rain-fall has exceeded one inch, and only thirty-three days on which it has exceeded seven-tenths of an inch. The heaviest rain-fall, amounting to 1·78 inch, occurred on the 1st of April, 1853. The two wettest consecutive days were 27th and 28th of September, 1856, on which 2·72 inches of rain fell; 1·31 inches on the 27th; and 1·41 inches on the 28th.

Plate I. represents the rain-fall for twenty years, from 1841–1860; the ordinates which represent the depths of rain are drawn to a scale of one-tenth.

Plate II. represents Kirwan's observations on the rain-fall in Dublin, as observed at his house in Cavendish-row, from 1792–1808. These observations are to be found in volumes v., vi., vii., viii., and x. of the Transactions of the Academy. There seems to be no record of the year 1793.

The rain-gauge of the Magnetic Observatory is circular, having an orifice of 12 inches, and is placed on the flat roof of the Observatory, which is 17 feet above the level of the ground.

TABLE I.

Rain-fall for ten years, 1851–1860.

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1851	5·28	0·49	2·38	1·77	1·31	2·71	3·48	2·01	1·81	3·27	1·01	0·88	26·40
1852	3·20	2·72	0·61	1·28	2·35	7·09	1·96	3·27	2·69	3·46	7·43	4·10	40·16
1853	2·75	2·16	1·63	3·81	1·04	1·91	2·73	1·93	2·39	4·32	1·69	2·60	28·96
1854	3·83	0·75	0·67	0·40	2·43	3·93	2·29	1·24	0·91	1·64	3·15	2·60	23·84
1855	1·24	2·83	1·50	0·59	1·74	1·92	3·68	2·74	1·34	4·83	1·41	1·65	25·47
1856	2·64	1·93	0·77	1·58	5·49	2·40	1·41	2·60	3·88	2·03	0·65	2·55	27·93
1857	2·66	1·30	3·13	3·96	1·48	3·28	1·65	1·20	1·57	2·65	1·79	0·44	25·11
1858	1·04	1·03	1·14	5·08	1·64	1·37	3·34	1·66	3·02	3·31	1·38	3·06	27·07
1859	1·43	1·00	2·59	3·99	0·68	1·24	1·35	1·92	3·01	1·62	3·24	3·21	25·28
1860	4·15	0·84	2·57	2·62	3·12	4·59	2·43	4·75	2·65	2·27	2·90	3·17	36·06
Mean	2·82	1·50	1·70	2·51	2·13	3·04	2·43	2·33	2·33	2·94	2·46	2·43	28·63

TABLE II.

Monthly rain-falls from 1841–1850, *compared with those from* 1851–1860.

Mean Value.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1841–1850	2·64	1·86	1·90	2·58	2·11	2·16	2·34	2·74	2·33	3·35	3·03	2·38	29·42
1851–1860	2·82	1·50	1·70	2·51	2·13	3·04	2·43	2·33	2·33	2·94	2·46	2·43	28·62
1841–1860	2·73	1·68	1·80	2·54	2·12	2·60	2·39	2·54	2·32	3·15	2·75	2·40	29·02

Mean rain-fall for twenty years (1841-1860) = 29·02 inches.

Table III.

Distribution of rain-fall according to the seasons.

Years.	Spring.	Summer.	Autumn.	Winter.
1851	5·46	8·19	6·09	6·80
1852	4·24	12·32	13·58	9·01
1853	6·48	6·57	8·40	7·18
1854	3·50	7·47	5·70	6·67
1855	3·83	8·34	7·58	6·22
1856	7·84	6·41	6·56	6·51
1857	8·57	6·13	6·01	2·51
1858	7·86	6·37	7·71	5·49
1859	7·26	4·51	7·87	8·20
1860	8·31	11·76	7·82	9·02
Mean,	6·33	7·81	7·73	6·76

Table IV.

Number of dry days in each month, with their average for ten years.

[N. B.—A day is counted dry if the rain-fall is less than the hundredth of an inch.]

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Dry days.	Wet days.
1851	8	19	10	17	18	16	16	9	24	16	17	21	191	174
1852	13	13	26	25	18	8	21	14	16	15	11	8	188	177
1853	12	12	15	23	20	17	13	23	19	11	15	14	184	181
1854	7	11	23	23	16	15	16	16	21	14	11	11	184	181
1855	16	9	18	22	16	14	16	14	20	13	21	16	195	170
1856	7	13	25	16	15	15	17	16	11	20	25	18	198	167
1857	14	16	14	7	22	19	15	19	15	16	21	20	198	167
1858	21	20	20	14	17	21	16	20	16	16	21	11	213	152
1859	20	13	13	14	26	22	21	16	11	17	13	18	204	161
1860	7	18	9	16	12	8	20	9	18	14	16	14	161	204
Aver. no. of dry days.	12·5	14·4	17·3	16·7	18·0	15·5	17·1	15·6	17·1	15·2	17·1	15·1	191·6	
Aver. no. of wet days.	18·5	13·6	13·7	13·3	13·0	14·5	13·9	15·4	12·9	15·8	12·9	15·9		173·4

Mr. Frith and Professor Hennessy expressed a hope that Professor Galbraith would communicate the observations of temperature and barometric pressure made within the same period.

Mr. Yeates stated that his observations of rain-fall coincided very exactly with those of Professor Galbraith. In connexion with the fact of the minimum of monthly rain-fall occurring in February, he remarked that the annual minimum of temperature occurred, with remarkable regularity, in the middle of the same month.

The Rev. Samuel Haughton read a paper "On the Evaporation and Fall of Rain at St. Helena, Dublin, and Enniskillen, during the year 1860."

Dr. Sidney, Mr. Frith, and Mr. James Haughton made some observations on that part of Mr. Haughton's paper which referred to the water supply of the city of Dublin.

Professor Hennessy expressed a doubt as to the perfect accuracy of the method employed by Mr. Haughton to estimate the difference between rain-fall and evaporation.

Mr. Haughton briefly replied.

The Rev. Samuel Haughton, F. R. S., Fellow of Trinity College, Dublin, read a paper—

ON THE STORM OF THE 9TH OF FEBRUARY, 1861.

On the 11th instant I expressed to the Academy my opinion, that the disastrous storm of the 9th instant was not a Cyclone, and that its occurrence could not therefore be predicted from barometrical observations made in a single locality. Further inquiry into the circumstances of this storm shows that this opinion was correct, and that it constitutes an admirable example of Dove's second kind of storm, outside the limits of the Trade winds (Ueber das Gesetz der Stürme, p. 48.) In this class of storms, there is a direct opposition between the S. W., or equatorial current, and the N. E., or Polar current, of air; there is generally a succession of non-cyclonic gales, N. E. and S. W.; and when the S. W. wind gives place to the N. E., there is a rising barometer and minimum temperature corresponding to the time of the storm. The following facts place the peculiar and non-cyclonic character of this storm beyond all doubt.

Dublin.—In this city a wave of atmospheric pressure occurred, of 8 days, 4 hours' duration, the two crests of the wave being—

1st crest, Feb. $1^d\ 22^h$; Barom. = 30·70 in.
2nd crest, Feb., $10^d\ 2^h$; Barom. = 30·48 in.

And the hollow of the wave being—

Feb. $5^d\ 2^h$; Barom. = 29·00 in.

The gale or storm occurred of maximum violence,—

Feb. $9^d\ 22^h$, velocity 24 miles per hour.

The accompanying Table shows all the circumstances of the week preceding the storm :—

MAGNETICAL OBSERVATORY, TRINITY COLLEGE, 1861.

February.	Barometer, 1861.				Direction of Wind.			
	10 A. M.	1 P. M.	6 P. M.	10 P. M.	10 A. M.	1 P. M.	6 P. M.	10 P. M.*
1, .	29·870	30·051	30·467	30·595	N. W.	N. W.	N. W.	W. N. W.
2, .	30·724	30·674	30·628	30·590	S. W.	S. W.	S. W.	S. W.
4, .	29·836	29·820	29·790	29·718	W. S. W.	W. S. W.	S. W.	S. S. W.
5, .	29·273	29·163	29·058	29·029	S.	S. S. W.	S. S. W.	S. S. W.
6, .	29·040	29·058	29·215	29·287	S. S. W.	S. W.	S. W.	S. W.
7, .	29·432	29·458	29·586	29·625	S. W.	W. S. W.	W.	W.
8, .	29·704	29·700	29·718	29·735	N.	N.	N. N. E.	N. N. E.
9,*.	29·982	30·048	30·228	30·316	N. N. E.	N. N. E.	N. E.	N. E.
11, .	30·180	30·087	29·990	29·929	N. E.	N. E.	E.	S. E.
12, .	29·707	29·670	29·610	29·585	N. E.	E. N. E.	S. E.	S. E.
13, .	29·738	29·781	29·879	29·932	S. E.	S. E.	S. E.	S. E.
14, .	29·880	29·745	29·669	29·602	S.	S. S. E.	S. S. E.	S. S. E.
15, .	29·425	29·363	29·333	29·377	S. S. E.	S. S. E.	S. S. E.	S. S. E.
16, .	29·563	29·531	29·533	29·541	S. W.	S. S. E.	S.	S.
18,†.	29·509	29·511	29·488	29·371	S. E.	S. E.	S. E.	S. E.
19, .	29·102	29·242	29·472	29·472	S.	S. W.	S.	S. S. E.
20, .	29·156	29·158	29·156	29·088	S. S. E.	S. S. W.	S.	S. S. E
21,‡.	29·137	28·964	28·959	29·190	S.	S. E.	W.	S. S. W.
22, .	29·451	29·526	29·572	29·604	S. S. W.	S. S. W.		
23, .	29·740	29·758	29·896	29·982				
25, .	30·296	30·244						

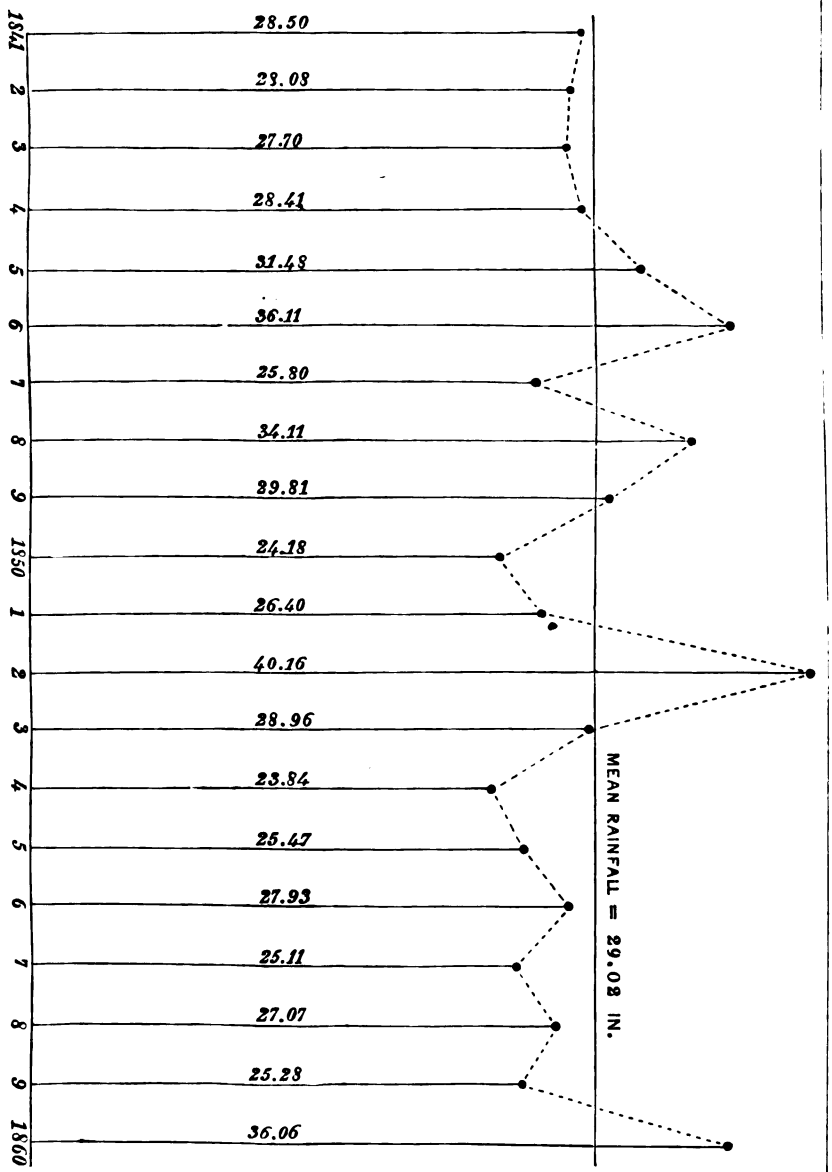
From this Table it also appears that the equatorial wind (S. W.) continued from the 2nd of February, to the evening of the 7th of Feb., when it gave way to a West wind, then a North wind, and finally settled at 10, P. M., of the 8th, into a N. N. E. polar current, at which point it held throughout the storm, which reached its maximum twelve hours

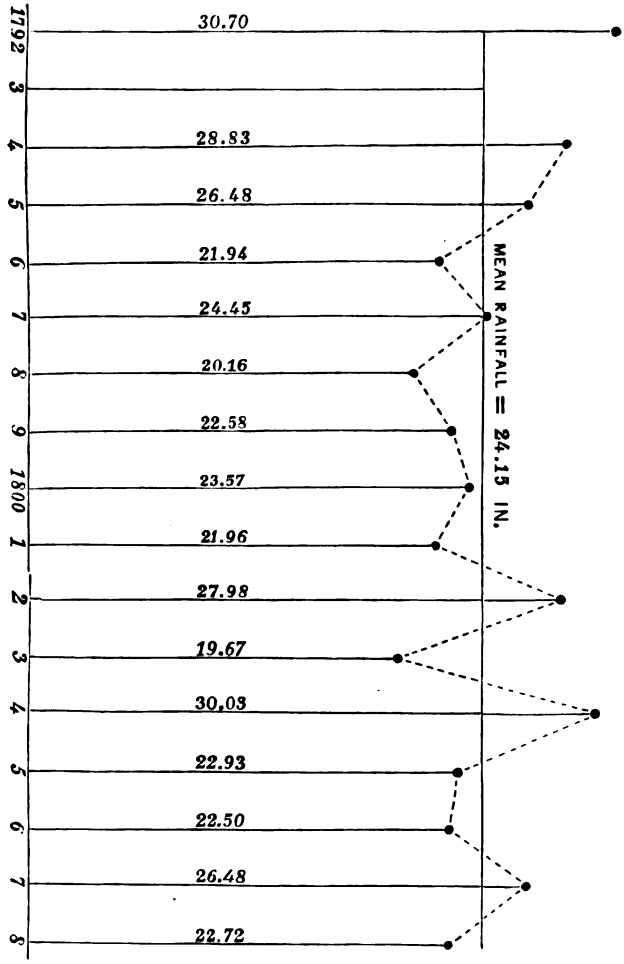
* *Storm* at Dublin from N. N. E. Same point throughout. Velocity of wind, 24 miles per hour.

† *Gale* at Drogheda, Dublin, Dunmore East, and Penzance, from S. E. Same point throughout.

‡ *Storm* in London, Chichester, and Plymouth; gale in Dublin at midnight. At 7 P.M. in London the pressure was 36 lbs. per foot.

Wind in Dublin at same point throughout,—S. S. W.





after the N. N. E. wind began to blow. On the night of the 9th of February it blew from the N. E., and so continued for 40 hours afterwards. The temperatnre, during the prevalence of the S. W. wind, and falling barometer, was mild, and the air damp, producing a feeling of closeness, from the vapour present in the air. . For eight days previous to the minimum height of the barometer, the mean temperature was 49°·7; while during the three days following the minimum of the barometer, the mean temperatures were—

Feb. 7, at 10 A. M., . .	42°·5	
„ 8, „ „ . .	40 ·8	
„ 9, „ „ . .	35 ·1	maximum of gale.
Mean, . .	39°·4	

This shows a rising barometer, a falling thermometer, reaching a *maximum* and *minimum*, respectively, at the time of the storm; and on the 8th and 9th of February heavy hail showers fell at intervals. Such a phenomenon cannot by possibility be confounded with a Cyclone, which has a *minimum* barometer just before, and in the middle of the storm, and no such relation of the gale to temperature as Dove has pointed out in the class of storms to which that of the 9th of February unquestionably belongs. The storm of the 9th was also only the first of a series, arising from the same cause, viz., the direct and non-cyclonic collision of the equatorial and polar currents of air.

I have drawn in Plate XI. the curve of Barometric Pressure at 10 A. M. and 10 P. M. for the week preceding the 9th of February, and also the curve of Temperature at 10 A. M. during the same period. These curves show at a glance that the storm occurred on the maximum of pressure and minimum of temperature; that the rising barometer occurred with a wind shifting from S.W. by W. and N. to N. E., and that the curve of temperature is inverse to the curve of pressure. Combining these facts with the fact that the wind continued for twenty hours in the N. N. E., and for twenty hours more in the N. E., the storm occurring during the first of those periods, I believe it impossible to suppose that any Cyclonic movement could account for such a combination of circumstances. The succession of gales from the 9th to the 21st of February was due to the Equinoctial gales arriving this year before their time, as is indicated by the high temperature and great moisture of the month, and by the excessive rain-fall, occasioned by the conflict of the polar and equatorial currents, unusual at so early a period in the year.

A *second* gale occurred on the night of the 18th, which was felt severely at Drogheda, Dunmore East, and Penzance, and caused the loss of several vessels; at all three places the wind blew steadily from the S. E.

A *third* storm has been reported from London, Chichester, Plymouth, and other places, on the evening of the 21st of February. It was felt in Dublin early on the morning of the 22nd, from the S. S. W., but not severely. At 7 P. M., in London, it was at its height, and is said to have

reached 36 lbs. per foot; and it had sufficient force to blow down the spire of Chichester Cathedral.

According to Dove's theory, these two storms are supplements to the storm of the 9th, and not distinct cyclonic movements.

Limerick.—I have ascertained from a respected correspondent in this city, that the barometer was rising slowly and steadily on the 3rd and 4th; during the night of the 4th it rose rapidly, and on the morning of the 5th it was over 30·5 inches. On the evening of the 5th, it began to fall, and continued to do so until the 9th, when the storm occurred at Dublin, at which time the barometer in Limerick stood at 29 inches. There was no storm felt in Limerick. It thus appears that the atmospheric curve in Dublin was the inverse of that in Limerick; and that on the mornings of the 5th and 9th there was a difference of pressure in these cities of above one inch, in opposite directions. Although the barometer in Dublin or Limerick alone would not have enabled an observer to predict a storm, yet any person acquainted with the condition of the barometer at both places might fairly have expected rough weather from the N. E., such as actually occurred on the morning of the 9th of February, in Dublin.

Mr. Haughton then read to the Academy the following letter from Mr. Robert H. Scott:—

"13, *Suffolk-street, February* 22, 1861.

"Dear Mr. Haughton,—I see by your remarks at the last Meeting of the Royal Irish Academy, that it is your opinion that the storm of the 9th instant could not have been predicted from observations of the barometer here in Dublin. I think, therefore, that it may interest you to compare the behaviour of the barometer and thermometer in the British Islands during the past month with the records of their behaviour throughout Europe in seasons similar to the present. You are aware that Professor Dove, in his Law of Storms (Berlin, 1857), whom I quoted in a letter to 'Saunders' News-Letter,' on the 12th, classifies all storms under three heads.

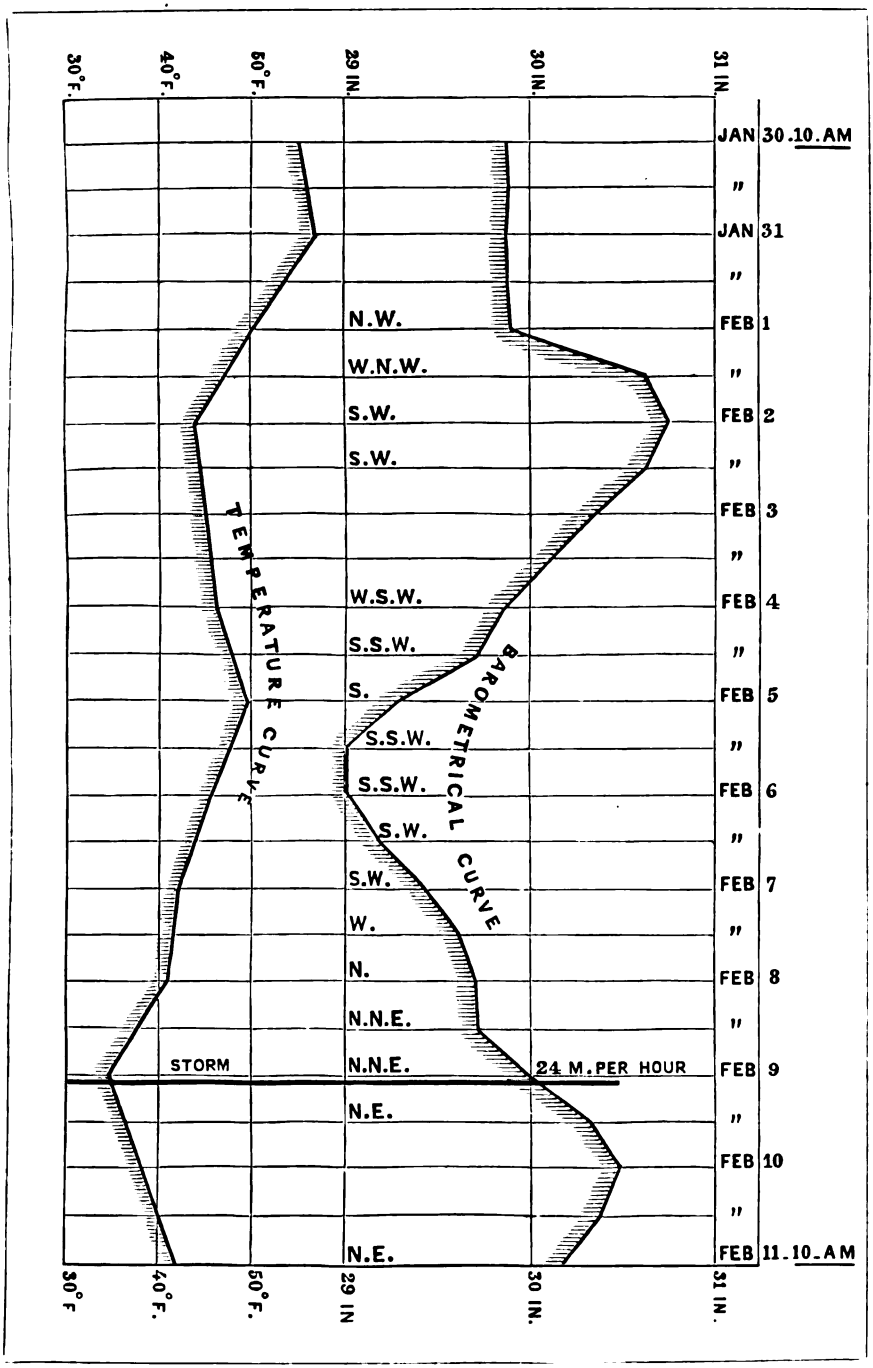
"I. Cyclones.—Arising within the zone of the trades from the interference of the return with the normal current.

"II. Gales.—Arising outside these limits, from the meeting of the two currents (equatorial and polar) blowing in directions opposite to each other.

"III. Gales arising from the lateral interference of these currents when they are, as is frequently the case, flowing in directions opposite to each other in parallel channels.

"The first class is fully treated of by the late General W. Reid. Cyclones are always preceded by a fall of the barometer; and the direction of the wind changes according to fixed laws during their continuance.

"The second class cannot be predicted by insulated observations at any one point, but requires a large amount of data obtained from localities scattered over a wide area of country. They are indicated by the co-existence of a high barometer and low thermometer over the eastern



portion of that area, while to the westward the instruments show great rarefaction of the air, and a mild temperature. In this case there is usually a succession of alternating N. E. and S.W. gales, separated by some days from each other. *There is no rotation of the wind* during these storms.

"The third class is rare. It arises from the fact that when the polar and equatorial currents are flowing in parallel channels, the latter will assume a more westerly direction than the former does easterly, owing to their friction against the earth's surface. There will, therefore, if the equatorial current lie to the southward, be a partial vacuum in it, and a liability to a N. W. storm, during which the barometer will rise; or, if the polar current lie to the south there will be a cyclone generated in it.

"If you will allow me to quote two cases from Dove's 'Mean Temperature for every five days' (Fünftägige Mittel, Berlin, 1856), I think that you will see that I may be justified in referring the storm in question to Dove's second class. I shall take the winters of 1850 and 1855.

"The cold in the north of Europe in January, 1850, was very intense, and reached a maximum about the 20th of the month. This intensity was only felt at the stations situated at a low level, as the temperature at the Brocken, at an elevation of 3500 ft., was 28° F. above what it was at Heiligenstadt, twenty miles S. W. from that mountain. The barometer stood 9 lines above its mean level, along a line from Königsberg to Prague. On the same day there was a barometric minimum of 8·5 lines at North Salem in the state of New York. In this case we find the oscillations of the barometer, and the accompanying storms of wind and snow at Vienna. From the 19th, on which day there was a violent snow-storm, it rose 15 lines in two days, and the thermometer sunk to − 7° ·6 F. On the 23rd the barometer fell again rapidly, and a N.N.W. storm, accompanied by a snow-fall of unusual magnitude ensued. In this case, we have at Vienna, lying on the line of contact of the two areas above referred to, a N.W. storm *preceded by a fall of the barometer.*

"On the other hand, E. storms, *accompanied by a rising* barometer, are recorded on two occasions in the winter of 1855–56.

"The autumn of 1855 was very warm and wet in the Mediterranean, while in the North of Germany it was marked by its extreme dryness, up to the end of October. In the middle of December the barometer rose to a great height over the whole of North Germany, the temperature sinking proportionably. From the 18th to the 21st a violent N. E. storm raged in the Black Sea, the Caledonia was lost at Sebastopol, and a fleet of ships were wrecked at the Sulina mouth of the Danube. Simultaneously with it there set in a violent S. E. storm in the British Channel, and on the south coast of Ireland, while the lowest temperature at Greenwich was felt on the 22nd. Hence we see that the polar current had gradually forced its way to the west. This barometric maximum was succeeded by a minimum on the 8th of January, 1856,

at which time a violent N. E. storm was felt over the greater part of the United States. In Europe a second maximum occurred on the 13th, and its advent was marked by a N. E. storm and sudden fall of temperature on the lower Danube. After this violent S. W. gales set in on the south coast of France and Spain, and the fall of the barometer was the precursor of a long spell of warm weather.

"In the case of the present winter we have had here in Ireland a low barometer and very mild weather, while in England the frost continued with undiminished intensity. We were, therefore, as I think, in the position described by Professor Dove, p. 289 :—

"'Should the barometer oscillate, and yet the air remain at rest, the cause of the disturbance is at some distance. At times, in winter, the southerly current maintains its ground over a large area to such an extent that the air is delightfully mild, the barometer being low meanwhile. In this case there is somewhere in the neighbourhood a district where the barometer is high, and the weather very cold. *This cold air may then suddenly force its way into the rarefied air in its neighbourhood, as a storm, causing the barometer to rise rapidly.*'

"I need not say that these views are an attempt to represent the published opinions of Professor Dove, under whom I have studied; and I cannot better conclude this letter than by giving you a confirmation of this theory which I have lately met with; it is from a paper by M. Spassky, entitled, 'Note sur la tempête d'hiver, &c., &c., entre le 9–11 Dec., 1850.' In explanation, I may say that there was on the 23rd of that month a barometric maximum in Europe, and a simultaneous minimum in America, followed by a violent snow-storm. This had been preceded by a minimum in Russia on the 6th, and a storm on the 9th. The narrative proceeds—'This storm lasted from thirty to forty-eight hours, between the 9th and 11th, without intermission. Before the gale it had been thawing; but the first gust caused the thermometer to fall 15° or 20° R. below Zero, so that persons who were out of doors fell dead, being lost in the driven snow, some close to their own doors. After the storm, 311 persons were found frozen to death in the Government of Kalonga, 140 in that of Tula, and 39 in the district of Kursk. It is probable that many more are as yet undiscovered, owing to the depth of snow. Houses were blown down, and even horses yoked to the sleighs were frozen to death. This atmospheric revolution was the result of the struggle between the two currents of air, by means of which Professor Dove's theory enables us to explain most atmospheric phenomena: and yet many physicists continue to dispute its truth, in the face of plain proofs like the above, which cannot be explained on any other hypothesis. In order to convince us that all the characteristic phenomena of the atmosphere were in exact accordance with Professor Dove's theory during this storm, we need only refer to the observations at Moscow. Before the 6th the Polar current prevailed there, N. wind, barometer 336·27 lines, and thermometer 14° 5 R. On the 6th the equatorial current appeared, barometer fell 15·53 lines before the 9th; the thermometer rose 12° 9, and the wind veered through S. to S. W. The polar cur-

rent, having thus yielded to the first onset, collected its strength to force its opponent back. On the 9th there was a lull, followed by a north wind lasting up to the 11th, during which time the barometer rose 7·46 lines, and the thermometer fell 15° 4. On the evening of the 11th there was a fresh lull; and on the 12th the equatorial current set in again, as is shown by the wind getting round to S. W., the thermometer rising above Zero, and the barometer falling 6·06 lines.'

"Yours very sincerely,

"ROBERT H. SCOTT.

"*Rev. Professor Haughton.*"

PROFESSOR HENNESSY, F. R. S., read the following paper:—

ON CLAIRAUT'S THEOREM.

LAPLACE has shown that this theorem follows whatever may be the density of the interior parts of the earth, provided it consists of similar concentric strata, and that the form of the outer stratum is ellipsoidal. In the "Philosophical Transactions" for 1826, Mr. Airy (the present Astronomer Royal of England) has presented an equivalent result; more recently, Professor Stokes has shown that we can deduce the law of variation of terrestrial gravity without any hypothesis whatsoever as to the earth's interior structure. He assumes merely that its surface is spheroidal, and that the equation of fluid equilibrium holds good at that surface. In vol. vi. of the "Cambridge Mathematical Journal," Professor Haughton presented a demonstration, founded upon the same assumptions as those of Professor Stokes, and in which he uses certain propositions relative to attractions which had been enunciated by Gauss and Mac Cullagh. While studying the labours of those mathematicians, it appeared to me that the question could be entirely divested of the hydrostatical character, and that Clairaut's theorem may be directly deduced from the equations to the normal of any closed surface, without any considerations as to the physical condition of the matter forming that surface. Thus every surface concentric with the earth, and perpendicular to gravity, will possess the property of exhibiting this relation in the intensity of gravity at its various points.

Let X, Y, Z represent the components parallel to the rectangular axes of the forces by which a point is retained at rest on a given surface whose equation is $L = 0$. Then from the equations of the normal we have

$$Y\frac{dL}{dx} - X\frac{dL}{dy} = 0, \quad Z\frac{dL}{dx} - X\frac{dL}{dz} = 0,$$

when the resultant of these forces is perpendicular to the given surface. If we represent by V the potential of the earth on the particle in question, by w the angular velocity of rotation, we have

$$X = \frac{dV}{dx} + w^2x, \quad Y = \frac{dV}{dy} + w^2y, \quad Z = \frac{dV}{dz},$$

and the above equations become

$$\frac{dV}{dy}\frac{dL}{dx} - \frac{dV}{dx}\frac{dL}{dy} = w^2\left(x\frac{dL}{dy} - y\frac{dL}{dx}\right)$$

$$\frac{dV}{dz}\frac{dL}{dx} - \frac{dV}{dx}\frac{dL}{dz} = w^2 x\frac{dL}{dz}.$$

If, in conformity with General Schubert's* recent determinations, we assume the earth's surface to be that of an ellipsoid, with three unequal axes, we should substitute for L

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} - 1 = 0,$$

or

$$\frac{dL}{dx} = \frac{2x}{a^2}, \quad \frac{dL}{dy} = \frac{2y}{b^2}, \quad \frac{dL}{dz} = \frac{2z}{c^2};$$

whence we have

$$b^2x\frac{dV}{dy} - a^2y\frac{dV}{dx} = w^2xy(a^2 - b^2), \quad c^2x\frac{dV}{dz} - a^2z\frac{dV}{dx} = w^2a^2xz.$$

Each of these partial differential equations can be easily integrated, and the value of V, finally obtained, is equivalent to the equation of fluid equilibrium; or

$$V + \frac{w^2}{2}(x^2 + y^2) = C.$$

Let θ represent the complement of the latitude, and ϕ the longitude, counted from the meridian of the greatest axis, then $z = r\cos\theta$, $x = r\sin\theta\cos\phi$, $y = r\sin\theta\sin\phi$, and

$$V + \frac{r^2w^2}{2}\sin^2\theta = C.$$

In the case of an ellipsoid having the ellipticity e, we have, neglecting small terms,

$$r = a(1 - e\cos^2\theta).$$

From these equations, and from the properties of Laplace's functions into which V can be expanded, an expression can be obtained of the same kind as that deduced by Professor Stokes from his own and Gauss' theorems relative to attractions.

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* Mémoires de l'Académie Imperiale des Sciences de St. Petersbourg, VII^e serie, tome i.

SATURDAY, MARCH 16, 1861, STATED MEETING.

JAMES HENTHORN TODD, D.D., President, in the Chair.

The SECRETARY of the Council read the following Report of the Council for the year ending March 16, 1861 :—

REPORT.

SINCE the date of the last Annual Report, the first part of Volume xxiv. of our Transactions has been issued and delivered to the Members of the Academy. It contains the following papers:—

1. Dr. Lloyd, "On the Light reflected and transmitted by thin Plates."

2. Mr. Donovan, "On a new Sun-dial."

3. Mr. G. J. Stoney, "On Rings seen in fibrous specimens of Calc Spar."

4. Mr. G. J. Stoney, "On the Propagation of Waves."

No papers on Polite Literature or Antiquities have been printed in the Transactions within the year.

Many interesting communications have been brought before the Academy, of which abstracts have appeared in the Proceedings.

In Mathematics we have had papers from Sir William R. Hamilton, Mr. Carmichael, Mr. Stoney, and Professor Hennessy. In the Sciences of Observation and Experiment from Professor Jellett, Mr. Stoney, Mr. Mallett, Captain Blakeley, Dr. Hart, Professor Galbraith, Professor Haughton, Dr. Robert M'Donnell, and Mr. David Moore.

In Polite Literature and Antiquities, from the President, Dr. Reeves, Mr. Charles M'Donnell, Dr. Wilde, Mr. Du Noyer, and Mr. Huband Smith.

We have again to express our obligations to Mr. Wilde for his valuable services in the preparation of the Catalogue of our Museum. The second part of the work has been published within the year. It contains descriptions of all the articles in the Museum which are composed of Animal Materials, and of Copper or Bronze. It forms an octavo volume of 396 pages, and is illustrated with 377 engravings. A third part has yet to be added, to complete the Catalogue of that portion of the Museum which Mr. Wilde originally undertook to describe. In it will be comprised the articles of gold, silver, and iron; and those included under the head of "finds." Mr. Wilde reports that it will consist of about eight sheets, or 130 pages. Ninety-three engravings for this third part have already been made and paid for.

The sale of the Catalogue appears to have been considerable. Since the 1st of April, 1860, 36 copies of Part I., and 102 copies of Part II. have been sold from the Academy's office, to which numbers must, of course, be added those which have been disposed of through the publishers.

The Treasury having at length acceded to the application made by us, six proper cases have been supplied for the display, as well as safe-keeping, of the gold ornaments in our Museum.

A series of casts, 40 in number, illustrative of primeval art, and throwing much light on Irish antiquities, has been procured by Mr. Wilde from the Museum of Mayence.

We are indebted to the Lord Lieutenant for a very valuable body of documents illustrative of our national history and topography, received within the past year. His Excellency, in consequence of a representation made to him by the President, placed himself in communication with the Right Hon. the Secretary of State for War; and by his influence obtained for the Academy a donation of 103 volumes of manuscript papers, containing much interesting information relative to the local history and antiquities of Ireland, collected during the progress of the Ordnance Survey under the superintendence of Major-General Sir Thomas Larcom. There were at the same time presented 11 volumes of sketches of various objects of antiquarian interest. We believe Her Majesty's Government have followed an enlightened policy in depositing these documents in the Library of this Academy, where they will be associated with other collections of a kindred nature, and will be always easily accessible for purposes of historical and antiquarian research.

We have also to acknowledge a liberal donation given by the Rev. John H. Jellett, to further the objects of the Academy. The Rev. Samuel Haughton has been for some time occupied with researches concerning the Analysis of Irish Granites; and Mr. Jellett has placed at his disposal the sum of £40 towards the necessary expenses of these researches. One-half of this amount has been already expended by Mr. Haughton on his investigations, and the results obtained have been printed in our Transactions. The further analyses now in progress will also, when completed, be laid before the Academy.

The Treasurer informs us that the finances of the Academy are in a satisfactory condition. All bills have been paid, and a balance of upwards of £100 will be carried to the credit of the Academy in the year now about to commence.

The Academy, by a resolution of January 28th, directed the Council to prepare a historical account of the Cunningham Fund, from its origin to the present time, including a list of the persons to whom prizes or medals have been awarded from the Fund; and a statement of the nature of the researches for which such prizes and medals were adjudged. The Academy also requested the Council to make such suggestions as they should think proper, with respect to the mode in which the proceeds of the Fund should, for the future, be disposed of. We have drawn up a statement respecting the history of the Fund, which will be brought before the Academy in the form of an Appendix to the present Report. The question of the best mode of disposing of the Fund for the future we have not had time to examine as carefully as its importance deserves; and we recommend that it be referred to the new Council for their mature consideration.

It will be remembered that, in the last Annual Report, the attention of the Academy was called to a subject on which the President

had already dwelt in his Inaugural Address, namely, the confused and uncertain state of the Laws of the Academy, and the necessity of a systematic revision and consolidation of the entire body of our Statutes. We recommended that power should be given to the Council to prepare a Digest of the Charter, Statutes, and By-Laws, not altering their substance in any respect, and modifying the language only so far as might be necessary for the sake of clearness and connexion. The Academy having entrusted us with these powers, we proceeded to prepare such a Digest. A draft of a new edition of the Statutes, drawn up by the President, was laid before us; we have carefully examined and corrected it; and we now submit it to the Academy, and recommend that it be adopted as representing correctly the present state of the Laws and Regulations by which the Academy is governed. Any changes in our Laws, which may from time to time be thought expedient, can without difficulty be introduced into their proper places in the Digest.

We regret that the increasing infirmity of age renders it impossible for the Rev. Dr. Drummond, now for so long a period our Librarian, to retain that office. In retiring from the Council, of which he has been a member for forty years, he carries with him the sincere respect and esteem of his colleagues, and, we believe we can truly add, of every Member of the Academy.

Fourteen Members have been elected within the past year:—

1. John G. Adair, Esq.
2. Charles A. Cameron, M. D.
3. Rev. James Graves, A. M.
4. George Meyler, Esq.
5. Viscount Monck.
6. Henry Cusack, Esq.
7. Richard H. Frith, Esq., C. E.
8. Rawdon M'Namara, M. D.
9. Alexander Mac Ilveen, Esq.
10. James Moore, M. D.
11. Right Hon. Sir Thomas Wyse, K. C. B.
12. James F. Duncan, M. D.
13. Wyville Thompson, LL. D.
14. David Walker, M. D.

No Honorary Members have been elected.

The Academy has lost, by death, during the past year, six Members:—

Samson Carter, Esq., C. E., elected December 11, 1837.

Sir Henry Marsh, Bart., M. D., elected June 22, 1826.

John U. Owen, M. D., elected April 8, 1839

Ven. Charles Strong (Archdeacon of Glandelagh), elected June 25, 1819

Lord Rossmore, elected June 27, 1825.

And one Honorary Member,—Baron C. C. J. Bunsen.

APPENDIX TO THE REPORT, BEING AN HISTORICAL ACCOUNT OF THE CUNNINGHAM FUND.

In compliance with the wish of the Academy, we have prepared the following statement respecting the origin and history of the Cunningham Fund:—

Timothy Cunningham,* of Gray's Inn, by his will, dated the 10th of June, 1789, bequeathed to the Royal Irish Academy a sum of £1000 to be laid out in such funds as they should think proper, and the interest to be disposed of in such premiums as they should think proper, for the improvement of natural knowledge and other objects of their Institution. By the said will he appointed the Rev. Thomas Hussey executor thereof, who duly proved the same, and obtained probate on the 16th June, 1789, from the Prerogative Court of Canterbury. The net amount of the bequest, namely, £1072 (Irish), was transmitted to the Academy in December, 1789. A committee was appointed for the disposal of it; and on their recommendation, it was resolved that it should be invested in Ballast Board Debentures, £28 being added to make up the round sum of £1100. This resolution was, however, not carried into effect. A sum of £1000 out of the fund was allowed to remain in the hands of the Treasurer, the Hon. William Burton Conyngham,† as a loan at 4 per cent.; and the remainder was applied to the general purposes of the Academy.

At Mr. Conyngham's death, in 1797, he remained indebted to the Academy in the full amount of his loan. The whole was, however, afterwards paid off by his representatives by instalments, the last of which was received in March, 1804. These instalments, as they fell in, were expended for general purposes, particularly—as will appear hereafter—on the repair of the premises of the Academy.

In March, 1800, when a sum of £892 9*s.* 6*d.* was still outstanding in the hands of Mr. Conyngham's representatives, the Academy presented a petition to the Irish Parliament for a grant in aid of their funds. In this they stated, among other things, that "the Academy had been put to very heavy expenses by the fall of different parts of the house, and obliged to lay out in repairs large sums belonging to a private fund, appropriated by the donor to particular purposes, and were not able to replace them;" and they expressed a hope "that a sum of £1000 would not be deemed too much for its relief." In answer to this petition, the Parliament, by the Act 40 Geo. 3, c. 60, sec. 3, granted a sum of £1000 Irish for the purposes of the Institution generally. The net amount of the grant, £970 Irish, was increased to £977 5*s.* 7*d.* out of

* For an account of Mr. Cunningham, and a list of his writings, see Gilbert's "History of Dublin," vol. iii.

† From a confusion with the name of this gentleman, the fund is often erroneously denominated the "Conyngham Fund" in the proceedings of the Council.

the funds of the Academy, and with this sum Government Three-and-a-Half per Cent. Debentures to the amount of £1400 were immediately purchased.

The last instalment of Mr. Cunningham's Bequest having been paid, the Treasurer was authorised by the Academy to vest in the Ballast Office Securities so much of the money of the Academy as he should think proper. No investment, however, took place in consequence, either at this period or for a number of years afterwards. Though the Cunningham Bequest was thus received in full from the representatives of Mr. Conyngham, the name of the Cunningham Fund has since the year 1812 been applied, not to the moneys resulting from that bequest, but to the Parliamentary grant; and the Three and a-Half per Cents. purchased with this grant have been regarded as affected with the trusts of Mr. Cunningham's will. This view, which was certainly incorrect, was first put forward in the report of a committee appointed in the year 1812, to examine into the state of the funds of the Academy; and was tacitly adopted and acted on by subsequent committees down to the year 1843, when, as we shall see, it was thought right to take the opinion of counsel on the subject.

In 1819, a special committee was appointed to consider and report on the state of the Cunningham Fund. This committee, understanding by the words "Cunningham Fund" those moneys which had been invested in Government Stock, reported that the total amount of interest on the fund, received both from the Hon. Mr. Conyngham and the Three-and-a-Half per Cents., exceeded the amount expended by the Academy on premiums and medals by £731 8*s.* 9*d.* They recommended that the Academy should add to the fund a sum sufficient to make it up to the even amount of £1600, which should be taken as forming the permanent fund of the Cunningham Bequest.*

The whole interest on the fund thus constituted was not expended in premiums and medals; so that in the year 1843 the fund standing to the credit of the Academy, and regarded as the Cunningham Fund, is stated in the case submitted to counsel to have amounted to £1665 4*s.* 2*d.*, besides a sum of £262 19*s.* 6*d.*, part of the interest accrued since 1819 due to the fund by the Academy.

Counsel, having been consulted in the same year on the question whether the Three-and-a-Half per Cents. funded in 1800 and 1819 were to be regarded as legally constituting the Cunningham Fund, gave the opinion that after such a lapse of time, and so many acts of the Academy, this stock must be taken as appropriated for that purpose, and affected with the trusts of the Cunningham Bequest.

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* The committee also recommended that an account should be opened under the head of "Cunningham Premiums;" and that the different sums received and expended for that account should for the future be regularly entered in it, instead of being, as often heretofore, mixed up with the general accounts of the Academy. This account, however, was not opened.

The present amount standing to the credit of the Cunningham Fund in the New Three per Cents. is £1775 12*s.* 1*d.*

So far with respect to the Financial History of the Fund.

In examining the way in which the proceeds of the fund have been expended in premiums and medals, we have found it impossible, from the accounts of the Academy or from the minutes of the proceedings of the Council, to ascertain with certainty in every instance of the award of a prize or medal, whether the amount of the one or the cost of the other was supplied from the Cunningham Fund, or from the general funds of the Academy. We have, therefore, thought it better to give a detailed history of *all* the honorary rewards given by the Academy since its foundation, for scientific, literary, or antiquarian papers or other writings, from whatever source the cost of those rewards may have been defrayed.

The first suggestion which appears in the Proceedings of the Council of a prize to be offered by the Academy for an essay occurs under the date of June 5, 1790. It was then proposed that a premium of £20 shall be given for the best essay upon the "Analysis of the Lucan Waters." And there is added on the Minutes the following query:—"Whether an inquiry after the best dyeing ingredients to be found in this country be not a fit subject for a premium." But no action seems to have been taken in consequence of this proposal or query.

The Council on July 10, 1790, resolved, in compliance with the trusts of the Cunningham Bequest, to announce in the public journals that a premium of £20 would be given for the best experimental investigation on any subject of natural philosophy, with a particular preference to researches tending to the improvement of arts and manufactures; the premium to be adjudged on the 16th of March in the following year.

Three papers were sent in to compete for the prize—

1. Entitled "A Review of the Properties of simple Earths, and the uses to which they may be applied in the establishment or use of Potteries."

2. "Discovery of a mode of making Pearl-white."

3. "Description of two new Standards for Weights and Measures."

The prize was adjudged to the third essay, provided that on trial of certain apparatus described in it, it should appear that by means of this apparatus an accurate standard of weights and measures might be constructed. But no further mention appears either of the apparatus or of the essay.

On October 8, 1791, an anonymous letter was laid before the Council, from which the following is an extract:—"It has occurred to me that it would serve the interest of Ireland, if the Irish Academy would adopt the scheme of giving premiums in money or medals for essays on subjects which tend to promote the happiness of the people, as practised by

many of the foreign academies. I have no doubt but a fund would soon be created, if the plan were adopted and its purposes announced. To make a beginning, I here enclose a Bank note for £100, which you will please to deliver to the President or Vice-President at the next meeting of the Academy:

"Fifty pounds for the best system of National Education, which shall include the children of the labouring poor, and the means of establishing it;

"Fifty pounds for the best treatise on the means of providing employment for the people:

"To be adjudged by the Academy."

These prizes were accordingly announced to the public.

The premium on the first subject was awarded to Dr. Stephen Dickson, for his essay, printed in vol. iv. of the Transactions; and a sum of £20 from the Cunningham Fund was voted to Mr. George Hey Treanor, for his essay on the same subject.

The premium for the best essay on the employment of the people was awarded to Samuel Crumpe, M.D. His essay, published as a separate work in 1793, has always borne a high reputation.

In June, 1792, the Academy offered a prize of £50 from the Cunningham Fund for the best essay in answer to the question—"What are the manures most advantageously applicable to the several sorts of soil, and the causes of their beneficial effects in each particular instance?"

Gold medals were at the same time offered for the best essay on each of the following subjects:—

1. "On style in writing, considered with respect to thoughts and sentiments, as well as words; and as indicating the writer's peculiar and characteristic disposition, habits, and powers of mind."

And, 2. "An historical inquiry into the ancient and present state of the Irish language, with the causes and remedies of the obscurity of ancient Irish manuscripts."

It was announced that essays on any of these subjects would be received in either the English, French, Italian, or Latin languages.

The author of the successful essay on Manures was the celebrated Richard Kirwan. It is printed in vol. v. of the "Transactions."

An essay on the subject of Style, by the Rev. Robert Burrowes, D.D., appears in the "Transactions," vol. v., but it does not appear to have been sent in to compete for the prize.

In December, 1795, a premium of £50 from the Cunningham Fund was offered for the best essay on the following subject:—"To what manufactures are the natural advantages of Ireland best suited, and what are the best modes of improving such manufactures?"

Gold medals were at the same time offered for the best essays on each of the following subjects:—

"On the variation of English prose composition from the Revolution to the present time;"

And "The authenticity and value of Irish manuscript histories of ages prior to that of Henry II."

The Cunningham prize was awarded to William Preston, Esq., for his essay on Irish manufactures; and a gold medal to Mr. Thomas Wallace, A.B., for his essay on the variations of English style since the Revolution. The latter essay is printed in vol. vi. of the Transactions.

In February, 1798, the Council nominated a committee of five persons to select three questions to be proposed for prize essays—one in science, one in polite literature, and one in antiquities. But we do not find that this committee made any report or recommendation to the Council.

In October, 1798, the Academy received from a gentleman in England, whose name was not disclosed, a sum of £50 British, which he desired should be proposed as a premium for the best essay "On the mischievous effects produced by too great credulity in times of civil commotion." The Academy, though considering the inquiry not to fall strictly within their province, yet, unwilling to disappoint the good intentions of the donor, consented to undertake the adjudication of the prize. But it seems not to have been awarded to any one. An essay on Credulity by Wm. Preston, Esq., is printed in vol. xi. of the Transactions; but it does not appear to have competed for the prize.

In May, 1799, a premium of £50 from the Cunningham Fund was offered for the best essay in answer to the question—"Can any substitute for bark be advantageously used in tanning?"

Gold medals were also offered for the best essay on each of the following subjects:—

1. "What judgment should be formed of the literary merit and moral tendency of those pieces of German literature which have been lately translated into the English language, and to what probable causes should their peculiar style be attributed?" And,

2. "What proofs are extant of a state of civilization in Ireland superior to that of the adjacent countries in any period priór to the reign of Henry II.?"

The prize for a new method of tanning was not awarded to the only candidate who produced an essay on the subject. An essay on the peculiarities of recent German writers was written by Mr. Preston, but withdrawn from competition; it is printed in vol. viii. of the Transactions. On the question of Irish history no essay appears to have been sent in.

In June, 1800, a premium of £100 was offered for the most detailed and accurate mineralogical and geological description of the county of Dublin, with specimens of the minerals found at an accessible depth. Gold medals were also offered for the best essays on each of the two following subjects:—

"The origin and progress of rhyme;" and,

"The Brehon Laws of Ireland."

A medal was adjudged to Theophilus Swift, Esq., for his essay on the former subject, printed in vol. ix. of the Transactions. There appears to have been no competition for the other prizes.

In November, 1803, the following were selected as the prize questions, "under the will of the late Timothy Cunningham, Esq.:"—

1. "What is the cause of the ascent and descent of the sap in vegetables at certain seasons; and how far is this cause modified by the climate?"

2. "Are the origin and progress of the polite arts in any country, connected with and dependent on the political state of that country?"

3. "What was the general character of the Brehon Laws of Ireland, and what inferences may be drawn from them, in regard to the ancient circumstances of the country?"

A prize of £50 was to be given for the best essay on the first question, and a gold medal for the best essay on each of the other questions.

The medal for the essay on the progress of the arts was awarded to that by William Preston, Esq., which is printed in vol. x. of the Transactions.

In February, 1806, the following prize questions were proposed:—

"What is the best method of applying turf or peat to useful purposes, exclusive of those which are usual in Ireland?"

"What are the limits of poetic licence?"

"What are the principal obstacles to the knowledge of the Irish history previous to the year of our Lord one thousand one hundred?"

A premium of £50 out of the fund "bequeathed for such purposes by Timothy Cunningham, Esq., was offered for the best essay on the first question, and a gold medal for the best essay on each of the two other questions.

Two essays on poetic licence were received, but neither of them was thought deserving of the medal.

In May, 1808, one prize question only was proposed, namely, "What are the chemical preparations which are extensively useful in the arts of bleaching or dyeing, that are not manufactured in this country, and the materials of which are its natural products; and what are the best processes for their preparation?"

In May, 1809, two subjects for prize essays were proposed:—

1. "On the resemblance and probable identity of the electric and galvanic fluids."

2. "On the influence of fictitious history on modern manners."

A premium not exceeding £50 was offered for the best essay on each.

A sum of £30 was adjudged to Miss Harriet Kiernan for her essay on the influence of fictitious history, printed in vol. xii. of the Transactions.

In April, 1811, the following prize question was proposed:—"Whether, and how far, the cultivation of science and that of polite literature assist or obstruct each other?"

The full prize of £50 was awarded to the essay of William Phelan, Esq., A. B., printed in vol. xii. of the Transactions.

In April, 1812, £50 were offered for the best essay "On the influence of Habit, considered in conjunction with the law of Novelty." A sum

of £30 was adjudged to William Phelan, Esq., for his essay on the subject; and a sum of £30 to Andrew Carmichael, Esq. The essay by the latter gentleman will be found in vol. xii. of the Transactions.

In May, 1813, a premium not exceeding £50 was offered for the best essay "On the effects of the discovery of Galvanism, both as regarding the theory of Chemistry, and as an experimental agent." A sum of £40 was voted to Mr. M. Donovan for his essay on the subject. The substance of this essay was incorporated in a work published by Mr. Donovan in 1816, entitled, "An Essay on the origin, progress, and present state of Galvanism, containing investigations, experimental and speculative, of the principal doctrines offered for the explanation of its phenomena; and a statement of a new hypothesis."

In May, 1814, the following was selected as the prize question:—"Does a country derive any advantages, and of what nature, from lateness of civilization?"

Two essays were sent in: one of them was not received, on the ground that the author "had transgressed the rules marked for such compositions by the usage of the Academy, by having introduced points of religious and political controversy;" the other essay was not deemed deserving of a prize.

In May, 1815, the following subject was chosen:—"On the mixture of fable and fact in the early annals of Ireland, and the best modes of ascertaining what degree of credit those ancient documents are justly entitled to." The prize was awarded to Thomas Wood, M.D., for his essay on this subject, which is printed in vol. xiii. of the Transactions.

On May 13th of the same year it was resolved by the Council that the annual prize of £50 be for the current year divided into two parts of £25 each, and that, instead of one prize question proposed this year, two be substituted—one in science, and the other in polite literature. No subjects, however, seem to have been proposed in consequence of this resolution.

At the stated meeting of the Academy in March, 1817, the Academy adopted, on the recommendation of the Council, the following alteration in the by-law respecting the medals:—"That, in place of the annual premium, which has been heretofore adjudged to the best essays, upon a proposed subject, there be three medals given for the three best essays, one in science, one in polite literature, and one in antiquities, which shall be read during each session, and which may be deemed by the Council to be worthy of publication and of this reward, whether the papers be furnished by Members of the Academy or by strangers; that the said prizes shall be adjudged by ballot at some meeting of the Council between the 1st of January and the 16th of March in each year, to such essays as may have been given in before the first day of the year; that each of these medals shall be of the weight of three ounces, and of gold, and shall be called the Cunningham Medal."

In the following year, the outgoing Council, alleging "the press of business," did not dispose of the medals, and requested that the duty

might be left to the next Council. Accordingly, on the 13th of April, the science medal was adjudged to Archdeacon Brinkley for his essay entitled, "Investigations in Physical Astronomy, principally relative to the mean motion of the Lunar Apogee." This essay is printed in vol. xiii. of the Transactions. No medal appears to have been given for polite literature or antiquities in 1818; nor in any department in 1819 or 1820.

The Committee of 1819 on the Cunningham Medals, of which we have already spoken, recommended that "the surplus, if any there be, above the expense of the annual medals given by law, should be given as medals or other rewards for essays on such subjects as may be proposed by Council; the subjects, &c., to be regulated by Council at the periods appointed for the adjudication of the Cunningham medals for the preceding year, or as soon after as may be convenient—these subjects to be always specified, and the essays given in, within a year from the time of offering the reward; and, if still there should be a surplus, that it should be applied to the increase of the fund." These recommendations were adopted by the Council.

The first proposal of subjects for essays in accordance with this arrangement is found under the date of May 1, 1820. On the report of a Sub-Committee, the Council then resolved that a medal should be given for the best essay upon each of the following subjects:—

In science—"On the relative ages of the limestone rocks of Ireland;"

In polite literature—"On the reciprocal influence of the fine arts and literature;"

And in antiquities—"On the origin and nature of the amphitheatrical buildings lately discovered in the south of Ireland."

Notwithstanding an extension of the time allowed for the sending in of these essays, there seems to have been only one produced, on the antiquarian subject. The medal was withheld; but a sum of £10 was presented to the author ("Philotechnos") as a reward for the industry and research displayed in its composition.

In May, 1822, it was resolved to offer, as formerly, a prize of £50 for the best essay on a given subject. The subject selected was—"On the means of rendering the sources of national wealth possessed by Ireland most available for the employment of its population." Four essays on this question were received. The full amount of the prize was given for one, whose author was the Rev. Richard Ryan; and ten guineas were voted to Dr. Wood, the writer of a second, as a reward for his industry and talents.

The prize question for 1824 was—"The influence of the extension of mechanical improvements on the character and happiness of a nation."

A gold medal of the value of £20 was at the same time offered for the best essay on the following subject:—"On the nature and influence of the Brehon Laws; and upon the number and authenticity of the documents whence information concerning them may be derived, ac-

companied by specimens of translations from some of their most interesting parts."

Four essays were received on the prize question, and one on the subject of the Brehon Laws. The prize of £50 was equally divided between the essays of Mr. O'Hanlon and Mr. Sharkey on Mechanical Improvements; and the additional prize was awarded to Mr. O'Reilly, for his essay on the Brehon Laws, printed in vol. xiv. of the Transactions.

It will be observed that the principal subjects in the two last years, as well as on other previous occasions, were of a kind not strictly referable to any of the three departments of the labours of the Academy, being connected with social economy, particularly in its application to the circumstances of Ireland. The amount of competition created in these instances appears to have encouraged the Academy to make further steps in the same course. Three prizes were offered for the year 1826:—

One, not exceeding £50, for the best essay "On the comparative state of the poor among ancient and modern nations;"

One, not exceeding thirty guineas, for the best essay "On the origin and progress of Gothic architecture, with reference to the ancient history and present state of the remains of such architecture in Ireland;"

And one, not exceeding thirty guineas, for the best essay in answer to the following queries:—"What are the general indications of metals being in any given place; the lines of direction, extent, and dipping of the veins, deduced from the appearance of the surface; and the occurrence of different metallic substances found combined or associated in veins or beds? What is the medium percentage of the value of the ores hitherto found in Ireland, and the average cost per ton of working and smelting them, with the expense of land and water carriage? It will be necessary that any popular terminology used by miners be added and explained, and that a section of a regularly worked mine be subjoined."

Two essays on the state of the poor, and one on Gothic architecture, were received. The principal prize was divided between the authors of the former, Mr. William Woodcock receiving £35, and Dr. Patrick Sharkey, £15. Mr. Thomas Bell received the full prize for his essay on Gothic architecture.

The subject of Irish mines was re-proposed as a prize question for 1827, £50 being offered for the best essay; and an additional prize of thirty guineas was offered for the best essay "On the state of architecture in Ireland previously to the reign of Henry II." To these was afterwards added a third prize of £80 for the best essay on the following subject:—"The social and political state of the people of Ireland from the commencement of the Christian Era to the twelfth century; their advancement or retrogression in science, literature, and the arts; and the character of their moral and religious opinions, as connected with their civil and ecclesiastical institutions, so far as they can be gleaned from any original writings prior to the commencement of the sixteenth

century, exclusive of those in the Irish and other Celtic languages, as such documents may, on a future occasion, be proposed by the Academy as a subject of investigation; every statement to be supported, not by reference only, but by extracts in the form of notes or an appendix; and it is expected that every accessible source of information shall be examined, under the above limitation." Besides the prize in money, the Cunningham Medal was to be given for the best essay on this last subject, and additional premiums to others possessing positive merit.

The Cunningham medal, with the prize of £80, was awarded to John D'Alton, Esq., and an additional prize of £40 to Thomas Carrol, M. D., for his essay on the same subject. Mr. D'Alton's essay is printed in vol. xvi. of the Transactions. The full prize of £50 was adjudged to Miss Beaufort for her essay "On the state of architecture and antiquities in Ireland previous to the landing of the Anglo-Normans," which is printed in vol. xv. of the Transactions.

A special prize, not exceeding £20, was offered in June, 1827, for the best essay "On the inflections of the nouns and verbs in the Irish language, and the proper mode of ascertaining the same; especially with reference to the analogy of the languages with which the Irish is supposed to be originally connected." No essay on this subject appears to have been sent in.

The following subjects were proposed in 1828:—

1. "To investigate the authenticity of the poems of Ossian, both as given in Macpherson's translation, and as published in Gaelic (London, 1807), under the sanction of the Highland Society of London; and, on the supposition of such poems not being of recent origin, to assign the probable era and country of the original poet or poets."

2. "Whether we have reason to believe that a change has taken place in the climate of Ireland; and, if such change has occurred, through what period can we trace it, and to what causes shall we assign it?"

A sum of £40 was offered for the best essay on each of these subjects. The full prize was awarded to the Rev. W. H. Drummond, for his essay on the poems of Ossian; and an additional prize to Edward O'Reilly, Esq., for his essay on the same subject. Both these essays are printed in vol. xvi. of the Transactions.

Two writers competed for the prize on the climate of Ireland; but the Council were of opinion that the question had not been fully answered by either of them.

It was therefore again proposed, the same prize being offered, as was also the question relating to the reign of Henry II., £60 being offered for the best essay on the latter subject.

The former prize was obtained by Dr. M'Sweeny, of Cork, whose essay is printed in vol. xvii. of the Transactions; and a sum of £20 was voted to Mr. J. D'Alton, for his essay on the reign of Henry II.

In August, 1829, it was resolved by the Council that the 1st of November in each year should be fixed as the day for receiving prize compositions.

In 1830, £50 and the gold medal were offered for an approved essay "On the Round Towers of Ireland, in which it is expected that the characteristic architectural peculiarities belonging to all those ancient buildings now existing shall be noticed, and the *uncertainty* in which their origin and uses are involved be satisfactorily removed."

The prize essay on this subject was that of Mr. George Petrie, which forms vol. xx. of the Transactions, and is probably the most valuable contribution ever made to the study of Irish antiquities. A premium of £20 was awarded to Mr. Henry O'Brien, for his essay on the same subject.

In 1831, £50 and the gold medal were offered for an approved essay on the question—"Who were the Scoti, and at what period did they settle in Ireland?" This question, having elicited no paper, was reproposed in January, 1833; and the following was added, as a second prize question:—"The military architecture of Ireland, previous to the arrival of the English." One essay on the former subject was sent in, but not considered sufficiently appropriate to the question to be regarded as competing for the prize. The successful essay on the military architecture of Ireland was produced by Mr. George Petrie, who received for it a prize of £50 and the gold medal. It is much to be regretted that this essay, which on the 14th April, 1834, was ordered to be printed in the Transactions, has never since appeared.

In April, 1834, the Council unanimously resolved that the Cunningham Medal be presented to Professor (now Sir Wm. R.) Hamilton, as the author of the mathematical paper read by him during the last session, being the well-known supplement to his essay "On Systems of Rays," in which he predicted from theory the phenomenon of conical refraction.

In June, 1834, the following prize questions were proposed, and gold medals, of the value of £20 each, offered for the best essays on them:—

1. "On the analogies of light and heat."
2. "On the state of civilization in Ireland, between the fifth and twelfth centuries, as compared with the neighbouring nations."
3. "The influence of the Greek and Latin on the modern European languages of the Germanic families."

On the first of these subjects alone an essay appears to have been sent in, which, however, was not judged worthy of the prize.

New rules respecting the awarding of medals were adopted by the Council in April, 1838. It was then resolved that one medal be given in each year for the best essay communicated for publication during the three preceding years, in the following cycle of subjects:—

1. "Mathematics."
2. "Physics."
3. "Natural history."

That one medal be also given in each year for the best essay, communicated for publication during the three preceding years, in the following cycle of subjects:—

1. "Polite literature."
2. "Antiquities."
3. "Polite literature, *or* antiquities."

And, as a first application of the new rules, it was resolved,

That two medals be given, one for the best essay in mathematics, and the other for the best essay in polite literature, read during the three years preceding the 1st January, 1837:

That two medals be given, one for the best essay in physics, and the other for the best essay in antiquities, read during the three years preceding the 1st January, 1838:

That two medals be given, one for the best essay in natural history, and the other for the best essay in polite literature or antiquities, read during the three years preceding 1st January, 1839.

The first of the medals given under this system of rotation was awarded to Professor M'Cullagh, for his beautiful memoir "On the Laws of Crystalline Reflexion and Refraction."

The first medal in physics was awarded (January 21, 1839,) to Dr. Apjohn, for his paper "On a New Method of investigating the Specific Heats of Gases."

A medal was awarded, June 3rd, 1839, to Dr. Petrie, for his paper "On the History and Antiquities of Tara Hill." These three valuable memoirs are all printed in vol. xviii. of the Transactions.

In the case submitted to Counsel respecting the Cunningham Medals in May, 1843, the following passage occurs, which seems particularly deserving of attention:—"The Academy have not given any premium since 1838. [This statement, however, does not appear to be strictly correct.] The essays worthy of prizes having generally been found to be written by members of the Council, has caused remissness in that body, with whom the prize questions originate, in continuing a system which operates in a great measure for their own benefit, and which is calculated to expose them to much odium in their decisions." Notwithstanding the existence of the difficulty here expressed, the distribution of medals on the principle of triennial cycles was resumed in the following month, June, 1843. The medal in physics for 1838, 39, 40, was awarded to Dr. (now Sir Robert) Kane, for his paper "On the Nature and Constitution of the Compounds of Ammonia," printed in vol. xix. of the Transactions.

No medals appear to have been awarded between this period and the year 1848.

In March of that year the following new regulations respecting the awarding of medals were adopted by the Council, on the recommendation of a Committee which had been appointed to consider the subject:—

"1. That medals given under the Cunningham Bequest be open to the authors of all works or essays in the departments of Science, Polite Literature, or Antiquities, which shall be printed and published in Ireland, or which shall relate to Irish subjects.

"2. That the award of medals be taken into consideration by the Council every third year, at the first meeting after the 16th of March, and that it be confined to papers or works published within the six years preceding.

"3. That the Council shall, from time to time, grant money premiums for reports or essays upon stated subjects, reserving to themselves the power of printing the papers, or not, as they deem expedient."

Medals were adjudged in April, 1848—

1. To Sir William R. Hamilton, for his researches respecting Quaternions, published in the Transactions of the Academy;

2. To the Rev. Samuel Haughton, for his memoir "On the Equilibrium and Motion of Solid and Fluid Bodies," printed in vol xxi. of the Transactions.

3. To the Rev. Edward Hincks, D.D., for his various papers on Egyptian and Persepolitan writing, published in the Transactions; and,

4. To John O'Donovan, Esq., for his contributions to the Transactions of the Irish Archæological Society, his Irish Grammar, and his edition of the Annals of the Four Masters.

On October 6, 1851, a medal was awarded to the Rev. J. H. Jellett, for his Treatise on the Calculus of Variations.

On February 1, 1858, medals were awarded, in science—

To Edward J. Cooper, Esq., M.P., for his catalogue of ecliptic stars; and to the Rev. George Salmon, for his researches on the geometry of plane curves.

In polite literature—

To the Rev. Dr. Wall, for his work "On the Ancient Orthography of the Jews, and the Present State of the Text of the Hebrew Bible."

And in antiquities—

To the Rev. Dr. Reeves, for his new edition of Adamnan's "Life of St. Columba."

We have now completed our historical sketch, which, we trust, will not be without utility in assisting the judgment of the Academy with respect to the most advisable mode of applying in future the proceeds of the Cunningham Fund.

It was Resolved,—That the Report of the Council now read be received and adopted.

The ballots for the annual election of President, Council, and Officers, having been scrutinized in the face of the Academy, the President reported that the following gentlemen were duly elected:—

President.—The Very Rev. Dean Graves, D.D.

Council.—Rev. Geo. Salmon, D.D.; Rev. Samuel Haughton, M.A.; Rev. J. H. Jellett, M.A.; Robert W. Smith, M.D.; Rev. Joseph A. Galbraith, M.A.; Sir W. R. Hamilton, LL.D.; and James Apjohn, M.D.: on the Committee of Science.

Rev. Samuel Butcher, D.D.; Rev. Joseph Carson, D. D.; John Kells Ingram, LL.D.; Digby P. Starkey, M. A.; John Anster, LL. D.; J. F. Waller, LL.D.; and D. F. M'Carthy, Esq.: on the Committee of Polite Literature.

John T. Gilbert, Esq.; Rev. William Reeves, D. D.; Eugene Curry, Esq.; William R. Wilde, M.D.; George Petrie, LL.D.; W. H. Hardinge, Esq.; and Rev. Jas. H. Todd, D.D.: on the Committee of Antiquities.

Treasurer.—Rev. Joseph Carson, D.D.

Secretary of the Academy.—Rev. William Reeves, D.D.

Secretary of the Council.—John Kells Ingram, LL.D.

Secretary of Foreign Correspondence.—Rev. Samuel Butcher, D.D.

Librarian.—John T. Gilbert, Esq.

Clerk, Assistant Librarian, and Curator of the Museum.—Edward Clibborn, Esq.

The Rev. James H. Todd, D. D., then left the chair, which having been occupied by the Very Rev. Charles Graves, D. D.,

It was moved by Sir W. R. Hamilton, LL. D., and seconded by the Rev. William Reeves, D. D., and

Resolved,—That the cordial acknowledgments of this Academy are due, and are hereby presented, to their late President, the Rev. James Henthorn Todd, D. D., for the dignity and courtesy with which he has filled the chair, and the untiring zeal which he has displayed in promoting the objects of the Academy.

The President nominated under his hand and seal the following

Vice-Presidents.—Sir William R. Hamilton, LL. D.; Rev. Samuel Butcher, D. D.; Wm. R. Wilde, M. D.; and the Rev. James Henthorn Todd, D. D.

The Academy then adjourned.

MONDAY, APRIL 8, 1861.

Very Rev. Charles Graves, D.D., President, in the Chair.

The Hon. Judge Berwick; Alfred Hudson, M. D.; George Nixon, M.D.; William J. Sargeant, Esq.; J. S. Sloane, Esq., C.E.; and Joseph Wilson, Esq.; were elected members of the Academy.

The President delivered the following Inaugural Address:—

THE PRESIDENT'S ADDRESS.

My Lords and Gentlemen,—In entering upon the office of President of the Royal Irish Academy, I feel that it is my first duty to return you my sincere and cordial thanks for the great honour which you have conferred upon me in calling me to this Chair. That honour, with the responsibility which accompanies it, would

be a burden heavier than I have strength to bear, if I were not supported, as I trust I shall be, by the same friendly confidence which has for so long a time lightened my labours as Secretary of the Council and Secretary of the Academy. The general concurrence of your suffrages in my favour is a proof that you expect me to use, for the benefit of the Academy, the experience which half a lifetime has enabled me to acquire. For nearly a quarter of a century I have been a member of this society, seldom inactive, and always deeply interested in what concerns its welfare. This acquaintance with the affairs of the Academy has been, I doubt not, my chief recommendation to you. Perhaps I was believed to possess another claim upon your favourable consideration. It was supposed that my own habits of thought rendered me capable of sympathising in the studies of members belonging to the different sections of the Academy. In this view, at least, my friends are not mistaken. Whilst I look up with respect to the attainments of brother Academicians who are my superiors in every separate department of science and literature, I have with them all a community of sentiment which enables me sometimes to cooperate, and always to sympathise; and thus I may be capable, in some degree, of representing that principle which was paramount in the minds of our founders. The Academy was designed to foster studies differing in their directions, but tending towards a common point. It was believed by those who laid the foundation of the Academy that its end would be best promoted by the alliance which has been here established between men of science, men of letters, antiquaries, and historians. To this belief I cling; and whilst I am permitted to hold the office which you have just conferred upon me, I hope I shall never do anything to loosen the bonds which ought to unite us. We have all witnessed the great advantages which result from the cooperation of persons engaged in like pursuits. We enjoy that advantage here, and many can bear witness to the pleasure and profit with which our members exchange information on the subjects of their common study. But we must not lose sight of, nor underrate, the benefits flowing from intellectual converse between parties engaged in pursuits of different kinds. Between all the various branches of study there is a wondrous correlation. In their actual matter and substance they are so connected, that every day furnishes some fresh instance of discovery made in one science or art by reference to phenomena observed in another. But, besides this, there are characteristic peculiarities in the methods of investigation used by scientific men, the knowledge of which would be most precious to persons engaged in researches of a wholly different kind. The antiquaries among us have been indebted to our mineralogists, chemists, and physiologists, for essential aid in the prosecution of their studies; I might even mention cases where the mere mathematician has come to their assistance. The boundary which separates archæology from polite literature is so faintly marked, that we are sometimes at a loss to determine to which of the two classes a paper belongs. But, over and above all this, there are cases where the antiquary, too hasty in forming hypotheses, and too prone to

follow the indications that seem to favour them, requires to learn a lesson from the natural philosopher, trained in the austere school of patient induction. The man of science may be less willing to admit the possibility of deriving instruction from the antiquary or the man of letters. And yet even he will find himself at times dependent upon them for help, and always the better, as he partakes more of their intellectual culture. Eliminate the literary constituents from the minds of Newton and Leibnitz, Herschel, Whewell, and Humboldt, and you will not leave the elements of their scientific power unimpaired. It is because the lines of truth meet and cross one another in every direction, that human sagacity possesses its wondrous power in unravelling the mysteries of science, history, and language. Who that remembers what it has accomplished in our lifetime will set limits to its achievements? And who could calculate the rapidity of its progress, when a more perfect communication is established between those who are conducting inquiries of different kinds? To know what others have done, or have failed to do, might just complete the chain of our own experiments and reasoning.

We have heard some complaints within the last few years of occasional irregularity in the supply of papers at our meetings. Under any circumstance this might be expected. Intellectual labours cannot be carried on with the uniformity of mechanical work. But I think that the fact to which I have referred is not by any means attributable to a falling off in intellectual activity amongst ourselves, or to a general disinclination on our part to submit to the Academy the results of literary and scientific investigation. It is owing, I am persuaded, to the establishment in Dublin of a number of separate societies intended to promote the cultivation of distinct branches of science. Their operation sufficiently accounts for a diminished supply of papers in some departments of the Academy. Members are unwilling to lay before us in this room papers neither announcing considerable advances in science nor discussing questions of difficulty. On the other hand, they do not hesitate to present fragmentary communications to societies having specific objects, where their value is more immediately recognised. I, therefore, look without apprehension upon this withdrawal of papers from the Academy. It will, I hope, continue to be the place where remarkable discoveries will be announced, and where philosophers will unfold their mature views of classification and method. Let us also take comfort from the reflection, that in matters of this kind there are fluctuations almost resembling those of fashion. Personal and temporary influences affect the manifestations of intellect. If we observe a stagnation in one section of the Academy, we have good reason to look forward to healthy reaction. The constitution of the Academy is sound; instead of blaming it, let us endeavour to increase its resources, and to stimulate its energies.

We have no right to count upon seeing the annals of the Academy marked, during the coming lustrum, by the appearance of such works as have in former times awakened the wholesome pride with which we greet the triumphs of our fellow-Academicians. Such papers as "Ha-

milton's Memoirs on Quaternions," or "Petrie's Essay on the Round Towers," fill a wide space in the literary and scientific history of Ireland: and even if their authors were to furnish us with no further proofs of their great powers, we might rest contented with what they had done for the reputation of the Academy.

Though it may be thought unreasonable, I still cherish the hope that from these veteran Academicians we may receive other papers, as remarkable as any which they have yet produced. If this expectation of mine be disappointed, other Irishmen will arise to run the same race, and to take up the torch which they have long borne with such distinguished honour.

Since the commencement of the present year, the members of the Academy have welcomed the appearance of the second part of Dr. Wilde's Catalogue of the articles in our Museum. I have so often given expression to the anxiety with which I regard the accomplishment of this work, that I should expose myself to the charge of wearisome repetition, if I now dwelt upon the arguments which have been used to recommend it to the support of the Academy. I need not remind you that, previous to the preparation of this Catalogue, we did not possess even an inventory of the articles in our Museum such as would suffice for their identification, and enable us to check them over from time to time, and ascertain whether we had not incurred losses either through fraud or negligence. If we have not suffered in either way, our exemption has been owing merely to the diligence and watchfulness of our curator, Mr. Clibborn. But we had need of something more than a common inventory. We required a catalogue which might serve as a manual for the instruction of visitors, by the help of which they might learn the nature, so far as it is known, of the different objects displayed in the Museum. We wished that those who had spent a morning in it should carry away with them antiquarian information and taste, which would be profitable to them elsewhere. A person of ordinary intelligence, acquainted with the general nature of our Irish antiquities, would meet with many opportunities of bringing his knowledge into useful exercise. Ignorant hands have destroyed relics almost priceless in the estimation of the antiquary, whilst here and there we have seen instances of the good effects produced by even a little knowledge in saving objects of interest from destruction. I will adduce an example, to illustrate this general observation. Some few years ago a person engaged in building a farm-house, near Killarney, opened a subterraneous gallery known to exist in an adjoining rath, and made use of all the large stones which it contained in the construction of his house. Had any one who took a part in this act ever visited a museum, and seen one or two of the Ogham monuments, of which we here possess good specimens, he would have noticed that several of the large stones which formed the crypt bore upon them long and perfectly preserved inscriptions in the Ogham character. Unfortunately, there was no one present who was aware of the interest attaching to these monuments; they were, therefore, ruthlessly handed over to be used by the masons as they thought fit. Some were partially dressed, and the inscriptions defaced;

others were broken up; only two or three remained to bear witness to the value of the entire group. I found one built into a drain, and two others employed as lintel-stones over the windows of the farm-house. It is my belief that this crypt contained a collection of inscribed monuments presenting a series of names which would have been of interest in illustrating the history, the topography, and the language of the country. In general these inscriptions disappoint us—each of them ordinarily exhibits nothing more than one or two proper names; but from a group of names, belonging, in all probability, to persons connected with each other and with the place, we might expect to deduce conclusions of interest and importance. The number of instances of this kind which have fallen under my own observation is very large. The Ogham inscriptions being not only illegible by most persons, but frequently escaping observation from their indistinctness, and the stones on which they are cut being, from their large size, available for various purposes, monuments of this class are peculiarly liable to be lost or destroyed for want of intelligence in the persons who happen to meet with them. It would be easy to multiply cases like the one which I have noticed, where objects of great antiquarian interest have shared the same fate. Earthenware urns, articles of flint, iron, and even bronze, are often contemptuously thrown aside by finders, who think that nothing but gold or silver is worthy of preservation. Amongst other good effects to be anticipated from it, we may expect that the examination of our Museum by intelligent visitors, having Dr. Wilde's Catalogue in their hands, will diminish the number of disastrous accidents of this kind. The preparation of his Catalogue has entailed what was almost as necessary as the Catalogue itself—I mean, a re-arrangement of the articles in the Museum. In the execution of this part of the task committed to him, Dr. Wilde has entitled himself to our approval and gratitude. Whilst he has grouped together objects of the same class, which illustrate each other by their juxtaposition, he has preserved all the evidence he could find of the circumstances under which particular collections of objects were discovered on the same spot. I hope to be permitted, from this Chair, to congratulate the Academy on the completion of the work which Dr. Wilde has taken in hand, and to be the medium of conveying your thanks to him for the service which he is rendering, not only to the Academy, but to Irish archæology. Devoting his time and his skill to the production of this Catalogue, he has carried it on in spite of occasional difficulties, which have retarded, but not discouraged him. In the end he will have an ample reward for the labour which he has incurred, and for the sacrifices which he has made. I cannot suppose that a work involving so much detail is free from error; and no one would be more ready to acknowledge this than the author. But I am persuaded that it has been executed with diligence and in good faith; and work done under such inspiration will bear a severe scrutiny.

There are some additions which I hope to see made to our Museum before the office of President passes into other hands. I think that the scientific value of our Museum might be largely increased, if we were ena-

bled to procure good *fac-similes* of objects preserved elsewhere. For many (though not indeed for all) purposes, *fac-similes* serve as well as originals; they will perfectly indicate the form and colour of objects; the weight and material of the original articles may be recorded on the label attached to the *fac-similes*. It will only be in rare instances that the archæological student will require a more exact knowledge of the antiquities which he has occasion to examine.

We shall greatly enlarge the means of study in the Museum, when we shall become possessed of a good collection of photographs and drawings illustrating objects which could not find a place on our tables or in our cases. A valuable donation of this kind was made to us during the past year by Mr. G. Du Noyer, who presented to us a portfolio of above 120 accurate and well-executed drawings of various objects, architectural details, monuments, and inscriptions. It is to be hoped that others may follow the example which he has so liberally set, though we can seldom expect to find in one person the same union of archæological knowledge with artistic skill. The antiquary knows what to look for, but he ought to have the eye and the hand of the artist, enabling him to portray it in such a way as most perfectly sets before us what it is essential to represent. I feel pride in seeing some of my own sketches worked up by Mr. Du Noyer into drawings, and incorporated with this series. For the sketches themselves, as he received them, no merit but that of fidelity could be claimed. Without compromising that quality, he has superadded his masterly handling, and has made them not unworthy companions to his own originals.

We are indebted to her Majesty's Government for a most precious collection of antiquarian drawings made during the progress of the Ordnance Survey in Ireland. These drawings represent many objects which no longer exist—at least as they were figured. The tooth of time or the hand of Vandalism is constantly at work, defacing and destroying monuments which stood for centuries to attest the truth of ancient records. If even now, late though it be, trustworthy drawings and good photographs were made throughout Ireland of the many interesting objects which have been left unfigured or only imperfectly drawn by our antiquarian draughtsmen, we should preserve materials, the loss of which may deprive our art students and archæologists of the clue to many discoveries.

I will venture to direct attention to another matter, which ought to be kept in view by our antiquaries. I am aware that it is not easy to carry my suggestion into effect, because the course which I am about to recommend is attended by expense. Nevertheless, I think it not undeserving of notice. As yet no systematic explorations have been carried on by antiquaries in this country in places known to have been the seats of power and civilization in remote times—nothing like what has been done in England and Wales. If careful explorations were made at Tara by practised antiquaries, guided by the abundant information and the maps which Dr. Petrie has provided us with, can we doubt but that the labour of their search would be repaid by curious

and important discoveries? I do not lose sight of the fact that the regal structures which once stood there were of perishable materials; nevertheless, I am sanguine enough to wish to see the exploration attempted. In connexion with this matter, let me note a desideratum which we ought to be on the watch to supply. For ethnological purposes, it is of great moment that we should be possessed of a collection of undoubtedly ancient Irish crania. To have two or three is not enough; we ought to have several, in order to be able to draw safe conclusions with respect to the typical form or forms which characterise them. If our legends relating to the early inhabitants of Ireland be not absolutely fictions, we may yet hope to find in our ancient places of sepulture confirmation of the long-received accounts of Firbolgs, Tuatha De Danann, Fomorians, and Scoti.

In addition to its Museum, the Academy possesses the appliance of a library, from the use of which many of us have derived great advantages. I believe those libraries are most useful whose rules permit the loan of books to the readers. The student often wishes to carry on his reading at hours when libraries are closed. It is also convenient to him to be surrounded by his own books, the tools with which use has made him familiar. I rejoice, therefore, that we are permitted to exercise the privilege of borrowing books from the library. It will be found necessary, however, I apprehend, to impose some additional restrictions upon the loan of books which from their extreme rarity, or for other reasons, deserve to be placed on the same footing as our MSS. To regulations having this object in view, I trust, our members will submit without dissatisfaction. I must here express my regret that our library is not provided with such catalogues as we might desire to possess. The zeal and bibliographical knowledge of our newly-appointed librarian give us reason to count upon many improvements in the department over which he presides. Perhaps one of the first services which he will render us will be to supply information fuller and more exact than we now have as to the contents of our library. I doubt whether the catalogue of the printed books is quite complete; but I am sure that we have no perfect list of our MSS., much less have we an adequate enumeration of their contents. In the case of one class of MSS. this may be readily accounted for, though the fact is much to be regretted. The full and instructive catalogue of our Irish MSS., commenced by Mr. Eugene Curry, was a laborious work, requiring a considerable expenditure of time and research. To complete it upon the plan originally adopted, and to include in it descriptive notices of the Betham MSS., and others which have been since acquired, would be quite indispensable, if we wished to make our MSS. as available as they ought to be, for the benefit of persons consulting them. But the labour required for the completion of this work must be remunerated out of funds much ampler than what are now at the disposal of our library committee. This is a question, the further consideration of which I must leave to them. It is enough for me here to draw the at-

tention of the Academy to the fact that our Irish MSS. are to a great extent uncatalogued and undescribed. They are consequently far less useful than they might be to the few who are capable of studying them. Besides this, their safety is not as well secured as it ought to be.

The time will come when the judgment and liberality of those who have aided in the collection of our MSS. stores will be appreciated. Scholars trained to habits of scientific investigation will arise, I hope, amongst ourselves. But if Ireland does not furnish them, Germany will. Under their hands the volumes which we have accumulated will give up the materials which they provide for the elucidation of historical and philological questions. Hardly one of them will be found useless. From some, our Irish Niebuhr will extract all that relates to the earliest history of the country; he will study the "origines" set forth in our ancient books; he will compare them with documents of the same class relating to other countries; he will disentangle the threads of truth and fiction which are interwoven in them; he will relieve us from the discredit of having suffered this field of historical research to remain in a state but little advanced beyond that in which it was left by the author of Ogygia. Another will analyse our ancient romances, and will exhibit the relations which exist between them and the legends of Scotland and Wales, or Brittany and the other Continental countries. The fireside stories once current in Ireland may be made links in a chain of evidence to prove the kindred of nations, parting, thousands of years ago, from a common stock, though now at last blending their influences in the formation of that society in which the peculiarities of race are, to a great extent, becoming merged in the attributes of a Christian civilization.

And there are other tasks, laborious but full of fruit, which will be undertaken by students of our MSS. These volumes will supply to the philologist materials for the construction of an Irish dictionary. We know where to look for the foundation of that work. It must be laid in the existing dictionaries and glossaries, combined with the collections amassed in the life-long labours of Mr. Curry and Dr. O'Donovan. But we are speaking of an enterprise the accomplishment of which will require the co-operation of many hands. Mr. Whitley Stokes, Mr. Siegfried, and others, must take part in it, and their labours must be spread over many years. I trust that the Academy may be able to give an impulse to this work. At all events, individual members of it will contribute aid, when a plan of operation has been matured. The loss of time which has been incurred already has brought reproach upon us. Let us delay a little longer, and some foreign student, inheriting the diligence and the capacity of Zeuss, will put us to shame by executing the project, in planning which we have allowed years to pass by. To effect this object in any practicable way that has been proposed would be better than to persevere in the present course of doing nothing. For myself, I do not expect to witness the realization of the most perfect schemes which have been drawn up for the construction of an Irish dictionary. I trust, however,

that I may live long enough to see separate works executed, such as will enable the student of Irish to pursue his studies with the same facility which he enjoys in translating most other languages. It has been said repeatedly, but I will declare it again from this chair, that without an Irish dictionary much superior in every respect to the existing ones, an ordinary scholar would find himself unequal to the task of translating the ancient documents preserved in our library. Once possessed of a copious and accurate Irish lexicon, we shall be far advanced on the way towards many objects aimed at by Irish scholars. Philologists in other countries will pursue the investigations which they have entered upon with greater facility and more abundant success; and materials will be multiplied for the use of writers illustrating the early periods of Irish history.

In close connexion with the projects already mentioned stands one by the execution of which the Academy would, I think, do much to promote Irish studies. We lately had upon our table a *fac-simile* of a part of Doomsday Book, executed by what is called the photozincographic process. The copy of MS. thus made is sometimes more legible than the original. It is at the same time absolutely free from the errors introduced by the negligence, weariness, or mistakes of transcribers. I am also assured that copies can be produced by this process at a very moderate expense. If this be so, it would be a work worthy of the Academy to issue a series of *fac-simile* copies of our most ancient and curious Irish MSS. The advantages consequent on this step would be felt by persons engaged in various literary occupations. The philologist, the historian, the antiquary, the genealogist, the palæographer, would all rejoice in the possession of perfectly authentic materials upon which to work. The translation and elucidation of these documents would soon follow, and the public would obtain results which the most sanguine calculator must regard as very remote, if our present rate of progress be not accelerated.

We have long looked with curiosity upon the MS. of the Gospels preserved in the Domnach Airgid—a MS. which Dr. Petrie has shown good reason to believe is of the time of St. Patrick. I trust that our men of science and our archæologists will cooperate in developing this remarkable MS. It is now a solid mass of wrinkled folios agglutinated together; but as two of the outer leaves have been detached, expanded, and read, it seems no very daring effort to continue the development.

In counting up the accessions which have been made in recent times to our library, I ought not to leave unmentioned the precious collection of papers collected by the officers employed in the Ordnance Survey of Ireland; we have to thank her Majesty's Government for having authorised the grant of these documents to our library. They will be invaluable to persons seeking information on any matters relating to the history or topography of Ireland. They contain, as you are aware, the antiquarian materials intended for use in the memoir with which it was proposed to accompany the ordnance map

of this country. Everything was done, under a well-arranged system, to collect, by observation on the spot, and by reference to existing sources of information, all the details necessary to illustrate the ancient and modern topography of Ireland. Every Irishman must regret the abandonment of this great design. We are, however, permitted to rejoice in the prospect of attaining several of the objects at which it aimed by other and independent means. The Census Commissioners and the Statistical Society have taken up portions of the proposed work. The geological department of the survey has assumed wider dimensions, and a separate existence. The Archæological and Celtic Societies are gradually bringing into view a great deal of the antiquarian matter which had been prepared for publication in a different form in the Ordnance Survey Memoir. We have in these facts a proof that the entire work was ably designed. For my own part, I do not hesitate to express my belief, that to the individual who planned and organised it we are indebted for some of the most important advances which have been made within the last quarter of a century in the studies relating to the history, the language, and the antiquities of Ireland. To Lieutenant, now Major-General, Sir Thomas Larcom, belongs this honour. Finding elements of knowledge and talent, and sources of information, existing apart from one another, he brought them into combination, and obtained effects which they were otherwise incapable of producing. He will leave behind him many and conclusive evidences of his judgment and ability in dealing with Irish affairs; but in this room there will never be wanting a monument to commemorate his services, so long as we preserve the volumes which contain the papers of the Ordnance Survey. Before Lieutenant Larcom, we had indeed a Petrie to prove that the round towers were Christian belfries, and not Persian fire-towers; that cromleacs were places of sepulture, and not altars of human sacrifice; that caiseals were military structures, and not temples for Druidical worship. But our great antiquary stood alone. A school of followers was gathered round him, and disciplined in the offices of Mountjoy. If it had not been for the agencies there brought into operation, I doubt whether we should have been able to point to such proofs of learning and diligence as Dr. O'Donovan and Mr. Curry have since given to the world. There, as in every other department of human study, experience has taught us the infinite advantages of philosophic method and systematic labour.

These, gentlemen, are the lessons which it is especially incumbent upon us to master for ourselves, and to communicate by our example to others. So long as these lessons are taught and practised amongst us, we shall never find occasion to abate the affection and respect with which we now look up to our Academy.

It was Resolved unanimously,—That the President be requested to allow his admirable Address, just delivered, to be printed in the Proceedings.

The following communication by RICHARD SAINTHILL, Esq., was read, with permission of the Council, by AQUILLA SMITH, M. D., M. R. I. A.

THE OLD COUNTESS OF DESMOND. AN INQUIRY,—DID SHE SEEK REDRESS AT THE COURT OF QUEEN ELIZABETH, AS RECORDED IN THE JOURNAL OF ROBERT SYDNEY, EARL OF LEYCESTER? AND DID SHE EVER SIT FOR HER PORTRAIT?

I WAS detained in London during the winter of 1829, dancing attendance on lawyers, and, but for the reading-room at the British Museum, should have had many a weary day. The late Sir Wm. Betham found me there, copying, from a Harleian MS., No. 1425, a pedigree of the Desmonds; and on my explaining to him that I was anxious to ascertain to which of the Earls Sir Walter Raleigh's old lady was Countess, Sir William offered to assist me from his own MSS. with a more correct document than the Harleian. Official and other avocations interposed, and occasioned a considerable delay to his kind intentions; when he sent me the rough draft of a very voluminous pedigree (to be corrected at leisure, which probably never arrived), with permission to copy, of which I availed myself as far as the direct line of the Earls was concerned. Waiting this document, I worked on, with the aid of the Harleian, in which Thomas Fitz James, beheaded at Drogheda, 8th February, 1467, is called the ninth earl. In Sir William Betham's pedigree he ranks as eighth earl; his eldest son and successor (James), in the Harleian, tenth earl, is there recorded to have been murdered at Rathkeale, 1487, and to have been unmarried.

Sir Walter Raleigh having stated that his old Countess was married in the reign of Edward IV., "and held her jointure from *all* the Earls of Desmond since then," the inference I drew was, that her husband must have been an earl during Edward IV.'s reign; and before receiving Sir William Betham's MS., I drew his attention to this; for as Edward IV. died in 1483, we seemed to have no choice but Ellen Barry, the mother of Earl James. In reply, dated 5th December, 1832, Sir William wrote:—"You are mistaken in supposing James, ninth earl, died unmarried; his wife was Margaret, daughter of Thady O'Bryen, and is much more likely to have been the lady alluded to. She might have danced with the Duke of Gloucester *before she was Countess of Desmond*, a title she only bore for a few months; for she became Dowager on the murder of her husband, in 1467, *not* 1487." And on further discussion on this question, in a letter, dated the 9th of January, 1833, Sir William wrote:—"I think there is not much doubt that this Margaret was *the raal ould Countess*;" and further on, in the same letter, "*she must have been Countess in the reign of Edward IV.* to have enjoyed a jointure *from* that time. James, the ninth earl, died or was killed the same year as his father; but I cannot refer to the authority at present, it being jumbled up with unarranged documents;" and, on the 1st February, 1833, Sir William adds—"the question is, therefore, between

Ellen Barry, widow of Thomas of Drogheda, and Margaret O'Bryen, widow of James, his son. I would give the vote to the younger lady, and I have not much doubt of the accuracy of the decision."

On the 26th November, 1833, Sir William sent me his "original draft of the Desmond pedigree;" and as he, equally with myself, considered Sir Walter Raleigh's authority unquestionable, I proceeded to investigate whether Margaret O'Bryen was not "the pearl" we were so anxiously seeking; and a variety of circumstances seeming to lend their separate and concurring aid, a very possible case that the young widow became the old Countess was apparently made out; which having submitted to Sir William Betham, he wrote me, on the 13th March, 1834—"*I think your Margaret O'Bryen must have been the old Countess; it is scarcely possible that she could be any other*, if you consider the dates and circumstances. Pelham must have been in error."

The paper, the result of this protracted inquiry, was read at the Cork Cuvierian Society, and, in 1844, printed in the first volume of my "Olla Podrida." Some months since, I was informed that in the "Quarterly Review" of March, 1853, the question of the old Countess's identity was clearly established, which, on referring to the volume, and, thanks to the very talented and entertaining writer of the able article, it certainly is, in the person of Kathrin, daughter of Sir John Fitz Gerald, Lord of Decies, who married Sir Thomas Fitzgerald, of Drogheda, third son of Thomas, eighth Earl of Desmond. Sir Thomas succeeded as twelfth Earl of Desmond, being then seventy-six years old, the 18th June, 1529,—say 46 years after the death of Edward IV., Kathrin became his widow in 1530; so that her jointure, instead being held from Edward IV.'s time, did not commence until 51 years after his reign had closed. A record, discovered in the Rolls' Office, Dublin, dated 5th August, 1575, and which clears up the long-puzzling question, is a surrender that she made of "the castell and town of Inchequyne" to Gerrot, the sixteenth earl, in which she describes herself as "the ladye Kathrin, late Wief to Thomas, late Earle of Desmond." There is every probability that this transaction was only a family arrangement, intended, under possible contingencies, to preserve Earl Gerrot's interest in the property, and that the old Countess continued in the occupation of the castle; and, as we shall see, after the earl's forfeiture she was living there, with all her legal rights of jointure, undisturbed and acknowledged.

Her paternity from the Decies' branch is found recorded in the MS. of Sir George Carew, Harleian, No. 1425, at the British Museum; and in another MS., No. 626, of Sir George's, in the Lambeth Library, that she died in 1604.

From the manner in which the deed of 1575 had been mentioned, I understood that it was the original, and with the Ladye Kathrin's autograph attached to it. I therefore requested my very kind friend, Dr. Aquilla Smith, who has more pleasure in conferring obligations than even the most of us have in receiving, to take a drawing of the signature of the old Countess, who at the execution of the deed would have

been about 111 years of age, that I might have it engraved. On inspection at the Rolls' Office, Dublin, the record was found to be only an enrolment, and that the original was an ensealed deed—a very common mode at that time,—to which her signature had *not* been attached.

Since these his discoveries have been made public by the writer in the "Quarterly Review," and Columbus has shown us the egg standing on its end, my paper has been referred to, and designated as "starting a perfectly new *paradox* of his" (Mr. Sainthill's) "own," and that "He fixed on a certain Margaret O'Brien, wife of James, ninth Earl of Desmond, as the Old Countess. Mr. Sainthill submitted his conjecture to Sir William Betham; and Sir William Betham, from his letters, which I possess from Mr. Sainthill, appeared to adopt it, though with some hesitation, and a slight correction of dates, assigning *a later period* for the death of the *supposed* old Countess's *supposed* husband."

The extracts that I have given from Sir William Betham's original letters, which have been returned to me for reference, show that the latter passage must have been written from an erroneous recollection of, and not a present reference to, the correspondence; for so far from Sir William assigning a *later* period than I had done, on the authority of the Harleian (1487), to the death of Earl James, Sir William writes, (5th December, 1832), he was murdered "in 1467, *not* 1487;" and I submitted to *his* correction, and accepted the *earlier* date. Again, as to Sir William's *hesitation* respecting my conjecture, that Margaret O'Bryen was the old Countess, it has been seen that I was indebted to Sir William for the knowledge of her having been the wife of Earl James; and he suggested that she was much more likely to have been the Lady; and subsequently, having submitted the question to him, in his letters of the 1st February, 1833, and the 13th March, 1834, he gave his hearty concurrence to the conjecture, and that he thought she *must have been the old Countess*.

To the propriety of this conjecture of mine having been "*a paradox*" I decidedly object. Words, like coins, are estimated and taken without any reference to their original, but to their present current value; and, in general society, "*paradox*" is now understood as an absurd conclusion from certain premises. In my paper the premises were laid down by Sir Walter Raleigh, who had stated that *he himself had known the old Countess of Desmond*, who was married in Edward IV.'s time, and held her jointure *from all the Earls of Desmond since then*. This personal acquaintance with the Countess was deemed to render Sir Walter's statement unquestionable, and consequently to limit the inquiry to the period of Edward IV.'s reign, which commenced 1461, and closed 1483. I considered that it was only within this period that I could look for her; and so limited, and believing, as I do, Sir William Betham correct, that James, the ninth earl, married Margaret O'Bryen, I still think, that, whether the earl was murdered in 1467 or 1487 (the latter date making most in my favour), my conclusion was the most probable that could then be arrived at. We *now* know that the most material part of Sir Walter's limitation, "that she held her jointure from *all* the earls from Edward IV.'s time," was not the *fact;* and my

building, the result of so much inquiry and consideration, rested on a quicksand, instead of being founded, as I fancied, on a rock, most venerable indeed in age and aspect, but which has sunk with it into the depths of darkness!

We may feel assured Sir Walter Raleigh did not intentionally make the misstatement. The old Countess, most probably, told him when she was married; and as in 1589 she had actually been sixty years a resident at Inchequin—a period of time which "the oldest inhabitant" would very naturally greatly lengthen,—Sir Walter might readily assume that her jointure went back to the same reign as her marriage.

I may notice that the Harleian MS. pedigree is a very meagre and imperfect document: it goes but slightly into the collateral branches, and is extremely deficient in the male line; it does not give the wives of its second, third, and fourth earls; and of Thomas, who, by marrying Katherine M'Cormack, lost his earldom and estates, the Harleian record is only "Thomas Fitz John, 7th Earl of Desmond, Obit. at Paris, S. P. 1430," ignoring any marriage. Sir William Betham gives this expatriated earl a son (Maurice), to whom the usurper of the earldom gave the manors of Moyallow, Kilcolman, and Broghill, which estates descended from Maurice to Raymond Fitz Gerald, of Broghill, executed for high treason, by Sir Henry Brouncker, in the reign of Elizabeth; and to Thomas the twelfth earl (the Harleian's thirteenth), it gives only one wife, "Giles Da. to Connac Oge Cartie Lo. of Muskerry," ignoring the second wife, Kathrin Fitz Gerald. So that, as far as the Harleian is concerned, the existence even of our old Countess could never have been ascertained. It is very much to be regretted that Sir William Betham's original MS. has not been published; even what I extracted has much valuable information which I have not seen in any other pedigree of the Desmond family.

We now come to the first part of our inquiry,—Did the Old Countess of Desmond seek redress at the Court of Queen Elizabeth, as recorded in the Journal of Robert Sydney, Earl of Leycester?

The original MS. of the earl is at Penshurst Castle, Kent, and is believed not to have been published; but in the British Museum's additional MSS. is a volume of extracts from it, made by Dr. Birch, about 1746, and in one of these reference is made to our Countess:—

"Table-Book of Robert Sydney, second Earl of Leycester, written when Ambassador at Paris, about 1640, page 71.

"The old Countess of Desmond was a marryed woman in Edw. IV.'s time of England, and lived till towards the end of Q. Elizabeth, so as she must needes be neare 140 yeares old. She had a new sett of teeth not long afore her death, and might have lived much longer had she not mett with a kinde of violent death; for she would needes climbe a nut-tree, to gather nuts; so falling down she hurt her thigh, which brought a fever, and that fever brought death. This my cosin, Walter Fitz-william, told me.

"This old lady, Mr. Haniot told me, came to petition the queen, and, landing at Bristoll, she came on foot to London, being then so old

that her daughter was decripit, and not able to come with her, but was brought in a little cart, theyr poverty not allowing meanes for better provision: and, as I remember, Sir Walter Rawleigh in some part of his story speakes of her, and sayth that he saw her in England in anno 1589. Her death was strange and remarkable, as her long life was, having seen the death of so many descended of her, and both her own and her husband's house ruined in the rebellions and wars."

I am indebted for this extract to my friend, John Gough Nichols, who appends a note that Sir Walter Raleigh did not say that he saw her in England in 1589, but that she was living in 1589, and many years since.

As Lord John Hay prefaced an anecdote to a brother of mine:—"It is a verra cur'os fac', but it *is* a fac'," that though this remembrance of Lord Leycester's having read what Sir Walter Raleigh never printed is part of an unbroken pargraph, the writers who quote my lord's record of gossip stop short at his remembrance, and omit any mention of it. One might have thought that what the earl remembered to have read was at least equal in authority to what he remembered to have heard. But whether Lord Leycester gives us the gossip of my cousin Fitzwilliam, or of Mr. Haniot, or his own remembrance of what Sir Walter Raleigh sayth, he is clear, consistent, and uniform on one point,—that it was to Queen Elizabeth the old Countess came, and sought redress and relief. Now, Lord Leycester *is the only authority we have* that the Countess did appear at the English court seeking redress and relief, and on his authority we are required to believe that she did so. But having laid this down as history, we are then told, and required equally to believe, that our historian was mistaken as to the time of the Countess's crossing the sea, which, say they, occurred in the reign of James I. For this change of the venue, however, not a scintilla of evidence is offered; and while they endorse the earl on his opening gossip, they imperiously contradict him on the remainder. Lord Leycester wrote thirty-six years after the death of the Countess, and now, 120 years subsequent to the penning of his notable history, we are to receive their amendment of his conclusion on their mere assertion. Surely, if he knew little in 1640, they know less in 1860. He had the tittle-tattle of his day, but they have only his, and of this they choose to make '*a mingle-mangle*'* of their own. To admit the change of the supposed pilgrimage of the Countess from the reign of Queen Elizabeth to that of King James on their no-authority, would indeed be transforming what they claim as history into fiction, but still requiring it to be accepted as history,—accepting Kenilworth as correcting Edward VI.'s diary.

The MS. "Bib. Cotton, Nero. c. 10, p. 55, Plut 6, D," in the British Museum, is King Edward VI.'s Diary or Journal of his reign, entirely in his own handwriting, and from which I copied this extract:—

* Latimer's Third Sermon before Edward VI., March 22, 1549.

"1550. June 4.—S. Robert Dudeley, third sonne to th' erle of Warwic, maried S. Jon Robsarte's daughter, after which mariage ther were certain gentlemen that did strive who should first take away a goses heade, wich was hanged alive on tow crose postes.*

"5. Ther was tilt and tornay on foot, w^t^ as great staves as the run w^t^al on horsbake."

That the Countess went over to England in her latter days is brought before us as an historical fact; and no counter-authority being even referred to, Lord Leycester's narrative must be taken altogether as he has given it to us, or rejected altogether. We, therefore, now enter on the examination of the question as the Earl of Leicester has laid it down,—Did the old Countess of Desmond repair to the court of Queen Elizabeth, seeking redress and relief?

We must first collect such scattered notices as we can respecting her that bear on our inquiry.

We are indebted to the extensive researches of the widely-informed writer in the "Quarterly" for one article of very material importance. At page 342, he writes:—"A MS. state paper, dated 1589, enumerates among the forfeitures of the attainted Garrett 'the castle and manor of Inchiquin, *now in the hands* of Dame Katherine Fitz John, late wyfe to Thomas, sometyme Earl of Desmond, for terme of lyef, as for hir dower.' The desolated possessions of the rebel had been given away, the grantees undertaking to settle English colonists in the land; but having failed in this engagement, they were now called on to fulfil it. Sir Walter Raleigh, who was in this category, after specifying the leases he had made, thus concludes his rejoinder:—'There remaynes unto me but an old castle and demayne, which are yet in occupation of the old Countess of Desmond for her jointure.'"

No reference is given where this state MS. is preserved, and I have been unsuccessful in searching for it. I accept with the most perfect assurance the extracts in the "Quarterly;" but I wished to know the whole contents of the document. In looking for it at the State-paper Office, London, we met with some very interesting papers respecting the Countess Ellynor, widow of the rebel Earl Garrett, which will be appended to the present inquiry. An opinion has been expressed that they may have given rise to the Earl of Leycester's gossip; but that is no concern of mine.

This MS. State paper, it is to be remembered, is an official document, addressed to Queen Elizabeth's government (most probably to Mr. Secretary Walsingham), and by it the forfeited estates of the Earl of Desmond are returned to the crown, in 1589, as legally charged with a jointure to our Countess; and Sir Walter Raleigh, in his rejoinder,

* The goose was hung by its legs, the head downwards, at a height only to be reached by the "gentlemen," riding at full speed, springing up from the saddle, and getting such a clutch at the goose's neck as to drag its head off. According to our modern notions, the twenty-four blackbirds, who all began to sing when the baked pie was opened, were a prettier sight to set before a king.

equally official, states that the Countess then occupied "the castle and demayne" of Inchiquin in her legal right of jointure.

In the Calendar of the Patent Rolls of Ireland of James I., printed by the Record Commission, page 37, we have the enrollment of the deed of sale by Sir Walter Raleigh of his Irish property to the afterwards great Earl of Cork :—

"CXXIV.—41. Deed dated 7 Dec. 1602, 45th Eliz. between Sir Walter Raleigh, Knt, Captain of the Queen's Guard, Lord Warden of the Stannaries in Devon and Cornwall co^s, and Governor of Jersey isle and castle, and Richard Boyle, esq., Clerk of the Council in Munster, being a native of England, whereby Sir Walter, in consideration of 500^l Eng. before hand paid, 500^l to be paid at Michaelmas 1603, and 500^l to be paid at Easter 1604, demised to said Boyle the lands following."

After reciting the lands and all other rights, &c., "the inheritance of the said Sir Walter in Ireland" follows, "excepting the lands, &c., which are stated in a schedule annexed to this indenture, to have been sold or leased, in fee-farm, or for a term of years,—To hold for ever," &c.

By this deed, enrolled no doubt by Mr. Boyle for his own security, we have this recorded proof, that his legal powers on the property were subject to Sir Walter's previous leasing, &c. Then follows, at p. 38 :—

"CXXV.—45. Schedule of Deeds, &c., referred to in the preceding grant," among which is, "To John Cleaver, Gent., a plowland called Covlid-clofyma, and other lands: 21 July, 30th Eliz."

To the Rev. Samuel Hayman, of Youghal, whose history of that borough, from its earliest period to the present, records an accumulation of interesting facts which the most laborious and judicious researches only could have dug out of the dusty and mouldering manuscripts of past ages, I am greatly indebted for his very kind permission to make extracts from a copy which Mr. Hayman made from one original counterpart of this lease to Mr. Cleaver, granted by Sir Walter Raleigh, of lands on which evidently the old Countess had a first, but only a life charge; as on her death the rent payable to Sir Walter doubled, and the tenant was then also to provide for Sir Walter Raleigh's service an efficient lighthorse-man and equipments. It is amusing also to remark the implied expectation that the Countess's life would not extend to five years beyond the date of the lease; and, as we suppose she was then 124, the expectation was not very extraordinary. She did, however, live for sixteen years longer, we may be quite certain, much to the satisfaction of the tenant.

Extracts from Sir Walter Raleigh's Lease of Coullie Clofina.

"This Indenture made the one and twentieth day of July, in the thirtith yeare of y^e raign of o^r Sou'aign Ladie Elizabeth by the grace of God, of England, France, and Ireland, Queene, Defender of the Faith, &c., Between the honorable Sir Walter Ralegh, Knight, Lord Warden of her Ma^tie^s Stannaries in ye Counties of Devon and Cornwall, & one of the principal undertakers with her Ma^tie^ for ye repeoplinge & inhabitinge

ye Attainted & excheated lands in ye Counties of Cork and Waterford, in ye Province of Munster, in her highnes Realme of Ireland of thone ptie. And John Clever of London Gentleman of thother ptie, Witnesseth, that the said Sir Walter Ralegh for divers good causes and reasonable considerations, &c., doth demise graunte betake & and to farme lett unto the said John Clever, All that Ploughland commonly called or knowen by the name of Coullie Clofinia, sett and beinge within the Barrony of Inchequyn in ye Countie of Corke aforesaid with foure hundred acres of arrable land & ferme wodes thereunto belonginge, &c. &c. (But reserving to Sir Walter Ralegh the Royalties and all wracks of the sea that happen within the same premises.) To have and to hold all and singular the same demised premises and every pcell thereof with the appurtenances, (except as before excepted,) unto the said John Clever, his Executors and Assigns, from the feast of Sainct Michaell Th' Archaungell next ensuinge the date hereof unto thend and tearme of one hundred yeares from thence next ensuinge and fully to be compleat and ended, yelding and payinge therefor yearely during three of the said yeares (viz) from thend of the yeare of our Lord God w^ch^ shall be One Thousand five hundred foure score, and nine, and from and after the decease of the Ladie Cattelyn, old Countesse Dowager of Desmond Widdowe, until thend of the yeare of our Lord God w^ch^ shalbe (1593,) unto the said Sir Walter Ralegh, his heires or Assignes, five pounds of good and lawful money of England at two feasts or tearmes of the yeare, that is to say at the feaste of Thannunciation of our Ladie St. Mary the Virgin, and St. Michaell Tharchaungel, by even portions, and also fower Capons or Hennes, at the feasts of Easter and Christmas, if they be demaded AND ALSO yeldinge and payinge therfor yearely unto the said Sir Walter Ralegh his heires or Assignes duringe the residue of ye said terme begynnyne from and after ye Decease of ye said Countesse, and after thend of the said year of o^r^ lord God which shalbe (1593) the yearly rent of Tenne Pounds of lawful money of England at the said two feasts of th Annunciation of o^r^ Ladie St Mary the Virgine and St Michaell Tharchaungell w^ch^ of them shall first happen after the death of the said Countesse, and after thend of the said yeare of o^r^ Lord God (1593) the first payment therof shall begyne, and also fower capons or hennes at the feasts of Easter and Christmas, if they be demanded. *And if it shall* happen eyther the said yearely Rents of five Pounds or tenne pounds, to be behind and unpaid, &c., &c. *And the said* John Clever for himself, &c., &c., covennteth & graunteth to & with the said Sir Walter Ralegh his heires and Assignes by theis pnts to find from tyme to tyme after the decease of the said Countesse, and after the end of the said yeare of o^r^ Lord God wh^ch^ shalbe (1593) a sufficient light horse man and furniture, to him the said Sir Walter Ralegh his heires and assignes, in the affaires of the Crowne of Ireland."

[Mr. Cleaver then further covenants to build a mansion or dwelling house in and upon the same premises; and also to enclose with hedge, ditch, and quicke sett one hundred acres at least of the same premises; and to pay a further rent of one penny per acre for boggy, mountaine,

or barren heath, converted into good ground, should y^e^ Queenes Ma^tie^ demand one farthing or halfpenny per Acre of Sir Walter Ralegh for the improved land.]

"In Witness whereof the said Ptics to theis Pnt Indentures, interchaungablie have putt their hands and Seales, Yeoven the day and yeare first above written (Anno Dni) 1588.

"W. Raleigh."

—*From the original lease, copied by S. H.*

The manor of Inchiquin is now the property of Lord Ponsonby, and among his Lordship's muniments is the copy of a subsequent lease of Sir Walter Raleigh's, of another part of the manor, in which the rights of the Old Countess are equally recognized, but with the same implied certainty that her life was not to extend beyond, A. D. 1593, if indeed so long.

"This indenture, made the 1st day of February, in the one-and-thirtieth year* of the reign of our Sovereign Lady Elizabeth, by the grace of God, Queen of England, France, and Ireland, Defender of the Faith, &c, Between the Honorable Sir Walter Ralegh, Knight, Lord Warden of the Stannaries in the counties of Devon and Cornewell, one of the principall undertakers with Her Majestie, for the repeopleing and inhabitinge escheated lands in the counties of Corke and Waterford, in the province of Munster, in Her Highnes realme of Ireland of the one partie, and Robert Reve of Bury Sainte Edmonds in the countie of Suff. gentleman, and Alice his wife of the other partie witnesseth, that the said Sir Walter Ralegh, &c., &c., &c., dothe give, grant, enfeoffe, and confirme unto the said Robert Reve and Alice his wife, all and singular the lands, tenements, and hereditaments whatsoever, called and knowne by the name of the Plougheland of Coullye Ffoina, within the barony of Inchequyn Ralegh in the countie of Corke aforesaide. And also if there be not 400 acres of arable grounde in Coullye Ffoina aforesaid, (the said 400 acres to be measured by the standard of England), then the said Sir Walter Ralegh hath given &c., &c., to the said Robert Reve and Alice his wife, so many acres of arrable grounde next adjoining, either in Cloyne, Ardes, or in Poull Moore, &c., &c., as shall make up the full number of 400 acres, &c., &c., &c. To have and to holde &c., &c., to the only use and behoofe of the said Robert Reve and Alice his wife, their heirs and assigns for ever, &c., &c., &c. Yieldinge and paying therefore yearly from and after the decease of y^e^ Lady Cattelyn oulde Countess Dowager of Desmond, Widdoue, and from and after the end of the year of our Lord God, which shall be one thousand ffive hundred ffourscore and nyne, untill the end of the year of our Lord God, which shall be, one thousand ffive hundred and ffourscore and thirteen, five pounds of lawful money of England, at two feasts or termes in the year, that is to saie, at the feasts of Sainte Michael the Archaungell, and the Annunciation of our Lady Sainte Mary the Virgin by even and equal portions, the first paymente thereof to begin at either of the said feasts, which of

* 1589.

them shall first happen after the death of the said Lady Cattelyn, old Countess Dowager of Desmond, and after the end of the said year of our said Lord God, which shall be one thousand five hundred and ten, &c., &c. And yielding and paying from and after the decease of the said Countess, and after the end of the said year of our said Lord God, which shall be one thousand five hundred fourscore and thirteen, the yearly rent of £10, of lawful English money, at the said two feasts, &c., &c., the first payment thereof to begin at either of the said feasts, which of them shall first happen, after the death of the said Countess, and after the end of the said year of our Lord God which shall be, one thousand five hundred fourscore and thirteen, &c., &c. And the said Robert Reve for himself, &c., &c., doth covenant, &c., with the said Sir Walter Ralegh, &c., by these presents, to find from time to time, after the decease of the said Countess, and after the end of the said year of our Lord God, which shall be one thousand five hundred fourscore and thirteen, a light horseman and furniture serviceable, to serve the said Sir Walter Ralegh and his heirs, in the affairs of the Crown of England, or otherwise in defence of the country, against private or public enemies."

Those who so far accept Lord Leycester's gossip, that the Countess was driven to England, but, on their own authority, place the event in a different reign from their historian, account for the necessity of her appearing personally at the English court, by assuming that her right of jointure was disturbed by Earl Garrett's attainder; that Sir Walter Raleigh generously allowed her to remain in the receipt of it, but that she was ousted from her residence and rents by Mr. Boyle (subsequently the celebrated Earl of Cork), when he purchased Sir Walter Raleigh's Irish estates; and that as she had come into the jointure in 1534, the English government passed her rights over, as considering them long extinct. The latter supposition has no ground to stand on; for, as the "Quarterly" shows us, the English government only became acquainted in 1589 that *a* Countess of Desmond, but not *the* rebel's wife, had the lien of a jointure on the forfeited estates. Its legality was admitted; and as Queen Elizabeth died March 24, 1603, in whose reign the Earl of Leycester states that the Countess went over—and I must repeat that the earl is the only authority there is that she ever left her castle of Inchiquin—the period in which the event, had it happened, could have occurred, was only fourteen years; during which time neither Elizabeth nor her ministers would have lost their recollection of her admitted legal right of jointure, connected as it was with such an important affair as the escheated Desmond estates, of which Fynes Moryson, at part ii., book i., chap. i., pages 4 and 5, gives the granting away to undertakers of 237,672 acres, reserving a yearly rent to the crown of £2,272 18*s.* 6*d.*; and the restoration to others of 336,956 acres; the whole forfeited by the earl and his confederates being 574,628 English acres. And with this acquiescence of Queen Elizabeth's government to the legal right of the old Countess Dowager to her jointure on the forfeited Desmond estates, I cannot sup-

pose that any lawyer would admit the Earl of Leicester's *gossip* to be worth a moment's consideration.

Be that as it may, Sir Walter Raleigh's lease to John Cleaver, and the lease to Robert Reve, clearly establish that the Countess then held her jointure by public acknowleged legal right, and not by sufferance or generosity. Her life-interest in the lands let by Raleigh to Cleaver and Reve are equally recognized by the lessor and the lessee, the landlord requiring, and the tenants engaging, to pay double rent, and to furnish and maintain a light-horseman after the decease of the old Countess Cattelyn, which we may fairly presume was considered by both parties equivalent to the interest which the Countess had in these lands: therefore, whenever Mr. Boyle purchased Sir Walter Raleigh's estates, he took them subject to this lease; and there is not the slightest shadow of evidence (supposing the Countess was then living) that he made any attempt to disturb what these papers prove was her acknowledged legal rights; for this supposed eviction is only another of the assumptions to support Lord Leycester's gossip; but if Mr. Boyle had made the attempt, he would have been also resisted by the London tenant, Mr. Cleaver, who had a beneficial interest in the continuance of her life-interest, and, being close to the English court, was not a person to be injured with impunity.

From "CALENDAR OF STATE PAPERS, DOMESTIC SERIES, James I. 1603–1610." London, 1857.

Page 146.—*Release to Richard Boyle for a payment of a debt of* £1000 *for Sir Walter Raleigh*, 1604, *Aug*^{t} 26.—[*Ind. W. & B. H.*], *page* 41. —*Calendar of Irish Patent Rolls, James* 1st, *page* 41, 10th *May*, 2nd [*year of reign*, 1604].—*Grant from the King to Sir Richard Boyle, Kt.*

This is a confirmation of Sir Walter Raleigh's deed of sale of his Irish estates to R^{d} Boyle, Esq^{re} for £1500; of which £500 was paid beforehand, £500 was to be paid at Michaelmas, 1603, and £500 to be paid at Easter, 1604; but Sir Walter being (justly or otherwise) attainted for treason against James I., Sir Richard Boyle, as we see, paid the two sums of £500 to the Crown, and very wisely got a grant of his purchase direct from the King. This grant commences with the barony, manor, and castle of Inchiquin; and among the denominations is that of "Cooly-Clough-Finnagh," clearly the land let by Sir W. R. to Mr. Cleaver, shewing that it was part of the old Countess Kathrin's jointure-lands.

In the enrolment of Sir Walter Raleigh's sale of his Irish estates to Richard Boyle, Esq., Rot. Pat. 1°, James I., p. 37–38, is a schedule annexed of all the leases granted by Sir W. R., 33 in number; the first dated 18th February, 30th Eliz. (1588), the last 27 May, 40th Eliz. (1598). The fourth lease in date is "To John Cleaver, gent., a ploughland called Coolid Clofyma, and other lands, 21st July, 30th Eliz." The deed of sale is dated 7th December, 1602, 45th Eliz. We have there-

fore in this roll the highest legal evidence that, fourteen years subsequent to its date, the existing validity of Cleaver's lease, preserving the old Countess's rights, is stipulated by Sir W. R. who sells, and recognized by Mr. Boyle, who purchases the property; and that Mr. Boyle enrolled his purchase in 1603, the new King, James I., being then on the throne, whose ministers (the same persons, be it remembered, who were Queen Elizabeth's) are assumed by the Earl of Leicester's followers, "to have overlooked the old jointuress of seventy years' possession, and in issuing the new patent to have ignored the poor old widow;" they themselves overlooking and ignoring that, so late as 1589, on their own shewing, these very ministers had admitted the Countess Kathrin's legal possession of the jointure lande.

From "*Memoirs of the illustrious Family of the Boyles, Dublin*, 1754." Pages 13 and 14.

The Lord President of Munster, Sir George Carey (Carew), after the taking of Beer Haven Castle from the Spaniards, "told Mr. Boyle that he resolved to send him into England, to obtain leave from her Majesty that he himself might repair to her royal presence, and give her a full account of the posture of her affairs in Ireland. At the same time he advised him to buy all Sir Walter Raleigh's lands in Munster, and offered to befriend him in the purchase. Accordingly, when he dispatch'd him for England, he sent two letters by him: one of these was directed to Sir Robert Cecill, Secretary of State, in which he gave a very advantageous account of Mr. Boyle's great abilities, and of the services he had done his country; in consideration of which, he desired the Secretary would introduce him to Sir Walter Raleigh, and recommend him to that great man, as a proper purchaser for all his lands in Ireland, if he was disposed to part with them. The Lord President's other letter was directed to Sir Walter himself, acquainting him that the bearer, Mr. Boyle, was a person capable of purchasing all his estate in Ireland, which he presumed he would be glad to dispose of, since the management of it in those troublesome times gave him a great deal of trouble, and the income it produced was very inconsiderable. These letters occasioned a meeting between Sir Robert Cecill, Sir Walter Raleigh, and Mr. Boyle; at which the two last, by the mediation of the first, soon struck up a bargain, and proper conveyances were executed between them. These lands, though they had yielded but little to Sir Walter Raleigh, became soon after (when the war in Ireland was fully ended) a very noble estate to Mr. Boyle, who had purchased them. 'And this (says he in his Memoirs, when he was Earl of Cork) was a third addition and rise to my estate.'"

From Calendar Irish Patent Rolls, James I., page 41, 10 *May* 2*nd* [*year of reign*, 1604].—*Grant from the King to Sir Richard Boyle, Kt.*

This is a confirmation of Sir Walter Raleigh's deed of sale, Sir Richard paying the King the two sums of £500, which he was to have

paid to Sir Walter Raleigh in 1603 and 1604. The grant commences with the barony, manor, and castle of Inchiquin; and among its denominations is that of Cooly-Clogh-Finnagh, clearly the land let by Sir Walter to Mr. Cleaver, and shewing that it was part of the jointure-lands of the old Countess Kathrin.

I submit that I have now shown legal proof that the Countess could not have been disturbed in the enjoyment of her jointure, and I entirely acquit the Earl of Cork from the groundless aspersion of having even attempted to deprive her of it.

We will now take into consideration the negative evidence, deduced from the notices of the old Countess of Desmond in the works of Sir Walter Raleigh, Lord Bacon, and Fynes Moryson.

From Sir Walter Raleigh's "History of the World," book I., chap. v., sec. 5, folio edition, 1614, p. 66:—

"I myself knew the old Countess of Desmond, of Inchiquin in Munster, who lived in the year 1589, and many years since, who was marryed in Edward IV.'s time, and held her joynture from all the Earls of Desmond since then; and that this is true all the Noblemen and Gentlemen of Munster can witnesse."

Lord Bacon twice notices the Countess; but it appears to me clearly that in both instances he derives his information almost entirely from Fynes Moryson, whose "Itinerary" was published six years previous to Lord Bacon's earliest mention of her, which is in his "Historia Vitæ et Mortis." London: 8vo, 1623:—

"Hiberni præsertim sylvestres, etiam adhuc sunt valde vivaces: certe aiunt, paucis abhinc annis Comitissam Desmondiæ vixisse ad annum centissimum quadragesimum, Et ter per vices dentiisse. Hibernis autem mos est se nudos ante focum butyro salso et veteri fricare et quasi condire."

[The Irish, particularly those who live in the country, even now, are very long lived. They say for certain that within these few years the Countess of Desmond lived to her 140th year, and cast her teeth three times. But it is a custom with the Irish, placing themselves naked before a fire, to rub, and as it were season, their bodies with old salt butter.]

On the latter part of this extract I may remark, that although Lord Bacon's rule of inductive philosophy did not allow him to express an opinion on what he had not witnessed and tested, yet the passage is evidently given as a probable explanation of the means by which the Countess's years were so wonderfully extended; and with this great philosopher's implied conviction, considering it in a mercantile point of view, it would seem very desirable that the medical body should carefully test this prescription and practice of the olden time: for should it prove so greatly conducive to longevity, not only would the faculty benefit, and a serious stimulus be given to the production of butter, but the class of butter which is now almost valueless, that which has over-

stood the market, would, by being stored for some years, become of more value than 'New Rose'* of the present year, and brands of fifteen or twenty years past rival in price and attraction vintages of the same dates, while tubs of bog-butter would literally prove nuggets of gold!

Should these possibilities become realities, though this paper may fail in its intended purpose, it will not have been written in vain.

With, however, that conscientious impartiality that all historic inquiries should command, I feel bound to state that this implied opinion of Lord Bacon is directly impugned by the present representatives of old Thomas Parr, who in the "Life" they have published of him (we are to presume from his original documents) state, "that during Parr's stay with the Earl of Arundel he was introduced to the celebrated Countess of Desmond, to whom, it is believed, Parr gave a supply of the medicine by which he maintained his vigour to such an extreme period of life; and this is extremely probable, as the Countess lived to the amazing age of 145 years."

We are thus called to exercise our judgment between a fact implied and a fact probable,—the rival merits of an outward application on the human frame of animal matter, and an inward action on the human frame of vegetable matter—between the butter firkin and the pill-box. The result is immaterial to my inquiry; and, unconscious of bias, I must say, I think that the firkin carries most weight.

Lord Bacon's next notice is in his "Sylva Sylvarum; or, A Natural History in ten Centuries." London: folio, 1627; page 194, century 8, "Experiments in consort touching Teeth," No. 755.—"They tell a Tale of the old Countess of Desmond, who lived till she was seven score years old, that she did dentire twice or thrice: casting her old Teeth, and others coming in their place."

We now pass on to Fynes Moryson's visiting Youghal in 1613, and note what he learned there respecting the Old Countess, then dead. And it will be observed, that Lord Bacon is entirely indebted to Moryson for the information of the Countess's age, and renewing of her teeth. Sir Walter Raleigh only mentions her being married in the reign of Edward IV., and this era accords with her reported age at Youghal. I think the two, but quite dissimilar, notices mutually support and confirm each other.

From "Fynes Moryson, his Ten Yeeres' Travel," &c., folio. London, 1617, Part ii., Book iii., chap. ii., p. 299. "Ireland."—"In the yeere 1613, by the intreaty of my brother Sir Richard Moryson (Vice-President of Mounster), and out of my desire to see his children God had given him in Ireland (besides some occasions of my private estate), I was drawne over againe into Ireland, where we landed the ninth of September, miraculously preserved from shipwrack. For at nine of the night, (beinge darke at that time of the yeere), we fell upon the coast of Ireland, and not well knowing the coast, but imagin-

* The highest brand in the Cork butter market.

ing it to be Yoghall Port, we tacked about, to beate out at Sea, the night following. But having some howers before sprung a Leake, and our Pumpes being foule, so as they would not worke, we had no hope to live so longe at sea, and againe not knowing the coast, wee durst not venture to put in upon it, besides that in case it were Yoghall Harbour, our best fortune was to enter a barrd Haven by night. In this distress by Divine Providence, we were preserved, the Moone breaking out through the dispersed clouds, and shining so bright, as our best Marrines easily discovered the Harbour of Yoghall, and the tide serving happily, we passed the barre into the same. And the next morning we might see the danger we had escaped most apparent; for our ship was so farre unable to indure the waves of the sea, with her great leake and the foulenesse of the Pumpes, (if we had been forced to keepe abord till the next daies light might make us know the coast,) as the same night she had sunke in the quiet Harbour, if the Marriners had not chosen rather to drive her on ground."

Part iii., Book i., chap. iii., page 43. "Opinions of Nations. Long Life."—"The Irish report, and will sweare it, that towards the West, they have an Iland, wherein the Inhabitants live so long, as when they are weary and burthened with life, their children in charity bring them to die upon the shoare of Ireland, as if their Iland would not permit them to die. In our time the Irish Countesse of Desmond, lived to the age of about 140 yeeres, being able to goe on foote foure or five miles to the Market Towne, and using weekly so to doe in her last yeeres, and not many yeeres before shee died, shee had all her teeth renewed."

Our first concern now is to get the old Countess and her decrepit daughter, the former walking, the latter in a little cart, up from Bristol to London, at some period of some year intervening between 1589, when Sir Walter Raleigh knew her at Inchiquin, and 1603, when Queen Elizabeth died.

As her daughter may have been 120 years of age, we may allow her to have been decrepit, and that she required the little cart; but the question naturally arises, why did she accompany her mother? Scarcely as a protectress. The pedigree of the Desmonds, given by the "Quarterly," states, that the old Countess's only child, a daughter, was married to Philip Barry Oge; and as her father, Earl Thomas, had a son and grandson, her marriage portion would have been in money. Earl Garrett, in 1574, when making the feofment of his estates, settles "the sum of one thousand pounds to the preferment of evrie of my daughters, which at the time of my death shall not be preferred."—Cotton MSS., Titus, B. xiii., page 195.

The Countess herself had only a life-interest in the jointure, consequently neither on her own nor on her mother's right could Mrs. Philip Barry Oge have any claim on government. If the Countess had been decrepit, and the daughter, at the age of 120, strong and courageous, we should have to admire filial piety braving all dangers. But my Lord Leicester's narrative reverses all this, and we commence with the absurdity of the Countess encumbering herself with a helpless companion, for no

earthly purpose; but so my lord wills, and we depart from Bristol, Mrs. Barry in her little cart, and Dame Katherin trudging on the road-side. But why walk, with only one in the cart? It is hard to fancy such a tiny vehicle that would not allow room for two old ladies. Or, when it had to be purchased, why had not one been selected that would accommodate two? Well, as our heroine now takes to the tramp, what time are we to allow for the journey, say about 120 miles? When at Inchiquin, once a week she walked eight or ten miles, but the present, we infer, was daily continuous walking. What the state of the roads then were, it is not easy for us to imagine, when eighty years ago the coach from London to Hitchen, distance thirty-four miles, took twelve hours to get over the ground. Thus far we have considered the difficulties. Come we now to dangers. The insecurity on the English roads is of historic notoriety. Latimer, preaching before Edward VI., 22nd March, 1549, touches on the subject in terms which evince how general it was—"What, princes, thieves? Had they a standing at Shooter's Hill, or Standgate Hole to take a purse? Did they stand by the highway side? Did they rob or break open any man's house? No, no; that is a gross kind of thieving. They were princes; they had a prince-like kind of thieving. They all love bribes."

As to the unsafety of the English high roads at the end of Queen Elizabeth's reign, we have the contemporary evidence of Fynes Moryson. In his Precepts for Travellers, Part iii., Book i., after detailing the dangers of foreign travel, at page 28 we come to those at home—"Theeves in England are more common than in any other place, so far as I have observed or heard, but having taken purses by the highway, they seldome or never kill those they rob." In the preceding page, Germany, he recommends the stranger, if assaulted by thieves, to "defend himselfe the best hee can, for they alwaies kill those whom they rob." So that, while the purse was in greater danger in England than anywhere else, life was less so. Rather cold comfort for our old Countess and her decrepit daughter; but still some, comparatively. Under any circumstances, whether continuous or at intervals, the Countess's walk from Bristol to London would have required twelve days at least; and with Morryson's report as to the abundance of "thieves," there can be no doubt these "unprotected females" would have been plundered a dozen times successively, if the first gentlemen of the road who met them had left them anything but their skins; and when eased of their money, little cart, and horse, if not of most of their clothes, how were they to proceed on their journey to London? If Lord Leycester had studied how to compose a tissue of deepening improbabilities, I do not think he could have exceeded those I have now submitted for consideration, and so we dismiss this part of his gossip. It is difficult in these days to realize to our thoughts the discomforts and dangers of travelling in England, even at the close of the last century. In the very neighbourhood of London, at that time, no person unarmed could pass with any safety over Hounslow Heath (across which the Bristol road to London ran), Bagshot Heath, Shooter's Hill, Standgate Hole, Finchley Common, and Wim-

bledon Common, which were amongst the most notoriously dangerous localities. I was at school near Finchley, and remember one of two highwaymen who stopped the carriage of a traveller being shot dead. At length, about 1815, armed horse patrol took charge of the roads, and the evil was abated.*

Such difficulties and dangers had they ever really been encountered, our travellers in the little cart and on foot would have had their pilgrimage ended for them somewhere on the Bristol road, a long way from London. But Lord Lecyester wields a magician's rod, and as in its power they are brought safely to London, roads and robbers notwithstanding, we must per force attend their steps—a veracious chronicler,—and, as best we may, faithfully record how the Countess prospered in her suit.

Remembering that they landed at Bristol in great poverty, and had been at least a fortnight on the journey, the purse could not but have become fearfully light. Consequently, she must look round for assistance; and, most fortunately, her friend, Sir Walter Raleigh, who had shared her hospitality at Inchiquin Castle in 1589, was now stationary in London, high in favour at court, and, in addition to previous preferments, had become captain of the guard to the queen, and so continued during Elizabeth's reign. Of course, the Countess bent her steps to his residence, "claimed kindred there, and had her claims allowed." We have seen, by Sir Walter's lease of 1588, that he not only acknowledged, but guarded her legal claims on the lands he let to Mr. Cleaver. No person, therefore, could be better acquainted with her rights; and few at that period had more court influence to assert them than the warrior, statesman, and philosopher; and, be it told to his honour, that he instantly and heartily took up her cause, and fought her battle with all his heart and head.

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* Since writing this paper, I find my statement of the dangers of travelling at this time most fully borne out by an article in the "Gentleman's Magazine" for January, 1861, founded on the records of the county of Middlesex of the sixteenth century, p. 31.

Unfortunately this reprehensible course had been followed by men whose after eminence gave peculiar eclat to such depravity, and rendered it difficult for the popular mind to regard a gentleman highwayman with the same feelings that would have been shown to an ordinary thief. Eminent courtiers had been recognised, in spite of their masked faces, on the road: even the dignity of justice was marred by the fact that some of her administrators had, in their youth, followed such vicious ways. Sir Roger Cholmeley and Sir Edward Popham were both said to have occasionally practised as gentlemen highwaymen. A party of wild young fellows being taken before Chief Justice Cholmeley, one of them had the effrontery to remind the judge of his early irregularities.

"Indeed," answered he, "in youth I was as you are now, and I had twelve fellowes, like unto myselfe; but not one of them came unto a good ende, and, therefore, follow not my example in youth, but follow my counsel in age, if ever ye think to cum to this place, or to these yeares that I am cum unto, lest you meet with povertie, or Tibburne on the way."

"With bad roads and dense thickets yet skirting the suburban thoroughfares, the pursuits of the highwayman were unattended with much danger. He had few risks, and had little fear of interruption."

Would that the chronicler* of the Countess's youthful court days had survived, or that his mantle had descended to a kindred spirit, to record the scene, when, at Sir Walter's powerful intercession, he was permitted to bring his friend, the old Countess Cattelyn to the foot of the throne, there humbly to supplicate her dread Sovereign's grace and favour for the redress of wrongs, and the restitution of her jointure, mannors, and castle. Try—how vain soever the attempt—try to picture the excitement, the wonder, and the curiosity of the court of Elizabeth, at the appearance of this almost, as would seem, antediluvian lady. A belle of the White Rose era, a dynasty dethroned by the Tudors, time long since out of mind. Yet the knowledge of the gay splendour of Edward IV.'s revels had come down to them, as those of Charles II. have come down to us; and to really look on one who had shone in its dances, a partner with Royalty! And with these thoughts, a sigh may have arisen from many a fair damsel, as she contrasted in her mind the traditional, unchecked mirth and freedom of Edward's palace with the stately and severe ceremonial of the Virgin Queen's. Nor is it unlikely that in the circle were some bold turbulent spirits whose minds reverted to the up and stirring times of the wars of the White and Red Roses, when the conquering swords (always our own), carved out for their owners the rich domains of the vanquished. Neither can we doubt, as Sir Walter recounted the wrongs of the old Countess to the Queen, that the blood of many a gallant youth boiled up indignantly, while he fervently wished—and would have intreated, had he dared—that his Sovereign Lady, the great Gloriana of chivalry, would select him as her Arthegall,† to restore Inchiquin to its venerable owner, and inflict stern justice on the felon oppressor. What, too, may not have been the thoughts of the old Countess herself, actually comparing the rich gaiety of the past with the stiff splendour of the present,—Elizabeth Wydeville with Elizabeth Tudor,—a queen Consort in company with her handsome, voluptuous husband, their bevy of lovely daughters, fast rising into womanhood, equally promising sons, on both sides bands of relatives, and so circumstanced, with no other feelings than the enjoyment of the surrounding gaiety with a Queen Regnant, the last in direct line of the Tudors, choosing to stand alone in the world, not even to acknowledge a successor; and in a stormy political period, charged with the safety of an empire, whose cares the vigilance of no gentleman usher could exclude even from the presence chamber: while to Elizabeth herself the suppliant must have had a yet more thrilling interest, only short, we may believe, to the appearance of a spirit from the realms of the departed. Before her was a friend and companion of Elizabeth of York, by her brother's death the rightful heiress of the Plantagenet crown, and through whose blood Elizabeth Tudor now lawfully wore it. Think also of the suit, an appeal to the justice of the Sovereign for the restoration of a jointure which

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* Commines.

† 5th Booke of Spenser's "Faery Queene," the legend of Arthegall, or Justice.

commenced when Elizabeth was an infant nestling on her mother's breast. Look, a little to the right of the dais; there stands the Queen's prime minister, the younger Cecil, on whom, next to the Sovereign Ladye, every eye is bent, and to whom every knee sinks: secure of his present greatness during this reign, with its reversion equally so for the next, whose expectant rests on Cecil alone to obtain the throne, and when obtained to keep it—and Cecil did both. How observantly tranquil is that keenly penetrating countenance! What may be the within of this splendid exterior, the hopeless envy of so many around? A weakly body, a wearied mind, a saddened spirit. Seek we his own estimate of the scene in which he figures only second? Walk into the Mausoleum he added to Hatfield Church as an earthly resting-place for himself and descendants; and you stand, as I have done, before his tomb, most probably executed in his life-time, a circumstance of frequent occurrence later than his period.*

Can we suppose that, as Cecil's attention rested on the kneeling Countess, the sight could fail awakening trains of thought and comparisons of difference? Her vital stamina, which had upheld its frame for a period doubling the allotted life of man, and who had passed her fourscore ere his parents were united in marriage, yet seemed at this moment more vigorous in health than he felt himself to be. And great may have been the aiding placidity of her spirit, which, had it been otherwise tempered, would, as a rusty blade, long since have fretted through and destroyed its scabbard. Until the present, her troubles probably were limited to roguish tenants and marauding kerns; while his daily, never-ending labours, were to countermine Spanish aggression and domestic intrigue.

But, whatever were the trains of thought raised by the appearance of the old Countess, the result was the same, an intense interest in her

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* When I visited the Church of Saint Martin's, Stampford, where the great Lord Burghley and the elder branch of the Cecils are buried, the sexton directed my particular attention to the monument of "The Travelling Earl," which my informant stated the earl himself had brought from Italy; and the "History of Burghley House and Saint Martin's Church" describes it as "a lofty and splendid Monument of white and veined marble, nearly thirty feet high, erected to the memory of John, fifth Earl of Exeter, and his Countess. It was executed by Monnot, the Italian sculptor, under the immediate direction of the earl himself." On the monument is inscribed:—

"Petrus Stephanus Monnot
fecit Romæ MDCCIV."

But as the earl died in 1700, and the countess in 1703, the monument, though ordered by the earl, was not erected until after the death of the countess.

It is an open altar-tomb, of white marble, the upper table supported by four female figures, representing Fortitude, Justice, Temperance, and Prudence. On this table, the head resting on a superb cushion, is the full-length, life-size effigy of the Right Honourable Robert Cecil, Earl of Salisbury, Lord High Treasurer to his Majesty, and Knight of the Most Noble Order of the Garter, in all the trappings of peerage, office, and knighthood. Immediately below, on a table of black marble, is spread a coarse straw mat, the unrolled end forming a pillow, on which lies extended a skeleton—thus contrasting present humility and past grandeur, the pomp of life with the nothingness of the grave—mortality unclothed.

suit, and for its success. Those more immediately connected with the Government satisfied themselves that, as the Queen had provided for the widow and children of the rebel Earl, and by so doing had to allocate the provision from the revenues of the crown, surely she would befriend the present suitor, being only required to decree righteous judgment, without putting a finger into the pocket of the state. The crown lawyers were in indignant astonishment that a settlement of such long standing (21st of Henry VIII.) should be assailed and trampled under foot by an intruder, without even the pretence of a claim. The rough swordsman, who would have been ready and willing to join in ousting the rebel Earl, lance to lance, felt choking with contempt for the cowardly cur who would lay his robber hand on a defenceless old woman. Husbands saw in this transaction their own settlements reduced to waste paper; while wives and widows shuddered at the prospect of destitution, the possibility of which was visibly before them. A cloud dimmed the bright eyes of many an affectionate daughter, as, while compassionating the old Countess, her thoughts ran on, and in her terrified imagination she saw a fate that might befal her mother; and, under the same influences, the hands of sons clutched and worked on their daggers, with a burning wish to bury them in the villain's heart that had done this foul deed. When Sir Walter had concluded his statement, he handed to Sir Edward Coke, Her Majesty's Attorney-General, the Countess's settlement of jointure, dated the 17th September, 1529, executed by Earl Thomas, shortly after attaining the title and estates, on the death of his nephew, Earl James, which occured June 18th, 1529 (see Hamilton's "Calendar of State Papers relating to Ireland," page 7. Lond. 1860), calling Mr. Attorney's attention to the endorsement on the deed, certifying that it had been registered in his then Majesty's Court of King's Bench in Dublin, the following term. Sir Edward, to whom the deed had been previously sent, and who in his chambers had made himself master of its contents, with due gravity opened, examined, pondered; and then, kneeling before the Queen, humbly submitted the settlement, with, it was presumed, his official opinion thereon, audible only to her Grace. Being motioned, he retired; and Elizabeth, drawing herself up to her utmost height, the previous hush became an almost fearful silence; not a silk rustled; every breath was suspended; every eye with anxious earnestness rested on the Queen, and every faculty of hearing was stretched to its most painful expansion. The suspense was short, the sentence sharp. The Sovereign was insulted, the Woman outraged. No one possessed in a greater perfection than Elizabeth the power of instantly and suitably speaking, whether to the loyal outburst of a gathering at the palace gates, or receiving the ambassador of Sigismund the Third, King of Poland, A. D. 1597, in the sixty-fourth year of her age, who, she understood, came to compliment her, but whose harangue was to express his master's displeasure, and threaten her with its consequences, "when," writes our old historian, Speed, "lionlike rising up, she daunted the malapert orator, not less with her stately port than with the tartness of her princely checks." Concluding her reply, she turned to her court

with—"S'death, my lords, I have been enforced this day to scour up my old Latin, that hath lain long in rusting." Her present task was easier. Graciously extending her hand to the Countess, in a few words equally reassuring, she told her she had well done to bring her wrongs to the fountain-head of justice, and that the offender should soon find distance was no safety from just retribution for his evil doings. Cecil was then directed to issue the necessary powers to restore the Countess to her rights, and to punish to the uttermost the offending churl; while to Raleigh was delegated their enforcement. The pent-up feelings of all burst forth, to the disregard of state decorum, the younger nobles tossing up their gay and jewelled caps, with the cries of "Long live the Queen's Majesty's grace!" And Elizabeth, smiling at the scene she herself had created, and receiving with renewed kindness the almost inarticulate expressions of gratitude which her "poore Bedeswoman" endeavoured to utter, retired, followed by her attendants. Released from all restraint, the whole court crushed up to the Countess, and, in their various moods, tenses, and manners, poured out the expression of their hearty joy and congratulations. Many a young gallant pressed his rising moustache, and many a lovely damsel pressed her cherry lips, on the withered, wrinkled hand of the olde Ladye Cattelyn in all the sincerity of reverential, affectionate sympathy. And when Raleigh, fearing the continuance of this excitement, respectfully placing her arm in his, intimated their departure, the gay and glittering throng fell back on each side, opening a passage, and forming, as it were, a brilliant body-guard, with the kind word and the kind wish from every individual for her, as they passed through it. At the court of Edward Plantagenet, Katherin Fitzgerald had been one star in its galaxy of youth and beauty, dividing with the other stars of the constellation homage and adoration. But on this eventful day, at the court of Elizabeth Tudor, the old Countess of Desmond was the one star of the firmament,—engrossing every thought, engaging every hope, in whose success every heart rejoiced, identifying itself with hers, and feeling her triumphs as its own.

We have thus, step by step, accompanied our noble ambassador at Paris to the conclusion of his hazy dream, possibly an after-dinner forty winks, induced by the rival seductions of Lafitte and Margaux. But we must leave him with "Nature's soft nurse, sleep, gentle sleep," and return to the cold realities of waking life.

Sir Walter Raleigh, after his return from Youghal, which we are to presume was in 1589, formed part of Queen Elizabeth's court during the remainder of her reign. In his work, published in 1614, he brings our old Countess forward as a remarkable instance of long life. He does not specify her age, but states that she was married in the reign of Edward IV., and that he knew her in 1589. Edward IV. died 9th April, 1483, so that if the Countess had only been married in 1482, at the age of eighteen, she would have been 125. And Sir Walter continues, she lived many years since; but so little does he expect to be believed, that he adds "and that this is true all the noblemen and gen-

tlemen of Munster can witnesse." Now, Sir Walter wrote to an English public; and if the Countess had appeared at the English court to claim the restoration of her jointure-lands, her person and her history would have been known, not only to all the noblemen and gentlemen, but to all the public of London, to whom, and not to those of Munster, Sir Walter would have more naturally and confidently appealed. His not doing so, in my opinion, establishes a clear "alibi" for the Countess not having been at the English court between 1589, when Sir Walter left her at Inchiquin, and her death in 1604.

We have now to call up Sir Francis Bacon, who will establish as clear an "alibi" as Sir Walter, that the Countess was not in London subsequent to 1589. Bacon sought public employment, and was never absent from court, until sacrificed by James I. to screen Buckingham; and he became a member of the House of Commons in 1593. It was, therefore, impossible for the Countess to have been in London and Bacon not to have seen her. Remember, also, that Bacon's inductive philosophy requiring the test for the credence, cost him his life. Though the circumstance is so well known, I give it from Bohn's edition of his Essays, &c., London, 1854. "It struck him (Bacon), when examining the subject of antiseptics, that snow might preserve flesh from corruption, and he resolved to try the experiment. One frosty morning, in the spring of 1626, he alighted at Highgate, and proceeded to stuff a fowl, which he had bought at a neighbouring cottage, with snow, which he had gathered from the ground. At the end of the operation he felt in his limbs a sudden chill, a fever ensued, and he lingered only a week."

If this man of facts had ever had the opportunity of seeing the Countess, he would have spoken of her from his own certain knowledge and conviction; but in retailing the information given by the people about Youghal to Fynes Moryson, in the first instance, his language is —"*They* say for certain;" he himself knows nothing on the subject, nor expresses any belief in what has been told him. In the second instance we descend considerably—"*They* tell a tale." Words can scarcely usher in anything more contemptuously. The Countess's patriarchal age was a possibility, and we have the lavation of old salt butter before a blazing pile of turf suggested. But dentiring at the period of possible second childhood is left as a nursery tale.

We have, therefore, the testimony of two persons residing at the court of Elizabeth that they were ignorant of the Countess having been there. And we now pass over to Youghal with Fynes Moryson, to learn that no one there knew anything of the Countess ever having been absent from Inchiquin.

I should feel quite content to leave the decision of this question to a careful consideration and comparison of these two authorities—my Lord Leicester in 1640, and Fynes Moryson in 1613. The latter was an old and experienced traveller, at a time when travelling was accompanied with difficulties and dangers, of which we in these days can only form an idea by reading of what he encountered in his ten years' wandering

over most part of Europe and much of Asia. And if we refer to his "Precepts for Travellers," Part iii, Book i., we find that the traveller is required to observe and note everything; and the record of his journeyings proves that he practised what he preached. As secretary to the Lord Deputy Mountjoy, he had been from 1599 to 1603 actively employed in Ireland, and was thoroughly acquainted with the Irish. Unexpectedly, by stress of weather, in 1613, he finds himself in Youghal, where he makes the most of the chance opportunity to collect information. And, from his rank and connexions, we may be sure that all were anxious to meet his inquiries, and to communicate their own several, separate stores of information. This, we are to remember, was in A. D. 1613, and that the Countess had died there in 1604, say nine years previously. Moryson's information of the old Countess was, therefore, most probably obtained from individuals personally acquainted with her, "that she had lived to the age of 140 years; that in her last years she was able to walk four or five miles to the market town (Youghal) weekly; and that not many years before she died she had all her teeth renewed." So, when Fynes in his "Itinerary" comes to treat on "long life," the Irish Countess of Desmond becomes a remarkable illustration. But if, instead of an occasional walk of four or five miles out, and as many home, he could have stated that she had walked 120 miles consecutively, would he not have done so? and raised the really wondrous into the wondrously marvellous. And is it in the nature of any informant—an Irish one, more especially—to dwell on a comparatively trifling incident, and to be silent on what would be really and truly astounding, "barring only" that it had occurred. And yet, in 1613, when Moryson was at Youghal, "taking notes" of all he could glean that was interesting, every individual of the age of twenty, or even less, would have personally known, at least by sight, the great lady at the Castle of Inchiquin, only five miles from them, and whom, in her walks to Youghal, they had seen so frequently. Consider the idolatry that has ever existed in Ireland towards ancient and noble families—the feeling for blood which pervades all classes. I remember a countrywoman speaking to my mother respecting the wife of a neighbouring farmer—"Oh, Ma'am, she was a Kirby, and people was surprised that she demeaned herself to marry a Murphy." And in the Desmond family, Thomas, who became the sixth earl, A. D. 1399, marrying the beautiful Katherin M'Cormack, daughter of one of his tenants, was expelled from his estates and earldom by his family and vassals, for forming an alliance so dishonouring to his blood, and died an exile in France, Sir William Betham considers about A. D. 1421–2,—the Harleian, 1430. But our Countess was a Geraldine by birth, and a Desmond by marriage; combining in fullest perfection old blood and old nobility. Her husband, on attaining the earldom in 1529, when he was seventy-six years of age, fixed his residence at the Castle of Inchiquin, where he died 1534; and the castle, being part of his widow's jointure, she continued its occupant until her death, in 1604, a residence of seventy-five years, she being sixty-five when she came there as Countess. "The oldest inhabitant" of Youghal and its neigh-

bouring country, therefore, could only have known her from his earliest recollection, as being then a very ancient, old lady; and I can imagine the minds of old people in her neighbourhood to have become awed and bewildered, while feeling in themselves the gradual, creeping infirmities of declining life, to see years on years, years on years, passing, gone; and the great lady at the castle none the older, but as hale, as hearty, and as strong as when they were but children; still to be seen walking from the castle to the town for her pleasure, "she that could ride, if she but pleased, the best horse in the kingdom, with her beautiful pillion, all velvet and gold!" And in her later period, when, amidst the wreck, ruin, and desolation of this princely, patriarchal family, she, the venerable, solitary widow of a long past, an almost forgotten generation, she alone had remained unscathed, untouched—a fragmentary remnant of its past magnificent grandeur and power. Could all this be daily before the eyes, and in the thoughts, of the imaginative Irish, and not raise in their minds a mysterious and undefined idea that hers was no common life, but one guarded and preserved by an unseen Power, surely for some high and special design. The great Earl had perished miserably in his ill-advised rebellion. His only son, the last of the titled race, had since died, a prisoner in the Tower of London. The Earl's boundless estates in the counties of Kerry, Limerick, Tipperary, Cork, and Waterford, had been parcelled out in endless divisions, and were occupied by strangers. Yet the old Countess Cattelyn remained among them, unharmed; and for twenty years after its downfal, in her the Geraldine still seemed to have ONE to represent IT. And when, at long, long length, her wondrous course was closed, and she, too, with her husband, and six preceding earls, found her last earthly home in the Franciscan Friary at Youghal, her memory must have gathered round it an awful and affectionate reverence, from the recollection of her ancient lineage and high rank, her fabulous old age, and that with her the great house of Desmond was now indeed extinct!—that the proud halls of Askeaton were, as the regal halls of Tara, levelled in the dust,—the glories of the Geraldines, like those of Brian, of Clontarf, passed away to the bards and minstrels of other days; and all that now remained to the sorrowing survivors was the *Caoine** that had wailed over the old Countess Cattelyn; while a Boyle lorded in the castle of Inchiquin, and a Preston flaunted in the ermine and coronet of Desmond!

When, therefore, Fynes Morryson, nine years only after her death, was making his inquiries of all that was interesting and noteworthy, and when his informants came to the history of their old Countess, I again ask is it within the possibility of human nature, that, if she had been forcibly and illegally dispossessed of her castle and jointure, had been driven to wend her way over sea to Bristol, and from Bristol to toil

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* The pronunciation of *Caoine* is *nearly Queen-a*. That of the *c* is very like the French *que*.—J. WINDELE.

† Caoine, pronounced *Kwee-nā*, softening or dropping the sound of *w* as much as you can; or *Ko'een-na*, shortening the *o*, so as to make the sound *Ko'een* one syllable.—O. C.

on foot to London, to seek the redress of her cruel and bitter grievances, and in her 140th year had successfully surmounted those difficulties and dangers, made good her way to Queen Elizabeth, got back her own, and with the Sovereign's writ of restitution in her aged hands, had returned triumphant to dispossess in her turn the robber occupant of Inchiquin Castle; and that within its walls, and as its mistress, she had ended her days in peace; yet that on all these wonders, in all of which every man, woman, and child, would have taken an Irish, burning frenzied rejoicing and exulting interest, every talking and narrating individual was silent, and all they would communicate to the curious and inquiring English stranger respecting their Countess was, that she lived to be about 140 years of age, had young teeth in her old days, and once a week took a walk of some eight or ten miles. If any persons can bring themselves to believe that this could have occurred at Youghal in A. D. 1613,—*if* the Countess, by her wrongs, had been driven to England, I have only to say that I am not one of their number, and I suspect also that I am one of very many.

I may now briefly refer to the grounds on which I arrive at the conclusion that the Countess was not disturbed in the possession of her jointure, and did not appear at the court of Elizabeth seeking redress.

The story rests solely on the gossip of the Earl of Leycester, who distinctly states the occurrence to have taken place in the reign of Queen Elizabeth; his table-talk was written at Paris, A. D. 1640, being thirty-six years after the Countess's death. To the absurd improbabilities of the tale attention has been directed.

The Countess's legal rights to her jointure were acknowledged and admitted by Queen Elizabeth's Government, who accepted the return made in 1589 of Earl Garrett's forfeited estates, so charged, and Sir Walter Raleigh's return at the same time that Inchiquin continued in her occupation as her jointure. We have further Sir Walter Raleigh's lease of 1588 to Mr. Cleaver, and to Mr. Reve, 1589, proving the Countess had an acknowledged first charge on the lands, by the rent doubling itself, and a light-horseman to be maintained by the tenants on her death. And when Sir Walter appealed to all the noblemen and gentry of Munster, as knowing the Countess, of course they equally knew her established position and legal rights as Dowager Countess of Thomas, Earl of Desmond.

In the face of this known and acknowledged legal right of jointure for her life, who could attempt to disturb her possession of it?

This I consider direct positive evidence.

We have then the negative.

I have shown that Sir Walter Raleigh and Sir Francis Bacon were both constant residents in London from 1589, when we know that the Countess was residing undisturbed at Inchequin; so that she could not have been in London without their being acquainted with it. And yet both these parties, as appears in their writings referring to her, know nothing of it.

Fynes Moryson is at Youghal in 1613, nine years only after her death; but no one there knew anything of her ever having been evicted from her castle and lands, or of her having gone to England to recover them.

Any person conversant with business in public offices is aware that all transactions go through certain forms of writing, which become official records; and if the Countess Katherin had been driven to seek redress at the English court, there must have been documentary records of her application and its results. Yet in the search we have made at the State Paper Office in London, we cannot find a single paper. But of the Countess Ellynor, an abundance turned up, some of which, as interesting historic matter, will follow, though no ways connected with my inquiry, unless as adding their negative evidence that the old Countess could not have been a suppliant to Elizabeth; for had she, similar proof would have been forthcoming.

I submit I have shown that the Earl of Leycester's story respecting the old Countess of Desmond is a tissue of absurd improbabilities in itself, and that it is disproved by the most conclusive evidence, positive and negative.

We now come to the consideration of the paintings, assuming or assumed to be portraits of the old Countess of Desmond.

Rembrandt was born 1606, Gerard Dow 1613; consequently, any portraits painted by these great artists are at once put out of court.

At Muckross Abbey, Killarney, the seat of the Right Hon. Henry Arthur Herbert, M. P. for the county of Kerry, there is a portrait which asserts itself, by an inscription under it, to have been painted from the living original; and of which, as a portrait of the old Countess, the "Quarterly" pronounces, "the *vraisemblance* is at Muckross" (p. 353). The difficulty of the painter's own date the "Quarterly" easily disposes of, thus: "the date 1614 *must* be an error for 1604" (p. 343). The inscription is in these words, in modern English print letters (as distinguished from old black letter):—"Catherine, Countesse of Desmonde, as she appeared at y^e^ Court of our Soureigne Lord King James, in thys preasant A. D. 1614, and in y^e^ 140^th^ yeare of her age. Thither she came from Bristol to seek relief, y^e^ house of Desmond having been ruined by attainder. She was married in y^e^ reigne of King Edward IV., and, in y^e^ course of her longe pilgrimage, renewed her teeth twice. Her principal residence is at Inchiquin, in Munster, whither she undauntedlye proposeth (her purpose accomplished) incontinentlie to return. Laus Deo."

It does not appear so clear to me as to the "Quarterly" that a picture dated by the painter 1614 *must* have been painted by him in 1604.

Let us suppose Mrs. Herbert, of Muckross, to have been at the Drawing-room and St. Patrick's Ball, at Dublin Castle, this present A. D. 1860; and, while in Dublin, having sat for her portrait, that Mr. Herbert, wishing to have Mrs. Herbert's participation of the Earl of Carlisle's viceregal festivities recorded on its canvas, thus—"Mrs. Herbert, as she appeared at the Court of his Excellency the Lord Lieutenant of

Ireland, this *present* A. D. 1860"—can any one bring himself to believe that the painter could inscribe 1870? A portrait painter, who has to remark and to record every line and variation in his sitter, cannot be an absent man. A man in a state of intoxication could not paint letters of any size, and I suppose those on the Muckross painting are of small dimensions. We may at any time make a mistake as to the day of the month, but, after the first week in January, we never make a mistake in the date of the year; and then it is the past, instead of the present, we use, 1859 for 1860. Surely, it would not be ten years hence, 1870.

Allowing common sense to give place to good nature, let us try to suppose that our artist did paint A. D. 1870, in the absence of mind, or in the bewilderment of wine. Yet, is it not passing strange that in this haze he could copy the long inscription Mr. Herbert had given him with only one mistake, and that the only fact, the every-day matter of fact, with which he was perfectly well acquainted, the date of the *present* year? Well, let that pass. But paint will not dry for some days (I know it would not in 1824, and I infer that it does not in 1860). Then, during those days, before the picture could be sent home, did the painter continue in this haze, and the mistake of the date remain unnoticed? Were there no apprentices, or assistants, who watched and scrutinized "Master's doings," be he clear or hazy—no curiosity to read what was said on the canvas about this lady from the country, a circumstance so very unusual? no visitors, no new sitters, all anxious to see, and the painter more anxious to show *his* portrait of the great and beautiful lady from the Kingdom of Kerry, for whom gentle and simple had but the same appellation, "The Kerry Diamond"? And were all eyes and intellects as hazy as the painter's had been, and continued to be? Assume all this, and (as Mr. Roebuck remarked to one who assumed that the Admiralty had done all that they ought to have done), you assume a great deal! Be it so. And now the picture is sent to Mr. Herbert. But will he not read the inscription, and will he overlook 1870 for 1860? You say at once that he certainly will read, and will not overlook the blunder. So, the portrait is returned for correction, and comes back to Mr. Herbert with "this *Present* A. D." 1860.

Now, if the Muckross portrait had been painted from the living Kathrin, Countess of Desmond, it must have been for some one (like my supposed portrait of Mrs. Herbert) interested in having it taken, who had furnished the inscription, and who, consequently, would have detected the erroneous date of "*thys preasant A. D.*," and have had it altered to the true time.

Thus we see that, in the anxiety of the composer of this inscription to silence doubt, by inserting "*thys preasant A. D.* 1614," how he has *thereby* defeated himself.

But his ignorance has led him into a blunder, which alone would prove his pretentious statement to be a comparatively modern fabrication—the Countess's Christian name on the canvas commences with C, instead of K. I have no doubt that C was the usual mode when the

inscription was placed on this picture; but, in 1604 or 1614, *K*atherin was the only mode of spelling that Christian nomenclature. Let us try back a little for instances, facts being stubborn things.

Henry the Eighth chose to compliment some of his Queens by joining their initials with his own on some of his coinages, for circulation in Ireland, but which were coined in London; and we have H. A. (Henry and Anne), H. I. (Henry and Jane), H. K. (Henry and Katherin).*

In the award made at Cork, 22nd January, 1555, by James, Erle of Desmonde, the aggrieved and complaining party was *K*aterin Roche. (See Roche MS., printed in the 2nd vol. of "Olla Podrida," p. 428.)

In 1562, Augustine Berhner dedicates to *K*atherine, Dutchess of Suffolk, Latimer's Sermons, preached, 1552, at her Grace's request.

In 1564, at the Herald's visitation for the county of Devon, Peter Sainthill, of Bradninch, registers his first wife as *K*ath. Browne.

Grafton's "Chronicle," printed 1572, gives *K*atherine as Queen to Henry the Fifth, and three of Henry the Eighth's Queens were *K*atherines.

And then we have the very remarkable and all-important deed of the old Countess herself, dated August 5th, 1575, which commences, "whereas I, Lady *K*athrin, late wief to Thomas, late Earle of Desmond," &c. As the Countess was born, we suppose, not later than 1464, and took the name *K*athrin in baptism, we have her proof that *K* commenced *K*athrin when she commenced Christianity. The feast of Saint *K*atherine, Virgin and Martyr, is celebrated on the 25th November.

To bring this inquiry down to the period of the assumed inscription, I wrote to a friend in London, who is just reposing from the labours of bringing out a new edition of Shakspeare's Plays, to know how the name in question was spelt in the first folio, 1623. He replies, "In the folio it is always spelt with a *K;* sometimes there it occurs as *K*atherina, and sometimes as *K*atherine."

We thus have a stream of authorities as evidence to show that, from about 1464 to 1623, the name always occurs commencing with *K*. And we may go much further back; for, on referring to the Calendar of Saints in Sir Harris Nicholas's "Chronology of History," we find, at p. 131, *C*atherine, *vide K*atherine. At p. 147, we have six *K*atherines. Of these, the first, *K*atherine, Virgin and Martyr, is believed to have suffered martyrdom in the fourth century; and the last, *K*atherine of Sienna, died towards the close of the fourteenth.

In France, at a later period, K was used in Latin inscriptions where C now appears. I have coins of Charles the Seventh, who died 1461, and Charles the Bold, Duke of Burgundy, 1477, whose names are en-

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* I am indebted to my kind friend, Dr. A. Smith, for the following note, which bears strongly on this point—*K* used instead of *C* in a proper name:—

"Dr. William Bulleyn, who died on the 7th of January, 1576, in his book, 'The Government of Health,' mentions Dr. William *K*unningham. *See* 'Biographia Britannica, vol. II., p. 1022. Folio, London: 1748.'"

graved *K*arolus. I have also a medal of Henry the Third of France; reverse, the bust of his mother, who died 1589 (the same year as her son), inscription, "*K*ath. Hen. II. Ux. Hen. III. Fran. et Pol. Reg. Mat. Augu." These instances evidence that K then occupied the position that C has done in more modern times. I am, however, concerned with the English orthography of 1614, and I contend that, in the painter's *C*atherine we have a name never heard of in England, years after 1614, where the picture professes to have been painted. And can we believe that the person for whom the portrait was painted, and who may have seen the Countess write her name, or, at all events, must have known how she wrote it, could have acquiesced in the mistake, when C was an unheard-of departure from established spelling? In these our days we could only match it by inscribing *S*harlotte for *C*harlotte.

On all these grounds, I come to the conclusion that the Muckross portrait is NOT that of the old Countess of Desmond, but that the inscription is a comparatively modern fabrication, to enhance in value what we understand really is a painting of high artistic merit.

With the exception of the Muckross portrait, I apprehend that the credibility of all the other portraits, assumed to be those of the old Countess of Desmond, rest only on a supposed tradition, which cannot refer to any authority, good, bad, or indifferent. In one instance this has been recently exemplified, I may truly say, to the great regret of every person who was acquainted with it—the portrait which has been in the possession of the family of the Knight of Kerry for generations, and considered to be that of the old Countess of Desmond, but which the present Knight has clearly, provokingly, and I had almost said wickedly, ascertained to have been painted by Gerard Dow. In the family of an ancient and exalted branch of the Geraldines her portrait would have been in its natural position; and this picture fully realized all that expectation could have imagined to have distinguished the living original—the quiet dignity of high birth and rank, with a graceful, but powerfully developed frame, capable in its nature of vigorously sustaining health and intellect, through such a marvellously protracted period of years, to the attainment of that settled, earnest, yet observant placidity, whose equanimity, it would seem, joy could rarely elate, or sorrow scarcely depress—the intensity of old age, but with the absence of decline, mental or physical.

This picture was admirably engraved by Grogan, of Cork, in 1806, for Pelham's intended work on Kerry; and I consider myself very fortunate in having a proof before the letters, in splendid condition.*

The unwilling, regretful certainty that this characteristic picture, as the portrait of the old Countess, is proved a myth, has, I acknowledge, first raised in my mind the question, "Does her portrait exist?" and the

* The copperplate, engraved by Grogan, is now the property of Mr. A. Evans, printseller, No. 403, Strand, London.

result of my consideration is, that there is not the slightest probability that her likeness ever was taken.

Judging from what I have seen, and from my inquiries, addressed to the present representatives of old and estated families, I am strongly impressed with the conviction that family portraiture in Ireland was diffused by the Cromwellians. Settling down on the lands which their swords had transferred to them, they seem to have placed a picture of their chief in their castles and mansions as the penates, or protecting power, of their acquired possessions. At the mansion of a Cromwellian family, in the county of Tipperary, I saw the great Lord Protector, the only portrait in the house; another came under my ken, from a county of Cork family; and I have a third, a very fine painting, the features much softened down, but the characteristic likeness preserved; it descended to the gentleman who sold it to me from Colonel Barrachia Wallis, who wrested the castle and lands of Carrigrohane, county of Cork, from the Philistine Barrett, when the image of Dagon gave place to that of Oliver, whose head subsequently became a favourite seal. I have two letters, addressed to William Crosbie, of Ardfert, Kerry, afterwards created Earl of Glandore—one, from its tenour, rather earlier than 1758, has Oliver's profile, copied from his shilling, inscribed "The Glorious Protector;" the other, dated "Decem^{r} 4, 1760," is also a profile, evidently from the marble bust at the residence of the Cromwell family at Cheshunt, Hertfordshire.

At the expulsion of James II., the victors set up their idol, King William, in rivalry of the Protector; and family portraits seem from this period, though very slowly, to make their appearance. In private families I have seen few authenticated before the close of George II.'s reign; nor did the taste seem to have had much existence among the nobility. At Portumna Castle there was a portrait of the great Marquis of Clanricarde, of the time of Charles I., and the only other was that of the late earl. Both must have perished when the castle was burnt. At Rostellan Castle the oldest portrait, and, in my estimation, the only family painting of merit, was that of the celebrated Morrough O'Bryen, sixth Baron of Inchiquin, created earl by Charles II. So, at length, I come to the conclusion, that at the period of our old Countess, portrait painting was an art not practised in Ireland.

Nor can this conclusion be a matter of any surprise, when we quietly recollect what was the social, or rather utterly unsocial, state of the kingdom without the small territory called "The Pale," of which Dublin was the capital.

The island was occupied, with but rare exceptions, by native Irish chieftains, and so-called English nobles, "more Irish than the Irish," who, if not banded for the time in league against the Lord Deputy, always found pleasant little differences between themselves to prevent their swords becoming rusty for want of employment, and were more intent on destroying than preserving the image of heaven's master-piece, even in its fairest type,—woman! Seriously ask yourselves, when you recall those times, and the persons who flourished, what arts found favour

in their eyes beyond those that enabled them to appropriate their neighbour's chattles and possessions to their own use and behoof? or, among the smaller fry, than would assist their endeavour to keep the little they might have left from these "Dragons of Wantley," by whom the land was infested? Had a bard, a mason, or a smith sought shelter or employment at their castle gates, they would have been understood, and, as pride or necessity induced, they may have been entertained or employed; but had the painter made his appearance, and tendered the appliances of his art at Inchiquin, so utterly incomprehensible would his application have sounded in the ears of the grim, savage, old earl, our Countess's husband, whose historian gravely records as a subject of gratulation to "The Bald Knight," that two lords of Muskerry, one of whom was his first wife's father, fell beneath his sword! that, in the conviction of the stranger being either a spy or a wizard, his fate would have been to dangle in a halter over the outer wall of the castle,—a warning for "the likes on him" to keep at a safer distance, if they valued their necks.*

I think this is a fair and rational estimate of the state of Irish-chieftain society at this period; and we have now to inquire is there anything that has come to our knowledge of the old Countess that can induce the slightest idea that she ever sat for her portrait?

All the reliable information that we have of her, that I am aware of, is that of Sir Walter Raleigh, who writes that he personally knew her in 1589; and we are to presume that on her authority he states that she was married in the reign of King Edward IV.; but he does not specify where she was married. Sir George Carew fixes her death to have occurred in 1604; nine years after this (1613), Fynes Moryson, at Youghal, is informed that she lived to about the age of 140. Where she resided from her marriage (probably about 1482) to her husband's becoming earl, in 1529, we have no information. On attaining the title he was 76, and took

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* "From Calendar of State Papers of Ireland, 1509 to 1573." London, 1860:—

1566, March 1. Dublin. Lord Deputy Sidney to the Earl of Leicester.—"The English Pale spoiled daily, and in utter poverty, the soldiers so beggarlike and insolent, and allied with the Irish, that nothing can correct them. One may ride 30 miles, and not see one house left standing, where Sydney has known it as well inhabited as in many counties in England. Thomond worse still."

April 20, 1567, p. 330.—"Lord Deputy to the Queen. Description of Munster during Sydney's eleven weeks and two days' journey. Good conformitie of the towns, and some parts of the country. Great disorders and wasted towns in other parts. Ikerwin, called O'Meagher's Country, all waste and uninhabited. Verie greate possessioners in that county of Cork, who ought to be free subjects, are so injured and exacted upon by the late Earl of Desmond, as as in effect they are, or were, become his thralls or slaves. Desmond's flagrant tyrannies, the burning of villages and ruin of churches in his land. Yea, the view of the bones and skulls of your ded subjects, who partelie by murder, partelie by famine, have died in the feldes is such that hardelie anny Christian, with drie eyes, coulde beholde."

"Castletown, Septr. 14, 1568, p. 390. Lord Roche to the Lords Justices, complains that the Earl of Clancarty and others, with 6 or 7 banners displayed, has taken 1500 kine, burned 7000 sheep, all his corn, and a great number of men, women and children, desires a commission to hurt the said Earl."

up his residence at Youghal, near which town the Countess resided until her death, in 1604. Let us now consider what was the probability that either she, or any other person, would think of having her portrait taken; or, if such a thought had occurred to any one, how it could have been realised at Youghal, in the reign of Queen Elizabeth. Youghal was one of the chief head-quarters of the Desmonds, where pillage and plunder, rather than any of the peaceful arts and their refinements, were studied and practised. As to painting portraits, I question, at that time, if they even painted their doors; as to windows, as we understand the term glazed apertures, they were then, I suspect, of very rare occurrence, and I much doubt whether there may have been many panes of glass in the castle of Inchiquin. Yet, supposing that Youghal previous to 1604 was in a more advanced state of civilization than I have estimated, it was neither a place of trade nor of thoroughfare; and if a stranger was seen there, he was most probably, like Fynes Moryson, driven in from sea by stress of weather, or seeking safety for his life from some murderous, predatory inroad of an O'Keefe or an O'Kelly. A portrait painter finding his way professionally to Youghal, during the lifetime of our Countess, is a flight of fancy beyond my poor ideas. I question much whether such a craft existed at that time in the length and breadth of the green island.

But the "Quarterly" may assume, where it assumes so much, that the extraordinary longevity of the noble lady must have occasioned great interest at the court of Elizabeth; that a painter had been sent over to Inchiquin Castle to take her portrait for the Queen; that he brought back the painting, which is still at Windsor Castle, but which is not, I have ascertained, catalogued as that of the old Countess of Desmond;* and that from this assumed original those portraits in other collections most probably have been copied, with possible variations.

Plausible as this theory undoubtedly would be, and accounting satisfactorily for the origin of the portraits called the old Countess's, there is a trifling difficulty attending it, analogous to the date of 1614 on the Muckross picture, which is, that when the English public first became acquainted with the history of the old Countess, she had been dead for some years. The date painted on canvas, we have seen, is easily disposed of; but the date printed in a book is a more stubborn fact. Now, the date of the original edition of Sir Walter Raleigh's work is 1614, and of Fynes Moryson's, 1617 (the *Quarterly* says that Fynes Moryson

* I have been favoured by a gentleman at Windsor Castle, in answer to my inquiries respecting the picture there, rumoured to be a portrait of the old Countess of Desmond, with these particulars:—"It is said to be by Rembrandt, and is a very fine portrait; there is lace on the head-dress, and a fur tippet, a collar round the neck, and coming down in front, and no lacing. But it cannot be the portrait of the Countess of Desmond; and with this agrees the opinion of Nagler (Band 12, s. 419), who calls it Rembrandt's mother, or the portait of an old lady."

I find this entry in the catalogue of the pictures of Charles I.:—"Done by Rembrandt. An old woman, with a great scarf on her head, with a peaked, falling band (2 f. & 1 f. 6)." And with this our picture agrees exactly.—B. B. W.

died in 1614, but "the King's Letters Patents to F. M. to print his Itenerary is dated 29th Aprill, in the 15th yeer of his Maiestie's raigne in England," which was 1617). These writers only made the Countess known in England.

Lord Bacon, whose works referring to the Countess were published in 1623 and 1627, merely copies from Moryson. In 1640 my Lord Leycester at Paris scribbled his Table-talk. But when Charles II. was restored, and people had time to be idle, and portraits became fashionable, then I suspect that paintings were first baptized with the nomenclature of the old Countess of Desmond; and as such by tradition, and the warrantry of picture-dealers, have come down to us as unquestionable originals.

APPENDIX.

From the Calendar of State Papers relating to Ireland, 1509 *to* 1573, *page* 7.

James, 11th Earl of Desmond, died June 18, 1529.

From H. C. Hamilton's Calendar, page 106. 1550, *Feb., after* 2.

Lord Chancellor Alen to his brother Thomas to declare to the Government of England.

"The Countess of Ormond's practice to marry with the heir of Desmond. Alen's remonstrance. Her honour first to have husband so noble a man as she had, and after his death to have so noble a gentleman as this was, by whom she should enjoy an honest portion of living, for little more than a year's pain." "So in thende she promised me upon hir honor that she would lyve sole for oon yere."

Page 193.

Joan Countess of Desmond (and Countess Dowager of Ormond and Ossory, Ob. 1564) to Cecil in favour of the bearer, Andrew Skiddy, and his purpose of renewing his suit for the Grey Friars of Cork. License for corn.

BRITISH MUSEUM.

Cotton MSS.—Titus B. XIII., p. 195

This is a true copie of the feofm^{t} made by Gerald, Earle of Desmond, (testified under the Lo: Deputy and Councell's hands), w^{ch} appeareth to be made, seven weaks after the combination, 1574.

This deed, dated the 10th September, 1574, in the sixteenth year of our Queen Elizabeth, refers to, and confirms, a previous deed, dated 15th March, in the thirteenth yeare (1571) of ye prosperous raigne of our Sovereigne Ladie Queene Elizabeth, the Queene's Ma^{tie} that nowe is, enfeoffes James, Baron of Dunboyne, and Redmond Everett, with all his estates under certain trusts and entails.

After the Earl's rebellion "all deeds dated subsequent to one that proved his intent to rebel were pronounced void" (Exchequer MS.

Records, Dublin, quoted by *Quarterly*, page 352). Under which enactment, no doubt, these deeds and the assignment of the old Countess, 5th August, 1575, became waste paper.

Cotton MSS.—Titus B XIII., p. 126, Plut. XXVI., page 248.

The combination of Garret, late Earle of Desmond, attainted of high treason, in A°. 1578.

Where the Right Honorable Garret, Earle of Desmond, hath assembled us, his kinsmen, followers, friends, and servants, about him, after his coming out of Dublin, and made us privie to such articles as by the Lo: Deputy and Councell was delivered unto him the viiith of July, 1578, to be performed, as also his answers to sayd. Wch answeres we find so reasonable as we wth one accord doe councell and advise the sayd Earle not to consent nor yield to any more then in his answere is already graunted. And further, the sayd Earle declared unto us that if he doe not yield presently to the pformance of the same articles, and put in his pledges for observation thereof, that then the Lo: Deputy will lend his force and make war against him, We, the psons under written, doe advise and councell the sayd Earle to defende himself from the violence of the sayd Lo: Deputy that doth ask so unreasonable a demande, as in the sayd Articles is contayned. And for to defende and sticke to this our advise and councell. Wee renounce God, if we doe spare life, body, lands and goods, but will be ayding, helpinge, and assistinge the sayd Earle to mayntain, and defende this o^{r} advise against the sayd Lo: Deputy, or any other that will covet the sayd Earle's inheritance. In witness whereof that this is our councell to the sayd Earle we have hereunto put our hands the xviijth of July, 1578.

GARRET DESMOND.
THOMAS LIXNAWE.
JOHN OF DESMOND.
JOHN FITZJEAMES.
RORYE MCSHEAGHE.
MOROUGH O'BRIEN.
MORIERTAGH M^{c}BRIEN, of Longforthe.
JA., K E ff D R B.
THEOBALD BURKE,
DONEL O'BRIEN,
RICHARD BURKE.
JOHN BROWNE.
DANIEL M^{c}CANNA, of Drombrane.
JAMES RUSSELL.
RICHARD FITZEDMUND GERALD.
ULICKE M^{c}THOMAS, of Ballancarrighe.
ULICKE BURKE.
JOHN FITZWILLIAM, of Rarew Dirry.
TIGHE O'HEYNE, of Cairreyley.

Copia vera ex^{t}. MATHEW DILLON.

FROM HER MAJESTY'S STATE PAPER OFFICE, LONDON.

1580, *Apr.* 1.—*Camp at Carrigafoyle.—Lord Chief Justice Pelham to the Queen.*

Waste and execution in Desmond's country. Common rebels executed for their readiness to shake off the Queen's Government. Carrigafoile taken by assault after two days battery. Sixteen Spaniards, under Captain Julian kept it by assignment of the Countess of Desmond.

Poor people meeting Desmond cursed him bitterly for this war. His promises to them. Receipt of William Burke's patent of creation, and his own as Justice Requests to be discharged. All Limerick and Kerry in rebellion. Devotion of Ormond, Councillors, Captains, Gentlemen, and Soldiers.

1580.—*Apr.* 5. *Askeaton.—Lord Justice Pelham to Sir F. Walsingham.*

The whole of the shires of Limerick and Kerry now at her Majesty's devotion. They might be made to bear the whole charge of the garrison in Ireland. Pleasantness and commodity of the Shannon. The people of Munster docile and reformable. The practise for saving Desmond scorned by the Countess, who sent Dunboyne's letter to Sanders.

IRISH CORRESPONDENCE, STATE PAPER OFFICE.

No. 81. (*Indorsed*) 1583, *June* 18.—*To hir Ma^tie, from the Erle of Ormond,* (*directed*) *to the Queen's most excellent Maiesty.*

My duetye most humblye remembered to your most exsellent Maiestye, sins the dispatch of my servant Tegg to your Highness ther wear 22 traytors put to the sword and taken, of those feaw that folloed Desmond. The Senischall of Imokillye (being the man of most account amongst the rebells) cam to me the eleventh of this month acknowleginge his great and grevose offences, most humblye craving your hignes marcye, whom I receaved for cawses tending the sarvice of your Maiestye.

The Brownes (being th'erles trostiest folloers in all these bad actions) have this day submitted them to your Highness. The Countes of Desmond being for some cawses protected, to manifest her humble duetye the more, forsoke the benefitt thereof, and put her self holye to your Maiestyes marcye. To conclude, for avoyding your highnes farther troble, God hath geven your sarvice that success as your good subiectes may saflye travell in anye part of this province without danger.

Now craving pardon for these my rude lines I committ your Maiestye to the blessed guyding of God, who make your life long and your raygne most hapye From your highnes toune of Cashel the 18th of June, 1583.

Yo^r Maiesties most humble and obedient subiect and sarvant during lyfe.

THOMAS ORMŌD & OSS.

IRISH CORRESPONDENCE, STATE PAPER OFFICE.

No. 81. (*Indorsed*) 1583, *June* 18.—*Erle of Ormond.*—(*Directed*) *to the right honorable my veray good ll* [*lords*] *of her Ma^tie most honnorable privy Counsell in hast hast.*

May it please yo^r most honnorable good ll to be advertised that since the dispach of my servant Teig Mac Carty there were xxi of the fewe traitors that remained abrode put to the sword and taken. The Senisciall of Imokilly (being the chefe man of servic among them) came to me the

xith of this month, and submitted him self most humbly to her Mat^{ie} mercye, craving her highnes pardon. This day the Brownes, who were of speciall trust with Th 'erle in all rebellions, came hether unto me to submitt them selves to her Ma^{ie} mercy, so as there remaineth none abrode but th'erle with a veray fewe rascall whom I can scant heare of, yeat doth he contynue his former suite to have conference with me, as yo^{r} l. may perceave by the copie of his letter, which I send herein. God of his goodness hath so prospered her Ma^{ie} service heare, as a veray fewe men may travell over all this province without any great danger.

The Countess of Desmond being protected for sum considerations, utterly forsoke the benefitt thereof, and hath put her self simply to her Ma^{ie} mercye. This day I march towards Kierye, and woll advertise to yo^{r} ll of all that shall passe till my retorne. And so committing yo^{r} good ll to the blessed guiding of God, I humbly take leave From Casshell the xviiith of June, 1583.

Your good ll humblye to command.

THOMAS ORMŌD & OSS.

IRISH CORRESPONDENCE, STATE PAPER OFFICE.

No. 81. (*Indorsed*) 1583, *June* 18.—*From the E. of Ormond,* (*directed*) *to the Right Honnorable my veray loving frend S^{r} Frances Walsingham, principall Secretary to the Queenes moost excellent Maiestie.*

S^{r},—Since the dispache of my man Tieg Mac carty there were 21 of those fewe traitors that followed th'erle of Desmond put to the sword and taken. The Seniscial, being his chefe execucioner, came into me, most humbly craving her Ma^{ie} mercye. The Brownes also, whom he specially trusted, have forsaken him and have made their most humble submission, so as in all this province there is not a traitor in rebellion, but those fewe that followe him self, lurking from place to place. The contry, God be praised, is growen to such generall quiet as a veray feaw men travell quietly betwne Cork and Lymbro . . . and in all other places of this province, without any great danger. The Countess of Desmond this day forsoke the benefict of her protection, and put her self wholy to her Ma^{ie} mercye. I do not finde that Lacye can work the earle to that which he undertoke for him before the ll there, yeat th'erle contynueth his suit still to have conference with me. This day I marche towards the Dangin in Kiery, and as I shall procede I will advertise to you with all spede. This is the thirde post I sent to you, and as yeat have herd nothing from you. So for this tyme I committ you to the blessed guiding of God. From Casshill the xviii of June, 1583.

Yo^{r} veray assured frend,

THOMAS ORMŌD & OSS.

S^{r},—thogh the sarvice have this happye success, yeat I pray you hast away victuals notwithstandinge, with monye and munición, that the sarvice may be the better and speedlier ended.

I pray you deliver the inclosed letter to her Maiestye.

HARLEIAN MSS, No. 1425. BRITISH MUSEUM.

The Earle of Desmond was slaine upon the 11th November, 1583, by Donnell Mac Donnell Ymoriectagh, who w^th^ 15 Kearnes of his owne, and 6 of the Wardens of Castle Mange, found him in a poor cabbin in Glaneinelie, nere to the River Mange in Kerrie.

Sir Richard Cox, in his "History of Ireland," (page 367 *dorso*, *recte* p. 374), writes that the person who led the party, his sister's property having been plundered by the Earl of Desmond's followers, was named Owen O'Moriarta, als Drogbearla [i. e. of the *bad English*]; but that the person who killed the Earl was Kolly, who was bred by the English, altho a native Irishman; that the place was the wood of Glawniginky, four miles from Traley.

IRISH CORRESPONDENCE, STATE PAPER OFFICE.

No. 87. (*Indorsed*) 1584, *October* 24.—*From the L. Deputye*, (*directed*) *to the Queenes moast excellent Ma^tie^.*

May it please yo^r^ moast excellent Ma^tie^ becawse I yor L. Deputie have written at lardge to the moast ho: the ll and others of yo^r^ ma^ts^ privie counsell of the successe of your h: service in Ulster, of late, and that we the rest of yo^r^ Ma^ts^ counsell here were made acquaynted with the same, some of us having ben ey witnesses and partakers in moast of those actions. We thinck it inconvenient to troble yo^r^ h: with anie new rehersall thereof, knowing their Lls will impart yo^r^ Ma^tie^ w^t^ the same, wherein yo^r^ Ma^tie^ shall fynde somethinge don and motioned to be further don, w^ch^ being taken holde of and mayneteyned, seeme lyklie in all reasonable coniecture, to bring proffit to yo^r^ Ma^tie^ and securitie to this State, and make yo^r^ Ma^tes^ actions shyne above all yo^r^ predicessors for the relief it may gieve to the miseries of this lande; hoping therein of the better successe through the blessing that hath, and we pray God ever may attend yo^r^ Ma^tie^ and all yo^r^ moast gracious proceedings.

It pleased yo^r^ Ma^tie^ to require myne yo^r^ Deputies opinion by the advice of us, of this counsell concerning the Baron of Lixnawe and his son Patricke, the Seneschall of Imoghellie, and Patricke Condon, the protecties of Munster. Having accordinglie considered of the matter, we conceave that to continue them thus in protection, is to breede loosemen, while they are holden in jelozie of their safties, and a mean to make them the readier for a new sturr if anie bad one shoulde start owte. And to prosequute them wilbe not onlie a farr greater chardge unto yo^r^ Ma^tie^ then the pursute will recompence, but also a reviving of the miserie of that Province, nowe beginning to recover some breath, and inclyning to a generall lyking of dutie and obedience, whereof there as ells where is growne nowe a shewe of an universall tranquillitie. These men being called before me the Deputie at Limerick, and v more of us that were present, they pretended greatlie to sorrowe and repent their falt and pro-

tested to make amendes for the same, not onelie by reforming but also by spending their lyves as occasion shoulde be offred in yo^r Ma^tie service. They gave some testimonie thereof in the late northern jorney. And as we heere do accordinglie frame them selfs nowe in their cuntrey, falling to lyke of the plough. And therefore considring what stirring fellowes they are if anie occacon of sturr shoulde be offred, or that them selfs shoulde rayse anie, we are of opinion (under better reformacõn), that as things stand nowe, it were better to pardon them then either to pursue them, or (specially) anie lengre to protect them. And so, if they have but half the graves that they ought and seeme to have, be so thoroughlie devoted to yo^r Ma^tie service and obedience as men that throughe yo^r Ma^tie gracious clemencie have receaved a new lyef, and will accordinglie endevor them selfs to deserve the same.

The Countesse of Desmonde lay at Clonmel, where she was allowed a diet of viii^s per diem for her self, her daughters, and weemen. Wee thought it not meet to continue that chardge to yo^r Ma^tie, And therefore, both to cut it of, and to be the surer of her, we have cawsed her to be removed to this castle. We thincke her estate to be verie bare, and muche she lamenteth, and ernestlie desyreth to be sent over to yo^r Ma^tie. We have no warrant to proceede againste her by lawe, to send her over or releive her. We therefore humily beseche yo^r Ma^tie to geve some direction concerning her.

By one article of yo^r h. instructions to me yo^r Deputie, yo^r Ma^tie referred to us to consider what course were best to be taken w^th the Erle of Clanricarde. Upon advised conference of all things depending upon that cawse, we thought it the best way and moast agreeing to yo^r Ma^tie service to grant unto him yo^r Ma^tie pardon. His dutiful dealings since hath given us cawse to pray yo^r Ma^tie to think the same well bestowed upon him: he having yelded good testimonie, not onelie of a well reformed, but also of a well affected subject. For being of late called upon by yo^r Ma^tie chief Commissioner of Conaght to serve against Orwirk, who in delivering in of his pledges as was ordered made some stay, he attended w^t his forces readelie and served forwardlie, as the said chief Comissioner hath advertized. And further upon the furst demaunde agreed to delivre in both his sonnes pledges. The younger he presentlie placed in Galloway at Schole. The eldre and his heir the Lo: of Dunkellen he hath sent hither to me yo^r L: Deputie humily desyring me to send him over to yo^r Ma^tie w^ch I have presumed to do, and with him Orwirk's son (2 principal bands for Connaght,) not doubting but yo^r Ma^tie will geeve ordre for their educacõn, that they may hereafter serve God and yo Ma^tie as they ought to do.

We have thought good to make choise of this bearer S^r Lucas Dillon, chief Baron of yo^r Mat's Exchequer as the fittest man to carrie over this dispache, as well because he hath ben a doer in the iorneys and services don, since I the Deputy receaved this chardge: and thereby can the more particlerlie declare all things w^t their circumstances. As also for that he being learned in the lawes, and otherwise sufficientlie instructed is hable to confer w^t suche as yo^r Ma^tie shall appoynt for settling downe of those Statutes that we have sent over by him, or there shalbe thought

meete to be enacted, and for yo^r Ma^tie to geeve yo^r royal consent unto at the Parliament to be here shortlie holden. Humily beseching yo^r Ma^tie w^t yo^r accustomed favor in respect of his good deserts, to vouchesaf him yo^r Ma^tie gracious speeche and presense, and to return him w^t a gracious speedie dispache. God long blesse and preserve yo^r Ma^tie. From yo^r h: Castle of Dublin the xxiiii^th of Octobre, 1584. Yo^r Ma^tie faythfull subiects and bounden servants,

J. Perrot.

Ad: Dublin Canc.
Thomas Midensis.
J. Norreys.
Robert Dillon.
Ed. Waterhous.
Tho. le Strange.
J. Garvey.
Geffray Fenton.

Irish Correspondence, State Paper Office.

No. 89. (*Indorsed*) *Archb. of Dublin*, 1585, *Julii* 18.—*Countes of Desmond.*—(*Directed*) *To the right honorable my singular good Lord, the L: Burghley L: high Treasorer of England.*

It may please yo^r L. I am driven at this time to troble your L. by the importunacie of the Countesse of Desmond, ernestly requestinge me to signifie to yo^r L. hir bare and miserable state heare; wc^h chefely movid me. She hath receavid p̄don for hir lyfe, and have entrid into bonds of ten thousand pounds not to make clayme to any lands w^ch were assured to hir by hir husband as a zointtor. I assure your L. hir case (being chargid w^th childrin) is so miserable that seldom the lyke hath bene sene in a woman of hir calling. All hir frends (I know not upon what consyderation,) have quite forsaken hir: so as if yo^r L, w^th the rest of that honorable boord, be not a mean to hir Ma^tie to graunt unto hir some portion to releve hir and hir childrin, there is no doubt but very shortly they all will goo a beginge: and although hir offence hath deserved severitie, yet she emongest the rest hopethe to tast of hir Ma^ties clemencie; so leving hir and hir misery to your L. goodly consideration I humbly comitt your L. to the blessings of the Almightie God. From Dublin this 18^th of July, 1585.

Your L. most humbly at commandmēnt.

Ad: Dublin, Canc.

Irish Correspondence, State Paper Office.

No. 90. (*Indorsed*) 1585, *Sept.* 4.—*The Countes of Desmond.*—(*Directed*) *To the Right Honnorable my singler good Lord the Lo: Burghley, Lord high Treasorer of England.*

Right honnorable and singler good Lord, my humble duetie unto yo^r honnor remembrid yt maye please the same Albiet her Ma^tie of her

highnes bountie sent direction to the Lo: Deputy of this realm to passe unto me her Ma^tie graciouse pardon, yett the same was staied from me untyll the xxviii of Maye last, at w^ch tyme before I could receive my pardon, I was fayne to enter into recognizances of X^m li, (£10,000) that neither my self nor eny other to my use shall make tytle, challenge, or entrye to eny dower jointo^r, or thirds of eny parte of my late husbands lands. And also I was fayne to fynd suerties and enter in other bands, thatt neither myself nor eny of my five comfortles children, shall nott departe this realme, by meane of w^ch bands I can notte enjoy my thirds or jointo^r, neither can I obtayne licens to go into England to be a petitioner to her Ma^tie for the same. So, as I and my children have livid in suche calamitie thatt if my Lo: Deputie had nott taken pittie of me and them in relevinge us owtte of his Lops kitchin we might have starvid w^th honger: for in my necessitie all my kinsmen and frends here have utterly forsaken me. And sinc my Lo: Deputy w^th drewe his liberalitie from me, I and my children have tasted of so moche myserie thatt I protest unto yo^r honno^r I knowe no waye howe to presarve me and them from perishing by famyne, except her Ma^tie do nott relieve us. For my relief owtte of this pouertie I entred a supplicacon to my Lo: Deputie who inclosed the same w^thin a lre of his Lordships directed to the most honnorable lls of the Counsell referringe the same to be considered of by their honnors. Therefore I most humbly beseche yo^r ho: Lo: (for God's cause,) to take compassion of my distressed case, and to be a meane, that like as it hath pleased her higness to spare my lief, so it may likewise please her excellency of her accustomed clemency to send direction to my Lo: Deputie to lett me to enjoye my thirds and jointo^r the w^ch althoughe at this present it be in wast and shall growe of long tyme butt to small cõditie, yett it may be a great releif unto me and my poore children, as know^th God, whome I beseche longe to preserve yo^r honno^r in all felicitie. From Kylynely the iiii^th of Septembre, 1585.

Yo^r ho: Lo: most humbly to cõmand,

E. Desmond.

Irish Correspondence, State Paper Office.

1587, *Aug.* 27, *enclosed in*
1587–8, *Jan.* 8.

(*Indorsed*) 27 *Aug.* 1587.—*The L. Deputie to the L. Roche, in answeare to his desyre for leave to goe into England, as also to his advertisement that the Countess of Desmond ment to passe into England.*—(*Directed*) *To my verry good L. the Lo: Roch.*

After my verie hartie commendacõns to yo^r Lo: I have receyved your lrẽs of the 21 of this instante, wherein you renewe your former suite touching your going over to hir Ma^tie A thing w^ch in respecte of the troublesomenesse of the time I may not yet graunt, but the beginninge of the next terme, I mean then, if you send to me to answeare your

request. And for your titles I have sent the Queen's solicitor thither to consider thereof.

Touching the Countesse of Desmondes going into England y^t is more then I knowe, neither can she goe w^th out licence from me so to doe, w^ch she is not like to have.

So fare your L. hartely well. From Dublin the 27 of August, 1587.

Yo^r L. very loving frinde,

J. Perrot.

Irish Correspondence, State Paper Office.

No. 101. (*Indorsed*) *Irl.* 1587, *January* 8.

The Lord Roche with twoe Lrēs from the L. Dep. to him.

By which appeareth how earnestly he desyred leave of the L. Dep. to goe into England: as also that he foretoeld the L. Dep. of the Countesse of Desmonds purpose to pass over into England. Desyreth my favorable lrē to the L. Dep. that advantage of his bond of C^l be not taken by the sayd Countesses comyng over.

(*Directed*) *To the right honno^r and my assured frind Sir Fraunces Walsingham Knight, of her highnes moste hono^r privie Councell, theise be.*

Right honnor. my dutie remembred unto yo^r honno^r I doe send yo^r honno^r herinclosed the L. Deputie is lrēs (as I promysed to sende) concerning his deniall of geving my lycense to repair unto the Courte, whearby yo^r honno^r may judg wheather he hath sheowed my that favo^r w^ch may be easlie w^th out any prejudice extended to any other, and I not any way culpable for my departure, considering howe hardlie this twelvmoneth and better he hath stayed my from that jorney, and in the meane tyme hath lycensed dyuerse others of the nobilitie of the realme to passe thither, and of the inferior sorte a greate many, w^ch hath occasioned my to adventure the daunger thereof (yf any their wer as there was none at all). I certified unto his lp of the privie departure (which I understand) of the Countes of Desmond for whome I was bound in 1^c pounds Ster. w^th others, that she should not depart w^thout lycenc, whose answer thereuppon shall appere unto yo^r honno^r by the said lrēs. So praing yo^r honno^r to contynue yo^r accustomed favo^r and furtherance to wards me, I homblie tak my leave. Bristoll the viii^th of January, 1587.

Yo^r honno^rs most assured in what he may.

M. de Rupe and Fermoy.

I feare to be troubled for the departure of the said Countess of Desmond for the sum of 1^c pounds aforesaid. I doe therefore beseech yo^r honno^r considering that by the said lrēs I certified thereof to the L. Deputie, yo^r honno^r would uppon some convenient tyme writ yo^r favo^r all lres to th'end that I may be dischardged therin.

IRISH CORRESPONDENCE, STATE PAPER OFFICE.

No. 104. (*Indorsed*) *The humble peticõn of the Countesse of Desmond to the Right honnorable Mr. Secretary Walsingham.*

To the Right honnorable Sr Fraunces Walsyngham Knyght, principall Secretary to the Queens Ma^{ty} Right honorable, Wheras by your good meanes her Ma^{ty} bestowed on me l^{e} marckes, who havinge nothinge elsse but the same to releve me, in hope I myght bee the better payde I lay in Dublin, w^{ch} being not payde me accordinge her Ma^{tes} direcc̃on and your hono^{rs} expectac̃on, I was enforcede to roune in creditt for w^{ch} I owe duble for every thing I hadde. And nowe beinge these xii. monethes here in greate mysery, where I have lyved all the while on lyke creditt, and havinge sent my Lo: Tresourers lrẽs to Sr HyWolloppe in procuringe the payment of suche mony as was due to me, w^{ch} my man colde in nowyse receyve, eyther to discharg part of my creditors in that country, or healpe my pore children, whose myserable estate being reddye to peryshe dothe dayly cry out for relefe, besydes the extreamyty I endure here wth my poore famylly. In tender consyderac̃on wherof, I most humbly beseche your honnor, lyke as I accknowledge you have bene the only and furste procurer of my relefe sence my unfortunate fall: so nowe to my exceeding comforte vouchsafe the contynewaunce of your honno^{r} able favoure, so as by your good meanes I may have the furste yeres pencion of my last graunt payd me nowe, to supply my present wantes: protesting to your hono^{r} my creditt is quyght spent. Besydes the mysery I knowe, and am credybly enformed my children endure in Irland, wherin your hono^{r} shall (as you have alwayes donn) bynd us to pray for your hono^{r}, &c.

IRISH CORRESPONDENCE, STATE PAPER OFFICE.

No. 104. (*Indorsed*) *M. to the Deputie of Ireland for the Countesse of Desmond, Sept.* 1588.

Right trustie and well beloved wee greete you well. Whereas y^{e} Countesse of Desmond hath been an humble suter here unto us to relieve hir poore estate and miserie, whereunto she is brought by hir late husband's rebellion against us. Wee having compassion of hir unhappie and miserable estate, whereunto she is fallen, rather by hir said husband's disloyaltie, than by anie hir owne offence, are pleased for hir owne reliefe to bestowe on hir an yearely pencion of two hundreth pownds sterling, to be paid hir quarterly owt of o^{r} Excheq^{r} of that realme during hir . . . . . And therefore theise are to will and cõmaund you o^{r} Deputie to cawse a patent to be made from us and passed under o^{r} greate seale of y^{t} realme, of the said annuitie of CC^{li} by yeare, to be paid quarterly, as aforesaide, to the said Countesse by the hands of o^{r} Thrẽr, at warres there for the time beeing, ether of such mony as cõmeth to his hands of o^{r} revenewe there, or of such treasure as shalbe assigned from us here to him. And in so doing theise o^{r} lrẽs shalbe sufficient warrant and dischardge, as well to you o^{r} Deputie, and to o^{r} chancellor,

and to our now Thrēr, at warres of that realme, as to anie other o^{r} Deputie, or chiefe Gov^{r} nor, and to anie other o^{r} Chancellor or keeper of o^{r} greate seale of that realme, and anie other o^{r} Thrēr, at warres there, for the tyme being hereafter. Given, &c.

IRISH CORRESPONDENCE, STATE PAPER OFFICE.

No. 109. (*Indorsed*) *The humble peticōn of the Countesse of Desmond, to the Right honnorable the Lls. of Her Ma^{tie} most ho. privie Counsell.*

Having no meanes to live but upon her pencion, w^{ch} she cannot gett paid in Irland, Desyreth the same may be paid out of the Exchequer here.

To the Right honno^{r}able the lls. of her Mat^{ys} most hono^{r}able privie Counsell.

Most humbly maketh peticōn to your most ho: good Llps yo^{r} poore and daylie Oratrix Elleanor Countesse of Desmond. Whereas it hath pleased the Quenes most excellent Ma^{tie} of her princely favo^{r}, in Marche 1587, to bestowe upon you^{r} poore supl. for her relief a yearly pencōn of II^{c}li to be paied in Ireland. So it is most honnorable that notwithstanding the same graunt yo^{r} Oratrix doth live in most lamentable sort, by reason she is not duelie paied of her said pencōn; having receevid sinc the graunt thereof but one hundreth pounds at Xpas last, w^{ch} she did owe for her diet long before that tyme. Sins w^{ch} tyme she ranne in creditt untyll Easter. Her creditors (being not paied of their former debt) would no further lett her have meate, drinke, nor eny other necessaries. So that hitherto yo^{r} Oratrix (being in the meane tyme spent even to the uttermost) feeleth suche extreame penury, as she and her poore famylie are more like to perishe for want of food, than longer contynewe the misery thereof, if honnorable compassion be not speedily extended therin. Yt maye therfore please yo^{r} ho. Llps in relief of your poore supl. needy estate (considering she hath nothing wherewith to mayntayne or comfort her but her pencōn, and that ther is no hoape for her to receive it in Ireland), to be meanes unto her Ma^{tie} that the same pencōn may be paied owtte of th' Exchequer in this realme, where she maye be paied so moche of her pencōn as already is due, wherewith she maye paye her debts, and procure her further creditt. And she shall praye for yo^{r} good Llps, &c.

IRISH CORRESPONDENCE, STATE PAPER OFFICE.

No. 109. (*Indorsed,*) *A Note of the clere remayn due to the Countesse of Desmond upon her pencōn ending xxx Marcii* 1589.

Ther is due to Dame Ellenor Countess of Desmond for her pencōn of c^{li} [cc^{li}] Ir. p. an^{m} due for ii whole yeares and a quarter begenyng from Xpas 1586 (at which tyme her La: was full paied,) and ending at the feast of th' anuncyacōn of o^{r} Ladie 1589, the some of . . ccxxv^{li} Iři.

whereof
Ther hath bene impreested to her La: in A° 1587.
A° R. R^me Elliz xxix by severall bills
Rem̃. . . . . xxxii^li
And in A° xxx^mo 1588, to her La: by the
hands of Moris Shighan her Agent as by his
bill Rem̃ aperith . . . xxxi^li v^s ii^d ob. lxiii^li v^s ii^d ob.
And so remayneth clere due uppon this reckonyng for her La: pen͡c͡on, ending at o^r Ladie daie next 1589 the sum of . . . for ster. { clxi^li xiiii^s ix^d ob Iri. / cxxi^li vi^s i^d

Whereof impressed to the said Moriss Shigham by Bill vi° Marcii 1588, vi^li ster, so rem̃ cxv^li vi^s i^d ster.

STATE PAPER OFFICE.

1589–90, Feb. 9.—The following is an extract from a docquet of Irish suits:—

Countess of Desmond (90).

That whereas her Ma^tie hath graunted her a pen͡c͡on to be paid out of the Exchequer here, Desireth their Ll to bee a meanes to her Ma^tie to pay . . . . . Warrant for the same, she lying here . . . want and at verie great charges
Also her Sonne being diseased as Mr. Leiutenant . . . . . craveth their Ll carefull consideration of him . . . . . of his health.

BRITISH MUSEUM, LANSDOWNE MSS., No. 156, p. 114, extract:—

Pentions and Annuities granted by her late Ma^tie (Queen Elizabeth).

By the yeare Countesse of Desmond . . cc^li
2 Daughters of the said Countesse . . lxvi^li xiij^s iiij^d

STATE PAPER OFFICE.

Notes of Documents.

1588–9, Jan. (21).—To enquire what has been answered to the E. of Desmond, and others, on chargeable lands.

1589, Oct^r. 14.—Sir R. Greynville to Walsingham, "Concerning the state of Munster, and the government of the Desmond, before the rebellion, and the value of the lands."

1589, Oct^r.—Commissioners in Munster to P. Council. The tenants and pretended proprietors of the chargeable lands shew ancient charters proving their title to the lands before Desmond or any Geraldine had footing there.

Think they should pay *Shraughe* and *Marte** to H. M. as they did to Desmond.

1589, Dec. 15.—Petition of Morish Shigane to the Lord Treasurer to take order for the relief of the Countess of Desmond, before Mr. Secretary Fenton departs.†

1589 (*Circiter*) Cal. 195.—Names of the 8 persons excepted out of the Act of Attainder of the E. of Desmond.

From Calendar Patent Roll, 1 James I., part 1, page 5.

LVIII. 17.—King's letter for grants of pensions of 50^{l} each to the Lady Jane Fitzgerald, and to Ellen, and Elizabeth, her sisters,‡ all sisters of the late Earl of Desmond. 4 Sept. 1st.

MONDAY, APRIL 22, 1861.

REV. CHARLES GRAVES, D. D., President, in the Chair.

The REV. WM. REEVES, D. D., read a paper—

ON THE TOWNLAND DISTRIBUTION OF IRELAND.

THE civil distribution of Ireland, in the descending scale, is into Provinces, Counties, Baronies, Parishes, and Townlands; and under these successive grades of classification every acre of Ireland is accounted for in that noble compilation, the Census of 1851,—a work which, independently of its ostensible object, affords to the Irish topographer, next to the inestimable Ordnance Survey, the most valuable repertory of information in existence;§ and which would probably enjoy a higher literary character, had it been issued in a cover of any other colour than blue.

But this highly convenient distribution of the surface of Ireland is characterized neither by unity of design nor by chronological order in

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* Referring to the "Topographer," by J. G. Nichols, F. S. A., Part 14, p 123:—"1587. Names of Rentes, in Money, Victuals, and customes, which were due to the Earl of Desmond:—

Shraughe, A yearlie rent in sterling money
Marte A yearlie rent of beef."

† Morishe Sheghan (as he himself signs) was attorney for the Earl of Desmond in giving livery and seisin of the Earl's estates, under the feofment of 1574; and on the Countess Kathrin surrendering her castle of Inchiquin, 1575, to the Earl, the latter feofft it to Morishe Shegan in trust.

‡ Daughters of the rebel, Gerott, 16th Earl.

§ The census of 1841 descended no lower than the parochial division. There were, however, thirty-four fasciculi published in 1844, at one shilling each, in which the enumeration returns of *Houses* and *Persons* were given under the head of the several townlands. This was the first printed recital of all the townlands of Ireland. The census of 1851 adopted the same minute classification, and further added the acreable contents of every townland.

its development. The provinces, subject to one suppression,* and some interchange of adjacent territories,† represent a very ancient native partition, which, in the twelfth century, was adopted for ecclesiastical purposes. The counties and baronies, though principally based on groupings of native lordships, are of Anglo-Norman origin, and range in the date of their creation from the reign of King John to that of James I. The parochial division is entirely borrowed from the Church, under which it was matured, probably about the middle of the twelfth century; while the townlands, the infima species, may reasonably be considered, at least in part, the earliest allotment in the scale.

According to Irish authorities‡ of respectable age, the progressive subdivisions under the *Coigeadh*, or Province, were: the *Tricha-ced*,§ or "Thirty-hundreds," sometimes simply, *Tricha*, "Thirty;" the *Baile-biataich*, or "Victuallers-town," sometimes simply *Baile*, or "Town;" and the *Seisreach*, or "Plowland." Each Tricha-ced contained 30 Bailebiatachs, each Bailebiatach 12 Seisreachs, and each Seisreach six-score acres of native measure.‖ They represent the contents of the five provinces under these heads, as follows:—

	Tricha-ceds.	Baile-biataichs.	Seis-reachs.
Meath, . . .	18	540	6480
Connaught, . .	30	900	10800
Ulster, . . .	36	1080	12960
Leinster, . .	31	930	11160
Munster, . .	70	2100	25200
	185	5550	66600

The total amount of which, at 120 acres to the sheshragh, would be 7,992,000 acres for all Ireland. But this, though considerably less than half the actual extent of the country, is exclusive of wood, moor, and

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* That of Meath, the limits of which were adopted for, and are still retained as, the boundary of the diocese of the same name.

† Louth formerly belonged to Ulster, and Clare to Connaught. Elyocarroll, which is now represented by two baronies in King's County, in the province of Leinster, was originally included in Munster.

‡ Keating does not inform us of the source whence he derived his third chapter, which treats of the divisions of Ireland. An Irish poem on the subject, ascribed to Fintan, the antediluvian, is printed with a translation in Mr. Curry's Battle of Magh-Leana, pp. 106-109. Ware cites, as his authority, the manuscript which contains the so-called Annals of Multifernan, written in 1274; and the Registry of Duisk. (Works, vol. ii. p. 30.) Dr. Lynch, in his Cambrensis Eversus, takes the poem of Fintanus Orfear as his authority, (p. 306).

§ *Tricha* is latinized "Treuca" by O'Sullivan and O'Flaherty. *Ced* is rendered "centuria" by the latter. Ogyg., p. 24. In the Annals of the Four Masters, An. 1176, is recorded the grant of a *baile-biataigh*, namely the baile of Tuaim-achadh. See O'Donovan's note; and Hardiman's note on the statute of Kilkenny (Tracts of the Irish Archæological Society), p. 5.

‖ One trichaced = 30 ballybetaghs = 360 sheshraghs = 43,200 acres.

mountain, which did not enter into the agricultural calculation. The sheshragh or plowland was ascertained by estimation, not measurement; and thus we can account for the great discrepancy between the estimated contents of a townland two centuries and a half ago and the present result of actual survey. I give an example from the county of Antrim. The parish of Ballyclug has three townlands, called the Cross, Crebilly, and Caherty. Of these, the first was returned in an inquisition of 1640, as containing 120 acres; now it measures 1529 acres, or more than twelve times the early amount. Crebilly was reckoned at 90; now it is 800. Caherty was 120; now it is 946.

To the tricha-ced, or cantred,* as it is sometimes rendered, we have now no corresponding division. It is sometimes, but incorrectly, identified with the barony, because occupying the second place in the scale; the fact that there are 325 baronies, according to the present arrangement, or 271 undivided, while the tricha-céds amounted but to 185, proves that they were different in their constitution. The ballybetagh is still more destitute of a modern equivalent,† except in some few cases where groups of twelve townlands under a generic title still constitute distinct properties. In fact, the seisreach, which is derived from *seisear*, "six," and *each*, "horse," and is understood to denote the extent of ground a six-horse plough would turn up in a year at so much per day,‡ is the division best represented in our present allotment. The number of seisreachs, or plowlands in Ireland, is stated to be 66,600; and it is a remarkable approximation to that sum, especially in such high figures, when the number of townlands as now defined, named, and laid down on the Ordnance Survey, is found to amount to 62,205. In the former case, the average arcable extent of the plowland would be 304·8, while in the latter it is about 326·4.§ But, in detail, the townlands exhibit great variety as to their contents. For example, Sheskin, in the parish of Kilcommon, barony of Erris, and county of Mayo, ‖

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* Giraldus Cambrensis, when stating that the Isle of Man consisted of 343 villæ, or three cantreds, asserts that "Cantredus composito vocabulo tam Britannica quam Hibernica lingua, tanta terræ portio quanta 100 villas continere solet"—Itinerar. Cambr. ii. 7, (p. 867, ed Camden). Again, speaking of Wales as comprehended in 54 cantreds, he observes: "Cantredus id est cantref, a Cant, quod centum, et Tref, villa, composito vocabulo tam Britannica quam Hibernica lingua."—Cambriæ Descript. c. 4 (p. 884, *ib.*) According to this the Irish compound would be *ced-trebh*. In another place (Top. Hib. iii. 5) Giraldus Cambrensis states the *cantaredi* of all Ireland to be 176 (p. 737, *ib.*) We meet with the term very often in the Irish rolls of King John.

† The nearest approach to the estimated size of an ancient ballybetagh would be half an average parish. There are on the Ordnance Map 2422 several parishes laid down. In Ware's time they were in number 2293.

‡ O'Flaherty makes the *seisreach* the same as the *ceathramhadh*, or "quarter," and latinizes it "sesquiquadriga." Ogyg. p. 24.

§ In a very valuable paper, by Sir Thomas Larcom, prefixed to the Irish Relief Correspondence, in the Board of Works' Series (London, 1847), the number of townlands is stated at 66,700, and 330 the average amount of acres in each. It would seem that the learned compiler borrowed the old Irish computation of plowlands rather than computed the modern townlands, as there is only one hundred difference between his total and the old one.

‖ Ordnance Survey, Mayo, sheet 19.

which is the largest single denomination called a townland, in Ireland, contains 7012 acres; while Mill Tenement, a several denomination of like rank, in the parish of Ardclinis, county of Antrim,* does not exceed 1 acre, 1 rood, 1 perch. In mountainous districts, like the barony of Ballynahinch, in Galway, the Mourne Mountains, in Down, and some ranges in Donegal, we meet with single tracts called townlands, from five to six thousand acres in extent; then again, coming to the valleys in the same counties, we find patches in the shape of townlands of very small dimensions. There is in the parish of Kilclief, in the county of Down, a little townland of 4A. 3R. 2P., called Acre M'Cricket,† that is, Mac-Richard's Acre, which for ages formed a portion of the large Fitz Simon property, but in later times derived its severalty from its becoming, after successive subtractions, almost the sole residuum of the old family estate.‡

As regards the arcable average of townlands in the various counties, it is to be observed that it is not regulated by the general productiveness of the land.§ One might expect to find the highest average in wild mountainous counties like Mayo, Galway, and Donegal, and the lowest in level and fertile ones, like Meath and King's County. But it is not so. Down, which is a very fruitful county (though, no doubt, it owes a great deal to improvement created by industry since the denominational boundaries were fixed), has the maximum average, or 457 acres to the townland. After which come, successively, Donegal, 432; Kerry and King's County, 415; Antrim, 409; Londonderry, 408; Mayo, 382. The minimum average is Monaghan, which is only 172; then Fermanagh, 184; Dublin, 206; Cavan, 233.

This great difference between the extremes, 172 and 457, must have had its origin in the civil peculiarities of the districts, while in the possession of the original inhabitants. Monaghan and Fermanagh,‖ two contiguous counties which have the lowest average, thereby denoting the minutest subdivision, were found at the close of the sixteenth century to consist of a certain number of ballybetaghs, each of which contained 4 quarters, and each quarter 4 tates,—that is, in each ballybetagh 16 tates—a name peculiar to these two territories, the patrimonies respectively of Mac Mahon and Maguire. The tate was estimated at 60 acres native, and a sixteenth, instead of the more usual twelfth, was the unit; and this, continuing in local use, afterwards came to be stereotyped in these parts as a townland on the Ordnance Survey.

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* Ordnance Survey, Antrim, sheet 25.

† Ordnance Survey, Down, sheet 31.

‡ The townland Isle M'Cricket, in the same parish, consists of but 8 acres and 37 perches.—Ord. Surv., Down, sheet 38

§ Ware says that the quantity of a carucate or plowland is "greater or less, according to the nature or quality of the soil." Works, vol. ii., p. 31.

‖ The Surveys of the Counties of Monaghan and Fermanagh, made in 1591 and 1603, two very valuable documents, are printed in the introduction to the Ulster Inquisitions.

Cavan, which skirts them both on the south-west, succeeds them after one interval in the average scale; and its distribution was at the same period numerically similar, though under a different name. Its first division was the ballybet, identical with the ballybetagh of other parts; of this the proximate species was the poll or pole, sixteen of which constituted the ballybet. Each poll contained 2 gallons, each gallon, 2 pottles, descending even to a subdivision called pints. In most cases these fractional parts had peculiar names, some few of which may now exist in the townland nomenclature of the county; but the poll was practically the prevailing denomination, and to it, as the sixteenth, instead of the twelfth of a ballybetagh, we owe the numerical excess of townlands in this district.

In Down, on the other hand, the prevailing denomination was the ballyboe or "cow-land" sometimes called the carewe, from the Latin *carucata*, or plowland, which in the Bagenal Patent was estimated at threescore acres. Three of these formed the quarterland, and twelve the ballybetagh. Sometimes a smaller division was in use, called the sessiagh.* Thus O'Lavery's territory, comprising a principal part of the parishes of Magheralin and Moira, in this county, was found by inquisition to contain 13 sessiaghs.

In Antrim, the townland, latinized *villa* and *villata*, was the prevailing denomination at the commencement of the seventeenth century. The higher division was, as in Down, the quarterland, that is, the conventional quarter of the ancient ballybetagh. Here, as elsewhere, the original name of the quarterland was often lost, while the specific ones were retained; or the generic name was given in exchange to a principal component part.† Thus it often happened that out of a quarterland, with its four specific portions, each having its own boundaries and peculiar name, have grown five denominations of the same order. In Antrim we have still the traditional aggregation in the "four towns" of Carngrancy, of Ahoghill, of Duncane, of Drummaul, of Ballyclug, of Inver, &c.; the "eight towns" of Muckamore (now increased by subdivision, on the Ordnance Map to ten), the "eight" of Glynn; the "twelve towns" of Balleny; the "sixteen towns" of Connor"; and the "sixteen towns" of Antrim, now increased to twenty-seven. On the other hand, what were formerly the "four towns" of Cranfield, in Upper Toome, have lost their severalty,‡ and now form the single townland of Cranfield, of 834 acres.

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* Sessiagh is a different word from scisreach, but seems to convey the idea of sixth, though in reference to what standard it is difficult to say. As a measure it prevailed in Donegal, Tyrone, Armagh, and was considered the third of a ballyboe or plowland. As a townland name it occurs simply or in composition twenty-one times, and the average contents are 170 acres. In a stanza cited by the Four Masters, at 1031, we find the term *Seisedhach* in the sense of a 'measure.'—Ed. O'Donovan, p. 823.

† Thus, in Mayo, Criathrach was a generic tract containing three *baile*s, or 1440 Irish acres, while the modern townland Creragh, which represents it, consists of but 141 acres. See Dr. O'Donovan's judicious observations in his note on the Tribes and Customs of Hy Fiachrach, pp. 203, 204, 453.

‡ The names of the four sub-denominations are locally preserved. See Ecclesiastical Antiquities of Down and Connor, p. 87.

So also the "four towns" of Craigs, in the barony of Kilconway, are on the Ordnance Survey mapped as one townland of 2,800 acres, without any mark of subdivision; but the four names, Groogagh, Grannagh, Carhinney, and Aughnakeely, are locally remembered, although the boundaries cannot be exactly shown. The Ordnance Survey might advantageously have perpetuated the last name, as it belongs to a portion in which is an ancient cemetery, which Colgan notices as *Achadh-na-cille*.*

The divisions in Donegal were ballybetaghs, descending to quarters, ballyboes, and sessiaghs: of which the ballyboe,† with occasional sessiaghs, was the denomination which eventually merged in the general townland.

In Londonderry it was found by inquisition, about the year 1639, that there were four baronies, one of which, Terkerren, contained "14 ballybetaughes, making in the whole 182 ballyboes, or townlands";‡ that is, 13 ballyboes to the ballybetagh. Ardmagilligan, in the barony of Keenaght, was returned as containing "40 towns or ballyboes."§ On the Ordnance Map the same parish, now called Magilligan, has 43, which shows a very trifling numerical change in the last two centuries and a half.

In Armagh the prevailing denomination was the "ballyboe or town," which contained three sessiaghs. In 1623 the parish of Tawnaghtalee, now Ballymore or Tanderagee, was found to consist of 55 balliboes or townlands,‖ while on the Ordnance Survey it now contains but 48, showing, even after allowance made for some subtractions, that there has been since that date no further subdivision. Ballymoyer, the patrimonial parish of the Keeper of the Book of Armagh, has been for two centuries and a half reckoned as eight towns; and though some of the component names varied from time to time, yet the numerical character was always maintained, and to this day, both locally and on the Ordnance Survey, the "eight towns of Ballymyre" occupy their old position. Lorga Iwallane, returned as a sessiagh in 1609, is now the townland of Lurgyvallen, in the parish of Armagh, consisting of 184 statute acres. In several instances we meet with "proporcions" of ten ballyboes, in this county, which are estimated at 1000 acres, that is, 100 acres, with their appurtenances, to the ballyboe.

In Tyrone, as in Armagh, the ballyboe, or townland, was the prevailing denomination, and contained three "sheshawghes" or sessiaghs, which are jointly represented in the modern townland survey. It had, besides, a compound denomination called *tullagh*, consisting of a ballyboe and a sessiagh, that is, a townland and a third.

Travelling southwards into Leinster, we find a considerable change in the denominational terms. The popular division of Longford was the

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* Trias Thaumaturga, p. 182 *a*, n. 195.

† There are twelve townlands called *Ballyboe*, in Donegal, and one called *Eleven Ballyboes*, containing only 408 acres. There is no other townland called Ballyboe in Ireland, except one in the parish of Templeetny, in South Tipperary.

‡ Ulster Inquisitions Londonderry, No. 9 Car. I.

§ Ibid. No. 5, Jac. I.

‖ Ulster Inquisitions, Armagh, No. 8, Jac. I.

cartron, which was estimated at from 60 to 160 acres. Four of these made a quarter or ploughland. The cartron is represented by the modern townland.

In Louth we find the carucate, or carew, of which 120, sometimes 60, acres were the prevailing contents.

Meath had the plowland, and under it the carucate and townland. In the direction of Cavan we find the poll.

Westmeath had the cartron and carucate. An inquisition of 1621 finds 3 carucates to consist of 360 acres, or 120 acres each. We also meet "a half-carucate, otherwise half-plowland."

The county of Dublin, influenced by the neighbourhood of the metropolis, was considerably subdivided. Thus, the parish of Lusk contains on the Ordnance Survey 81 townlands; an inquisition sped in 1546 finds but 59.* The prevailing denomination was the plowland or townland.

Kildare was similarly distributed.

Wicklow had villæ, villatæ, hamlets, lands, and cowlands, or ballyboes.

The divisions of Carlow were mart-lands or beef-lands, and fractional parts; also penny-lands.† The half and quarter martlands are now represented by the townlands.

Thus, too, in Wexford, besides quarters, carucates, and plowlands, we find an inquisition which sets out the barony of Ballaghkene as containing 13 marte-lands; Goorey, 20; M'Vadock's Country, 7; Skarawalsh, 31.‡

In Kilkenny, also, we meet with the carucate and martland. It had, besides, a denomination called capell-lands, three of which made a plowland; and a subdivision called a horse's-bed or horseman's-bed, containing 20 or 30 acres.§

King's County had the carucate and cartron. An inquisition of 1667 finds 1 plowland 80 acres, and two plowlands 8 score acres of arable land.

The English of Waterford reckoned by plowlands; the native Irish by mart-lands, and the sub-denomination horsemen's-beds.‖

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* An early transcript is preserved among records of St. Patrick's Cathedral. See Mason's History of St. Patrick's, p. 35. One of the denominations, now swallowed up in the adjuncts of Kenure Park was *Ballybetaughe*.

† In Scotland we meet with the denomination of *halfpenyland* in some ancient charters. The *mercata*, *solidata*, *denariata*, or "markland," "shilling-land," and "penny-land" were common terms of estimation.

‡ Leinster Inquis. Wexford, No 3, Jac. I.

§ In the Kilkenny Inquisitions we find "4 caples terræ" (No. 9, Jac. I.); "7 capal terræ" (No. 31, Jac. I.); "5 caball terræ" (No. 40, Jac. I.). "horseman's-bed" (Nos. 33, 89, 91, 93, 96, Car. I.) "½ mart. terræ" (Nos. 25, 77, Car. I); "¾ mart. terræ" (No. 80, Car. I.).

‖ Many of the particulars regarding this and other counties of Munster are borrowed from an interesting MS. in the Lambeth Library on "The Sundry Denominations of the Measuringe of Land in Ireland." Carew Collection, No. 614, p. 197. It was copied in 1846 by Dr. O'Donovan, and was printed by Captain Larcom as an appendix to his valuable "Memorandum" on the Territorial Divisions of Ireland.

Tipperary had capell-lands, of about 400 acres English measure, each capell-land containing four quarter meeres.

Limerick reckoned by quarters, each divisible into four quarter meeres. It had also a sub-denomination called gnieve.*

In Cork, we find the plowland, latinized *carucata*, and the gnieve or gneeve, a sub-denomination.

In Kerry, the divisions were quarters and plowlands, as 1 to 3; each plowland estimated at 120 acres.

In Connaught the prevailing distribution was into townlands, of vague import; quarters, the fourth part of the former; cartron, the fourth of a quarter; gnieve, the sixth of quarter. The cartron was computed at 30 native acres.†

But, notwithstanding all the varieties of local usage, the "town" or "villa" was a term which was understood in all parts of Ireland; and 60 or 120 acres, with their appurtenances, were the prevailing allotments; so that the denomination of townland easily came into universal acceptation, and its average extent was fixed at the common rate.

If we suppose a widely diffused population to have existed in the island at an early date, which the thick interspersion of the earthen duns, raths, and lisses, authorizes us to do, we can easily understand how, among a people semi-pastoral, semi-agricultural, each occupation of land would acquire a severalty, and become defined by ascertained limits. Our idea of a primitive settler would be of one who obtained a tract of land, so circumstanced as to be clear in part, and have a fair supply of running water, near which a habitation might be erected; together with a proportion of mountain, wood, or bog, as the case might be. Should circumstances lead the neighbouring occupants to a community of abode, their several farms, while they retained their distinctive appellations, would naturally acquire a generic name, borrowed from their joint habitation.

An Irish memorandum in the Book of Armagh, written before the year 800, furnishes us with a sketch which may fairly be understood as representing the characteristics of a primitive townland—"Cummen and Brethan purchased Ochter n-Achid, with its appurtenances, both wood, and plain, and meadow, together with its habitation and its garden."‡ Ochter n-Achid signifies "upper-field," and is probably the place now known as Oughteragh,§ in the barony of Carrigallen, county of

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* In Irish *Gniomh*, "a parcel of land," or twelfth of a plowland. There are twenty-one townlands of the name, chiefly in Munster. One of them, *Two Gneeves*, in Castlemagner, East Cork, contains only 71½ acres; another, called *Three Gneeves*, in Kilmacabea, West Cork, contains 179 acres.

† An account of the divisions of land, principally in reference to Connaught, written by the Rev. John Keogh, is preserved in a MS. of Trinity College, Dublin (MSS. I. 1. 2. p. 159), and has been printed by Dr. O'Donovan in the Appendix to his Tribes and Customs of Hy-Fiachrach, p. 453.

‡ *Dirróggel Cummen acas Brethán Ochter nachid conaseilb iter fid acas mag acas lenu conallius acas allubgort.*—fol. 17 *ba*. See Petrie's Tara, in Transact. R. I. A., vol. xviii., pt. 2, p. 195; Stokes, Irish Glosses, p. 81, No. 580.

§ The Calendars of Marian Gorman and O'Clery commemorate "Fiadhabhair of Uachtar Achaidh in Cenel Luachain," at July 7th.

Leitrim. Another passage* in the same collection makes mention of a grant of land to St. Patrick or the see of Armagh, in Drum-lias, now the parish of Drumlease, in the county of Leitrim, in which the boundaries are most circumstantially recited, and indicate a well-ascertained and accurately-named territorial demarcation at so early a date, and in a region which to this day is wild, and thinly peopled.

Three centuries later, we find the community of Kells granting for the support of pilgrims a tract in Leyny called Ardcamma, consisting of the sub-denominations "Baile O'Heerin, with its mill and land, and Baile O'Cowgan, with its land and mill."†

The earliest record, however, which enables us to form a comparative estimate of the ancient subdivisions of land in Ireland, is King Maurice MacLoughlin's charter to Newry, about the year 1158. In this record twenty denominations of land are recited by name.‡ During the period which elapsed between that date and the reign of Edward VI., either considerable additions were made to the original grant, or these twenty denominations had been subdivided; for in an inquisition of 1549 we find the possessions of the abbey described as consisting of 47 carrucates at the time of dissolution. But during the last three centuries little or no change seems to have taken place in the numerical arrangement; for the townlands which now constitute the parish and barony of Newry are exactly 47 in number.

Other charters of the twelfth century have recitals which might afford an interesting comparison with the present equivalents. That of St. Mary's Abbey of Monasteranenagh, of the year 1200, sets out the names of a hundred denominations.§ All the old monasteries presented in their post-dissolution inquisitions a much fuller list of lands than in their foundation charters, partly owing to accessional endowment, but principally to the subdivision of their possessions.

In districts where the English settled, the process of disintegration was carried on according as property became subdivided. Thus, in the parish of Swords, county of Dublin, out of 46 townlands, 35 have English names, some of which derived their origin from foreign settlers in the

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* Book of Armagh, fol. 17 *ab*.

† The record, of a date between 1128 and 1140, is entered in the Book of Kells. See Miscellany of the Irish Archæol. Society, p. 128; Ordnance Memoir of Templemore, p. 210.

‡ They are given, together with their identifications as far as ascertainable, in the Ecclesiastical Antiquities of Down and Connor, p. 117.

§ King John's confirmation charter to the Cistercian house of S. Mary of Magio was unknown to Archdall. It is a very valuable topographical record, and is printed from the original in the Tower of London, by T. Duffus Hardy, in his "Rotuli Chartarum in Turri Londinensi asservati" (London, 1837), p. 78 *a*. The site was anciently called Aenach Cairbre, or Aenach Beg; hence, prefixing the words Mainister-an, and dropping the second term, it became Mainister-an-Aenaigh; from the latter half of which another name, Nenay or Nenagh, was formed. It took the name *Magio* from that part of the Maigh or Maigue, now called the Camoge, upon which the monastery is situate, though the former name is now confined to the main river into which the Camoge flows.

twelfth and thirteenth centuries. "Hugh de Belynges" was a juror there in 1265,* and we find a *Belinstown;* "Petrus Salsarius," at same date, and we have *Saucerstown;* "Thomas Roussell," and *Rowlestown;* "John Walensis," and *Walshestown;* "Roger de Mora," and *Moortown;* "Michael Forestare," and *Fosterstown.*

Among the 81 townlands of Lusk† are two whose names indicate their creation. *The Regles,*‡ of 230 acres, lying next Lusk village, on the west, derived its name from a convent of Aroasian Nuns which existed there, and of which this was the farm. It signifies "The Abbey Church;" and the tract so called was probably a slice of the large townland of Lusk, which was appropriated to the nunnery at its foundation, and distinguished by its name. This house was dissolved in 1190, *ergo* this townland was defined and named before that date. *Grace Dieu,* a house of Augustinian nuns, was founded, on the suppression of the former, in 1190; and the townland, which still bears this name, dates its designation, and probably its severalty, from a period subsequent to the year just mentioned. By a similar mode of treating townland names, the ages when they came into existence might be easily determined, and especially in those parts of the Pale where English names both Christian and family, with the word *town* suffixed, prevail so generally. As an example—In the parish of Lusk, near the Railway Station, are two contiguous townlands, called Rogerstown and Whitestown. The former is named in early records "Villa Rogeri," and evidently denotes the settlement of an Anglo-Norman adventurer. The latter is a corruption of Knightstown, and is Latinized "Villa Militis," also savouring of a military occupation. Here are the ruins of a chapel and a cemetery, beside which is St. Maurus' Well, where, on the 15th of January, there was wont to be an annual commemoration of the patron saint, for whom "our ancestors," as Alban Butler observes, "had a particular veneration under the Norman kings." Thus all the circumstances of the places just mentioned point for their history to the period immediately consequent on the English invasion.

Of the subdivision of townlands in populous and fruitful districts, we have, as an example, among many, the Marquis of Hertford's estate in the county of Antrim, being the principal part of the ancient Killultagh. In the Conway Patent§ the denominations recited are 52 in num-

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* Registrum Alani, fol. 67 *a*.

† Of these 81 townlands, 29 only have Irish names. A prevailing form, both here and through the Pale, is a compound of a christian-name or surname with *town* suffixed, as Palmerstown, Parnelstown, Hacketstown, Thomastown.

‡ It is interesting to observe the traditional retention of the definite article with Irish names in places where the language has long ceased to be understood, and where the peculiarity is not recorded even on the map: thus we have The Naul, The Eglish, The Grallagh; which are very correct forms, denoting *The Cliff, The Church, The Clay,* although the people using them do not know the reason of the usage. Thus, also, in past times, we had The Newry, and The Naas, denoting respectively *The Yew* and *The Fairgreen.*

§ Patent Rolls of James I., p. 146 *a*. See also the great Hamilton patent, *ib.*, p. 73 *b*.

ber; while at present the same estate, which has continued unaltered for more than two centuries, and embraces in a ring fence the whole barony of Upper Massereene, with small adjacent portions of Upper Belfast and Castlereagh, contains about 150 townlands on the Ordnance Survey, the numerical increase being caused in part by the creation of new denominations as farms, with English names, but principally by calling up to the townland grade several of the subordinate divisions.

As regards the denominational terms which have been in use, I may observe that they differ greatly in their age and origin. The earliest which I have met is that of *coiced*, in the Book of Armagh, and therefore anterior to the year 800. It is Latinized in the same record by *quinta pars*, and is applied, in conjunction with the owner's name, to a portion of Drumlease parish.* The use of the term in later times† has been to denote a "province," and has given rise to the notion that it had its origin in this sense from the quinquepartite division of Ireland;‡ but, like our English "quarter," so wide and irrespective of proportion in its application, it seems to have its origin in some more general principle.§

The *Tricha-ced*, or "thirty hundreds" savours of foreign extraction, and seems to have its origin in the Saxon *hundred*.

The *Ballybetagh*, 30 of which made a tricha-ced, was, therefore, equal to one *céd*. There is a townland of this name, consisting of 464 acres, in the parish of Kilternan, in the county of Dublin.

The *Ballybo*, or "cowland" appears analogous in meaning to the Latin *bovata*, or Saxon *oxgang*.

Cartron,‖ which prevailed in Longford, Westmeath, King's County, and other parts, is an imported word, for which, in the sense of quarter, *ceathramhadh* (pronounced *carrow*) is the Irish term.¶ Cartron is derived, through the French, *quarteron*, from the Mediæval Latin, *quarteronus* or *quartrona*, and was probably brought in after the invasion.

Carucate is also of foreign extraction, being derived from *caruca*, "a chariot," which, in mediæval Latin, denoted a plough, and passed into the French *charrué*, from which was also borrowed in Ireland the form

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* Caichan was the possessor, and his portion was called *coiced Caichain* and *quinta pars Caichain*. Book of Armagh, fol. 17 *a b*. Zeuss also has *Coiced*, Gram. Celt., vol. i., p. 317.

† The modern form for "fifth" is *cuigeadh*.

‡ "Provinciarum quæque ob quinquepartitam, divisionem Cóiɜeaδ .i. Quintana ad hunc usque diem appellatur."—Ogygia, p. 24.

§ Ducange observes that *Quintana*, locally called *quinnon*, is used in Spanish charters in the sense of "villa" or "prædium." *Quinteria* is a farm from which the tenant paid a fifth of the fruits annually to the lord.

‖ Cartron was extensively naturalized in Ireland. There are 80 townlands, chiefly in Connaught, called *Cartron*. There are 60 more, spreading into Longford and Westmeath, in whose names *Cartron* is compounded with some Irish term.

¶ *Ceathramhadh* or *Carrow* is a very prevalent term. There are 640 townland names into which the word enters.

carewe, and *carue*;* hence it commonly denoted a plough-land.† In an English charter of Richard I.‡ a *carrucata* is declared to consist of 60 acres.

The *Tate* or *Tath*§ of Fermanagh and Monaghan, together with the *Poll*, the *Gallon*, the *Pottle*, and the *Pint* of Cavan, are all English terms, introduced by some unknown influence. To find names of liquid measure applied to land is strange; and still more so when it is remembered that they are English, and in such an un-English quarter as East Breffny. They had all become naturalized long before 1600; for we find, soon after that date, townland names into which these words enter in combination with Irish terms of qualification, as Tattenheglish, Tattenamona, Tattincaha, Tattinderry, Tattyboy, Tattybrack, Tattyreagh, &c.‖ So, also, Pottlebane, Pottleboy, Pottleduff, Pottlereagh; denoting White, Yellow, Black, and Mottled Pottle. These last names occur in Cavan, where we find also Gallonboy, "Yellow Gallon"; Gallonreagh, "Mottled Gallon"; Gallonnambraher, "the Friar's Gallon."

But the most interesting word connected with topical nomenclature is *Bally*. As an existing element it is the most prevalent of all local terms in Ireland, there being 6400 townlands, or above a tenth of the sum total, into whose names this word enters as an element. And this is a much smaller proportion than existed at the beginning of the seventeenth century, when there was a tendency, at least in some of the northern counties, to prefix *Bally* to almost every name whose meaning would admit of it.¶

Baile, in Irish, is supposed by some to be akin to the Latin *ballium* and *villa*,** by the latter of which it is generally translated in inquisitions. Philologists, however, hesitate to admit the connexion, on the ground that the Irish word possesses only a single *l*;†† and the earliest

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* Spelman observes on the term:—"*Carua* seu potius *carucata terræ*, est ea portio quæ ad unius aratri operam designatur, A PLOUGHLAND; Matheo Paris *hida*. Exoletæ jam penè inter nostrates sunt hæ voces: florent autem apud Hibernicos (saltem mihi notiores) occiduos. Connaciam enim in Comitatus, hos in Baronias, easdemque in *carucatas* dispescunt: plus minus, 120 acras continentes."—Glossar. voc. *Carua*. Ware is correct in identifying it with the *Carve*; but he should have written the word *Carue*.—Works, vol. ii., p. 226.

† O'Flaherty errs in connecting *carucata* with ceaċpamaḋ, as a division "quæ ex nominis notione est quarta pars pagi."—Ogyg., p. 24. There is nothing of a numerical allusion in the word carucata.

‡ Dugdale, Monast. Angl. vol. ii. p. 107.

§ There was a division in England called a *tothland*. In Norfolk and Suffolk also there was a custom called *tath*.

‖ The compounds of *Tate* or *Tatty* occur only in the counties of Fermanagh, Monaghan, and Tyrone, with the exception of one in Armagh, and a few in Louth.

¶ In the Ulster Inquisitions the counties of Antrim, Armagh, and Down, epecially the last, show by their indices the great prevalence of the word.

** See the Ordnance Memoir of Templemore, p. 210.

†† Luguballia (which with the prefix *caer* became softened down into the form Carlisle), if the latter member of the name be Celtic, affords an instance of a British form of *baile* with the double *l*.

recorded examples of it exhibit a meaning which favours their objection. In a contemporary marginal note in the Book of Armagh,* *baile* is used to denote "place"; and next, in the Book of Lecan, it is glossed in the same meaning, by the word *inad*.† It occurs, also, in the Tripartite Life of St. Patrick,‡ but probably in a sense approaching to the more modern use. Meanwhile we have, unfortunately, no certain instance, at an early date, of a proper name, into the composition of which this term enters.§

Names compounded with *baile* prevail extensively in Scotland, as well as Ireland. In the latter the word is generally written and sounded *bally*, but in some districts, principally the Dano-English territory of Fingal, in the county of Dublin, it is contracted to *bal*, as Balgriffin, Balheary, Baldungan, Balcunnin, Balrothery, Balbriggan, &c. In Scotland the same variety exists.‖ In the west, that is, Argyll, part of Inverness, and Rosshire, we find examples, at every step, of *ballys*; but proceeding towards the east and north-east side, *bal* is the corresponding form; and as this region is the Pictland of olden times, it may be that the Pictish language, which, with good reason, is referred to the British family of the Celtic, predisposed the tongue to despatch the word with that brevity which the genius of the British language encouraged. If such was the case, this peculiarity must have arisen many ages ago; for the vernacular language of Pictland has been, as far back as the memory of man can reach, the ordinary Gaelic of Scotland.

In Ireland, *baile* was a term of frequent occurrence in composition at the close of the twelfth century. We have already noticed the denomination Ardcamma, which, in a charter of Kells, was declared to consist of Balle Ui Uidrin and Baile Ui Comgain. In the monastic Charters, at a later period, in this century, we find abundant examples of it, as appears by the following list:—

In MacLoughlin's charter to Newry, among 20 denominations, one *bale*—namely, Balenatin.¶

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* *Is báile inso sis as incertus*, 'there is a place here below that is doubtful,' fol. 11 *ab*. See Stokes's Glosses, p. 156.

† Book of Lecan, fol. 164 *ba*, cited in Ordnance Memoir of Templemore, p. 210.

‡ See Stokes's Irish Glosses, p. 48, n. 110.

§ In Alcuin's letter to Colcu (A. D. 794), we meet with "et ad Australes fratres *Baldhuninga*," which name Colgan supposed to be a compound of Baile, and Chuinnigh, or Cainnech, so as to represent Bailechuinnigh or Cillchainnich, that is, Kilkenny. (Acta Sanctor., p. 380 *b*, n. 17); and, after him, Dr. Lanigan proposed *Baile-Dunsginne* or Lismore. (Eccl. Hist., vol. iii., p. 232, n. 45.) But their conjectures are untenable. Colgu was surnamed *Ua Duinechda*, and to this there seems to be some similarity in the latter clause of the name. See Ussher's Sylloge, Ep. 18 (Wks. vol. iv. p. 467).

‖ Aberdeen, a long list of *bals*, but no *bally*; Argyll, numerous *balles*, only 5 *bals*; Ayr, the *bals* predominate; Dumbarton, *bal* principally; Elgin, *bal*; Fife, *bal*; Forfar, *bal* numerously; Inverness, *bal* and *ballie*; Kincardine, *bal*; Kirkcudbright, *bal*; Perth, *bal* and *balli*; Ross and Cromarty, *balli* and *bal*; Stirling, *bal*; Wigton, *bal*.

¶ Monast. Anglican. vol. ii. p. 1031 *a*; Eccles. Antiqq. of Down and Connor, p. 117

In Dermod MacMurragh's charter to Ferns, among 15 denominations, 6 beginning with *Bali*.*

Jerpoint charter, in 34 denominations, 7 *Baley*-s.†

Holycross charter, in 11 denominations, 6 *Balli*-s.‡

Connal charter, in 15 denominations, 3 *Bale*-s.§

In St. Mary's, of Dublin, among 31 denominations, 8 *Balli*-s.‖

In St. Mary's of Nenay, among 100 denominations, 21 *Bali*-s.**

At this date, however, and for many centuries after, the word was applied only to large and generic tracts, and thus in some degree answered to the theoretical idea of a ballybetagh, which was sometimes simply called *baile*, and applied to an aggregation of lands. Thus, so late as the close of the sixteenth century, in the survey of Monaghan,†† each of the four baronies or hundreds consists of a number of ballybetaghs, varying from fourteen to twenty-one, the names of which invariably begin with *Bally;* while under each ballybetagh are recited the names of 16 tates, no one of which bears this generic prefix.

Entertaining the belief that the present townland names of Ireland not only preserve a great many ancient forms, but afford very interesting materials for philological deductions, both as regards the distribution of certain words, and the local varieties of the same word, feeling also the want of some comprehensive book of reference in the important work of the identification of ancient names, I undertook, in 1853, to compile an alphabetical index to all the townland names of Ireland, which I found to exceed sixty-two thousand in number. After a considerable amount of mechanical labour, I succeeded, in 1857, in producing the desired catalogue, in the form of these two large volumes, which I have now the honour to exhibit to the meeting. The plan I adopted was, to divide the page into five columns, the first of which gave the townland; the second, in the same line, the parish; the third, the barony; the fourth, the county; and the fifth, open for the etymology, where attainable. I should have been glad to have given the acreable extent of each; but the Addenda to the Census of 1841, from which I made my compilation, did not supply the desired information. It was my intention to have presented these books to the Academy as a work of public reference in topographical inquiry; but I lately learned that a similar index, containing all my items, and further supplying the areas, with a reference under each name to the sheet or sheets where it appeared on the Ordnance Survey, had been compiled from the Census of 1851, to which it was designed to serve as an alphabetical reference, and that it was likely, within a short time, to be published, and, of course, find its way to our library. It appeared to me, therefore, that it would be of no advantage to occupy a place in our shelves with an inferior production. It has, for

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* Monast. Anglican., vol. ii., p. 1040 *b*.

† *Ib*. p. 1028.

‡ *Ib*. p. 1035 *b*.

§ *Ib*. p. 1037 *b*.

‖ Rotul. Chartarum in Turri Londinensi asservati, ed. T. D. Hardy, p. 77 *b*.

** Ibid, p. 78 *a*.

††† Prefixed to the Ulster Inquisitions, p. xxi.

several years, however, done good service, not only to the compiler, but some of his literary friends, who, in their difficulties, sought counsel of the "monster Index." The printed Index will form an invaluable book of reference, and I hope that its appearance will promote investigations into the interesting topography of our island: certainly the Census list of 1851, with its admirable details, and this Index to follow it, will prove a rich treasury of topographical illustration; and ere long I hope to see the series on our shelves divested of their blue wrappers, and recommended to notice by a becoming exterior. It is impossible to overestimate the importance of such a work as this to the topographer. Not only is he enabled hereby to trace to its proper position the site of an ancient church, or the field of a distant encounter, or the subject of an early grant, but he has also materials for the correction of etymological fallacies, and the establishment of a true standard of interpretation.

I may adduce one or two examples.

The celebrated hill of Tara, in the county of Meath, is called in Irish *Temhair*, from the genitive of which, *Temhrach*, the common appellation obtains its form. Now, the old bardic etymologists derive the name from *Tea-mur*, "the wall" or "house of Tea," a celebrated female of olden time. A suggestion, however, is thrown out by Cormac, in his glossary, that the name may be allied to the Greek θεωρέω, inasmuch as *temhair* is used to denote an elevated place—the "temhuir of the country" being a hill, and the "temhuir of a house" being an upper chamber.* If, then, it obtained the name in consequence of having been the palace of a certain queen, we would naturally expect that it should be the only place in Ireland bearing this peculiar designation; but on looking to our Index we find, under the head *Tara*,† the following examples of its occurrence:—

	Townland.	Parish.	Barony.	County.
1.	TARA,	Durrow,	Ballycowan,	King's County.
2.	TARA,	Slanes,	Ards,	Down.
3.	TARA-HILL,	Kilcavan,	Ballaghkeen,	Wexford.
4.	TARA-HILL,	Kiltennell,	Ballaghkeen,	Wexford.

In numbers 2 and 3 of this list there are earthen forts, whose situation is high and commanding, and such as fully answers to Cormac's interpretation.

Again, according to the old Register of the diocese, the name Clogher was said to be derived from *Cloch-oir*, a "Golden Stone, from which, in the times of Paganism, the Devil used to pronounce Jugling Answers."‡

* See Dr. Petrie's Essay on Tara, in the Transactions, vol. xviii. pt. 2, pp. 131, 154.

† To these may be added *Temoria Singite*, in Westmeath (Colgan, Trias Th. p. 131 *a*); and *Teamhair-Brogha-Niadh* (in Leinster, Ogyg. pp. 269, 273, 283), an eastern limit of Connacht (Keating Hist. chap. 2); and *Teamhair Luachra*, in Kerry (Book of Rights, p. 90); *Beal-atha-na-Teamhrach* (Four Mast. 1580), now the townland Bellahantouragh, in the parish of Ballincuslane, in barony of Trughanacmy, county of Kerry.

‡ Harris's Ware's Works, vol. i., p. 175.

To such an etymon it is rather damaging to turn to the Index, and find 40 townlands called Clogher scattered all over Ireland, and 35 more having the same word in composition.

In like manner *Caisel*, or Cashel, the royal residence of Munster, is derived by Keating from *Cios-ail*, "tribute-rock," as being the depository of the provincial revenues. This etymon, so opposed to analogy and sense, is utterly refuted, when the Townland Index shows 90 instances of the word in various parts of the kingdom.

The Irish tamnac, signifying "a field," is omitted in O'Reilly's Dictionary, yet the Index gives a hundred instances of the word, either simply or in combination.*

The British word *aber* is only found in the east and north-west of Scotland, but does not occur in Argyle or proper Irish region, and we would expect that this was indicative of its absence from Ireland. And such is found to be the case, at least as regards townland names—*inver* in use, but its equivalent *aber* not found.†

A note on the name *Seanchus Mor*, in one of the Brehon-Law manuscripts observes that, though the term *mor*, or "great," formed part of this title, it was not distinctive, and that there was no correlative in the form *Seanchus Beg;* instancing, as an illustration, the fact, that, though there were many places in Ireland called *Domhnach Mor*, there were none called *Domhnach Beg*.‡ Such an assertion is worth testing. Accordingly, the Index gives:—

Townland.	Parish.	Barony.	County.
1. DONAGHMORE,	Cloonclare,	Drumahaire,	Leitrim.
2. DONAGHMORE,	Donaghmore,	Ballaghkeen,	Wexford.
3. DONAGHMORE,	Donaghmore,	Clandonagh,	Queen's County.
4. DONAGHMORE,	Donaghmore,	Dungannon,	Tyrone.
5. DONAGHMORE,	Donaghmore,	Fassadinin,	Kilkenny.
6. DONAGHMORE,	Donaghmore,	Ibane,	Cork, West.
7. DONAGHMORE,	Donaghmore,	Iffa & Offa, E.,	Tipperary, S.
8. DONAGHMORE,	Donaghmore,	Navan, L.,	Meath.
9. DONAGHMORE,	Donaghmore,	Raphoe,	Donegal.
10. DONAGHMORE,	Donaghmore,	Ratoath,	Meath.
11. DONAGHMORE,	Donaghmore,	Talbotstown, U.	Wicklow.

* The church of *Tamnach* is mentioned as early as theBook of Armagh (fol. 15 *aa*). It is now Tawnagh, in the barony Tierrill, county of Sligo.

† In the neighbourhood of Ballyshannon, the Donegal Inquisitions of the seventeenth century give us the word *ebber* in the sense of a "gut" or "channel;" and in an Inquisition, No. 10, Jac. I., we find *Abbernacapple;* 18 Car. I., *Abbirnellane;* 30 Car. I., *Abbermun;* and, what is startlingly like the Aberdour of Aberdeen and Fife, in Scotland, *Abberdoury* (No. 10, Jac. I.)

‡ "It is not because there was a [Senchus] Bec in existence [from which to contradistinguish it], but on account of the great number of the men of Erin who were at the making of it, and at the arranging of it. As every place where Patrick used to remain on Sunday is called *Domnach mor*, that is, from the number of the hosts who used to be about him, and used to give him great gifts. *Domnach beg* does not at all occur."—MS. Translated from H. 3, 18, Trin. Coll. Dubl., p. 359 *b*.

Townland.	Parish.	Barony.	County.
12. Donaghmore,	Donaghmore,	Salt, North,	Kildare.
13. Donaghmore,	Rathdowney,	Clandonagh,	Queen's County.
14. Donaghmore,	St. Patrick's,	Shillelogher,	Kilkenny.
15. Donoughmore,	Dunbin,	Dundalk, Up.	Louth.
16. Donoughmore,	Fertagh,	Galmoy,	Kilkenny.
17. Dunnamore,	Kildress,	Dungannon,	Tyrone.*

One, and only one *Donaghbeg* appears, namely, in the parish of Clooncläre, county of Leitrim;† but this is not an exception to the rule, inasmuch as it is only a portion or sub-denomination of Donaghmore, in the same parish, given in comparatively modern times, when the original usage of the word Donagh, that is *Dominica*, was forgotten.

Pistil is a British adoption of the Latin "fistula,"‡ and is applied to a pipe, or channel, or stream; borrowed from it, we have Glaspistol, in the parish of Clogher, county of Louth, and Cloghpistole, in the parish of Newtownlennan, county of Tipperary.

We find the compound name Drumshanbo applied to a townland in the parish of Cloone, barony of Mohill, county of Leitrim, and to another in the parish of Kiltoghert, in the barony of Leitrim, and same county; as also to another in Kildress parish, county of Tyrone. And this name is interpreted "the ridge" or "back of the old cow,"—a designation taken from the peculiar outline of the rising ground, on the same principle that Cynoscephalæ, or "Dogs'-Heads," was given to certain eminences in Thessaly; or Gamala to a ridge in Palestine, because, as Josephus says, its profile resembled the hunch on a camel's back.§

In various counties we have the name Corran, which is the Irish for a reaping-hook, applied to townlands, in reference to some local peculiarity; but nowhere more remarkably than in the Corran of Larne, whose sickle-shaped configuration on the map justifies the name, and brings up to mind the various *Drepana* of Grecian antiquity.

Endless are the curious applications and combinations of Irish words which such an Index presents to view. What a boon to Irish topography would the forthcoming compilation be, if it had but one column more, namely, an etymological one. There is no member of society, from the

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* To the above may be added the parish of Donaghmore, barony of Upper Iveagh, county of Down, where the townland Glebe, on which the church stands, was formerly known as Donaghmore; also the parish of Donaghmore, in Muskerry East, county of Cork, East; and the parish of Donaghmore, barony of Clanwilliam, county of Limerick. These, with the instances given above, amount to twenty; and by the absence of a corresponding *Donaghbeg*, show that the *mor* in their composition is an absolute, not a relative term.

† Situate a little to the east of Manorhamilton.—Ordnance Survey, sheet 11, N. E. angle.

‡ Fons, "quem *Pistyll Dewi*, fistulam David vocant." Girald. Cambrens. Itin. Cambr. ii. 1 (p. 858, ed. Camden). "Rivulus Sancti Cadoci, qui Brittannice *Pistill Cattwg* appellatur." Vit. S. Cadoci, c. 24, Rees, Cambro-British Saints, p. 71.

§ Jewish War, iv. 1, 1.

great landed proprietor down to the humblest antiquarian student, who would not welcome with delight the appearance of such a work. In some words considerable difficulty would attend the interpretation; but the majority could be surely ascertained and safely expounded; for it would be found that certain prevailing elements of composition pervaded the names to a great extent; in which, as has already been observed, *Bally* is so frequent; *Kill*, the first syllable of 2890 names, representing, according to the combination, either *Cill*, 'cella,' 'church,' or *Caille*, 'sylva,' 'a wood;' *Drum*, 'dorsum,' 'a ridge,' introduces 2000 names; *Knock*, a 'hill,' 1600; *Lis*, 'an enclosed abode,' now called 'a fort,' 1380; *Derry*, 'an oak wood,' 1310; *Cluain*, 'a meadow,' 756, in the form *Clon*, and 924 in that of *Cloon*. The etymologicon, however, to be complete, would require a careful comparison of the old forms of the townland names, as found in Inquisitions, Patents, and kindred records, which were much purer than those now in use, as approaching nearer to the fountain head, and as current at a time when the Irish language was comparatively uninfluenced by foreign influence or intermixture.

TABLE *showing the number of Townlands and the average Contents in each County.*

	Townlands.	Average of Acres.		Townlands.	Average of Acres.
Carlow, ...	597	370	Clare, ...	2255	340
Dublin, ...	1081	206	Cork, East, . . .	3175	324
Kildare, ...	1240	337	Cork, West, . . .	2423	333
Kilkenny, ...	1602	316	Kerry, ...	2793	415
King's County, . .	1186	415	Limerick, ...	2162	305
Longford, ...	930	277	Tipperary, North, .	1651	310
Louth, ...	672	299	Tipperary, South, .	1603	334
Meath, ...	1631	354	Waterford, ...	1667	273
Queen's County, .	1154	368			
Westmeath, . . .	1381	314	MUNSTER, . .	17,729	334
Wexford, ...	2386	240			
Wicklow, ...	1374	363			
			Antrim, ...	1733	409
LEINSTER, . .	15,234	316	Armagh, ...	962	324
			Cavan, ...	1995	233
			Donegal, ...	2745	432
Galway, ...	4593	326	Down, ...	1335	457
Leitrim, ...	1509	249	Fermanagh, . . .	2262	184
Mayo, ...	3458	382	Londonderry, . .	1248	408
Roscommon, . . .	2053	284	Monaghan, . . .	1853	172
Sligo, ...	1336	336	Tyrone, ...	2160	360
CONNAUGHT, . .	12,949	326	ULSTER, . .	16,293	325

The Rev. Samuel Haughton, F. R. S., Fellow of Trinity College, Dublin, read a paper—

ON THE SHOWER OF AEROLITHS THAT FELL AT KILLETER, CO. TYRONE, ON THE 29TH APRIL, 1844.

On the 29th April, 1844, a shower of meteoric stones fell, in the sight of several people, at Killeter, near Castlederg, Co. Tyrone; they broke into small fragments by the fall, one piece only being found entire. It was (according to the testimony of a resident) "about as long as a joint of a little finger." The account given by three gentlemen, who, however, did not actually see the shower fall, was that they were at a distance of three or four miles, up the hills in the neighbourhood; it was a fine sunny evening, three or four o'clock. They heard "music" towards Killeter, which they supposed to proceed from a strolling German band, which they knew to be in the neighbourhood; they are under the impression that they heard the music several times in the course of the evening; they remember also to have noticed clouds in the direction of Killeter. On reaching Killeter the same evening, they were told of the wonderful shower of stones, which had spread over several fields. I received the fragments of these stones from the Rev. Dr. M'Ivor, ex-Fellow of Trinity College, Dublin, and rector of Ardstraw; he writes to me that "it is now very difficult to get either a specimen of a stone or any very distinct intelligence of them; even the very rumour of them has nearly died out, and you might ask intelligent middle-aged men about the neighbourhood who had never heard them mentioned." He adds that the people of that locality are very "uncurious;" and that if there were a veritable burning bush thereabouts, few would "turn aside to see."

The largest specimen given to me by Dr. M'Ivor weighed 22·23 grs. in air, and 16·32 grs. in water, showing that its specific gravity is 3·761. It and the smaller fragments presented the usual black crust, and internal greyish-white crystalline structure and appearance, with specks of metallic lustre, occasioned by the iron and nickel alloy that was present. I analysed it in the usual manner; but, owing to an accident, I was unable to determine the composition of the earthy portion soluble in muriatic acid.

The following is the mineralogical composition of these aërolithes:—

1. Hornblendic mineral, (Insoluble in acid).	34·18
2. Earthy mineral, (Soluble in acid).	30·42
3. Iron,	25.14
4. Nickel,	1·42
5. Sesquioxide of chrome,	2·70
6. Cobalt,	Trace
7. Magnetic pyrites,	6·14
	100·00

The earthy portion insoluble in muriatic acid had the following composition:—

		Atoms.	
Silica, . . .	55·01	1·22	
Alumina, . .	5·35	0·10	
Protoxide of iron,	12·18	0·34	1·66
Lime, ...	3·41	0·12	
Magnesia, . . .	24·03	1·20	
	99.98		

Omitting the alumina, the preceding analysis gives the rational formula of the Hornblende family

$$4RO, 3SiO_3;$$

and taken as a whole, it agrees with the analysis of many Hornblendes —the variety of Hornblende with which it has the closest relation is Anthophyllite.

According to Mr. Greg's catalogue of meteoric stones and irons, three other falls of aëroliths are recorded as having occurred in Ireland:—

a. A. D. 1779; at Pettiswood, Westmeath; 6 oz.
b. August, 1810; Tipperary; 7¾ lbs.
c. 10th Sept. 1813, Adare, Co. Limerick; 17 lbs. + 65lbs. + 24lbs. Moving E. to W. sp. gr. = 3.64.
d. 29th April, 1844, Killeter, Co. Tyrone; fragments of one stone sp. gr. = 3·761.

MONDAY, MAY 13, 1861.

The Very Rev. Dean Graves, D. D., President, in the Chair.

The Rev. William S. Burnside; Richard Hartley, Esq.; John Hatchell, Esq.; D. Toler, Esq.; T. Maunsell, M. D.; and the Rev. Henry Joy Tombe; were elected Members of the Academy.

Professor Hennessy, F. R. S., read a paper—

ON THE CONNEXION BETWEEN STORMS AND VERTICAL DISTURBANCES OF THE ATMOSPHERE.

Storms are now fully recognized to result from antecedent abnormal physical conditions of the atmosphere. The contact of unequally dense and elastic masses of air usually precedes every kind of storm. These disturbing conditions are themselves dependent chiefly on inequalities of temperature and dryness in the aërial strata. Were we able to observe these physical conditions simultaneously over a wide surface, and vertically in ascending over several points of an extensive district, we should be able to predict a coming storm from the observed conditions, quite as securely as a physician can prognosticate the ultimate results, by studying the symptoms of some well-known and frequently-recurring malady. But

it is extremely difficult to observe the atmosphere in the manner thus indicated. The barometer presents manifestations of the physical state of the entire column of air situated vertically over it; and although such indications are limited in their character, they are those on which we are obliged principally to rely. Rapid changes in atmospheric pressure in any locality, as well as unequal simultaneous pressures in places but little apart, are now regarded as very frequent precursors of storms; but if we inquire into the causes of such inequalities of pressure, we shall find that other indications of atmospherical disturbances may be expected.

When two masses of air of unequal density are in contact, the tendency towards equilibrium will not be so immediate or so simple as most writers on the theory of winds appear to assume. Resisting forces of various kinds exist, among which some arise out of the friction of the currents among themselves, and against terrestrial objects; but the most important will result whenever it happens that the less dense mass of air possesses greater elasticity than the denser mass. Instable equilibrium may thus exist for a short time before either of the two masses could give way; but while such a state of comparative equilibrium temporarily subsists between the two great masses, minor disturbances will arise wherever their strata came into immediate contact. The mingling of the heterogeneous strata will take place, as in all fluids, by a process of convection.

I have already shown the important influence exercised by this process in the mode of heating of the atmosphere, and I have attempted to point out its relations with the most ordinary horizontal and vertical movements of the air.* In order to observe such movements, I devised a species of vane, which shows the existence of an upward or downward motion in the air, as well as the horizontal direction of the wind. When the air is still, or moving parallel to the earth's surface, the vane shows no upward or downward inclination. In the presence of two great heterogeneous masses of air, yet in a state of instable equilibrium, we would usually not have any indications of the convections of their particles, except the occasional ascent of light objects from the ground, or the sudden indraught of smoke in chimneys. But such phenomena are necessarily vague. If we are entitled to assume that much vertical convection of the air, with comparatively little horizontal motion, foreshadows an approaching disturbance, it follows that a better mode of observing vertical currents is desirable. During the three winter months, I have been occasionally observing vertical currents of the atmosphere, with the aid of such a vane; my observations have not been made at fixed hours, nor on every day; but they have usually arisen whenever abnormal disturbances occurred. As a general rule, I have found that most of the storms which we experienced during the past winter have been preceded by violent vertical movements of the atmosphere. In most

* "Reports of the British Association for 1858;" "Atlantis," No. V.; and "Philosophical Magazine" for May, 1860.

of those cases, downward currents appeared to prevail. During the fine weather at the close of January, I observed so little of vertical currents, that I laid aside my journal; but on the two days preceding the disastrous storm of Saturday, February 9, some circumstances attracted my attention, and induced me to resume my observations. On the 7th, I observed, at about 4 P. M., in a part of a wide street, bordered only by a wall, a gentleman's hat lifted off his head to a height of at least five feet. The hat dropped back again, without being transferred horizontally to any appreciable extent. On Friday, the 8th, at 2 in the afternoon, my attention was called to the anemoscope, by its shifting round, through N., towards N. E., with decided and frequent downward plunges. It appeared as if showers of cold air were descending;* the temperature was also falling. At this time the horizontal motion of the air was comparatively little, while the vertical convection was apparently highly developed. Next day, during the storm, the disk of the vane was in a state of constant oscillation; but no marked prevalence of upward or downward motions could be observed, and nothing resembling the plunges noticed on the preceding day.

Although we should scarcely expect to be able to observe the influence of such disturbances in a mercurial barometer, they may become manifest, were we to use a liquid column of much greater height.† During the short period that a column of water was so employed by Professor Daniell at the apartments of the Royal Society, he appears to have noticed numerous and rapid oscillations during storms. The diminution of such oscillations, both in frequency and intensity, enabled him to predict the approach of fine weather. During windy weather, the regular and continuous motion of the water-column resembled the action of respiration. This remark corresponds with what I have stated, both here and elsewhere, as to the oscillations of the anemoscope during gales of wind. The inference which I drew from the comparative regularity of such oscillations is, not that vertical currents prevail with strong winds, but that the motion of the air is essentially undulatory. The irregular and plunging motions of the air observed by me before storms, and sometimes even before rain, are essentially different phenomena, and they do not appear to have been noticed by Mr. Daniell in any of the appearances exhibited by his water-barometer.

One of the most remarkable phenomena connected with the storm of the 9th February was the rise of the barometer a short time before its commencement. A fall had taken place at a preceding period; and, in accordance with the usual empirical rules, the rise would be considered

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* Dove refers to the precipitation of cold air during whirlwinds, and to the storm assuming the form called by the Greeks *εκνεφίας*.—"Board of Trade Meteorological Papers," No. III., p. 22; and "Taylor's Scientific Memoirs," vol. iii., p. 215.

† In extraordinary cases the mercurial barometer has always exhibited such fluctuations: thus Dove refers to a remark of Hoskiaer, that during the great hurricane of August, 1837, at St. Thomas, the mercury sank two lines at each gust, and then immediately rose to the same height as before.

as showing the approach of fine weather; but when this rise was accompanied by northerly and easterly winds, and when the air at the surface of the earth was becoming mingled with cooler particles descending from above, it is manifest that the increased pressure was due to the increase of density of the entire aërial column over the barometer resulting from these influences. Thus the change from a high to a low density of the air was necessarily accompanied by convection between the warmer and cooler strata, as exhibited by the anemoscope.

Before, as well as during north-easterly storms, we may thus expect precipitation of cold air downwards, and ascent of warm air upwards. During a gale it becomes difficult to distinguish these phenomena from the merely oscillatory movements impressed upon the lower strata of the atmosphere by the influence of terrestrial impediments. When a shallow current of water passes over a rough bottom, it assumes a ridged surface. If we superimpose additional water, the surface of the current will become gradually smooth, and it may ultimately present no sensible inequality, as on the surface of a deep stream; but we cannot conclude that the oscillatory action of the particles near the bottom has been entirely extinguished. The influence of the obstacles upon the motion of the current will decrease in approaching the surface, and increase in approaching the bottom.

Thus horizontal currents of air, close to the earth's surface, are necessarily disturbed by the presence of trees, buildings, and other obstacles, and in this manner they may influence the movements of a vertical vane precisely in the way that has been observed. During a storm an observed diminution of vertical oscillations of the vane will result from diminished violence of the wind, just as the gradual lessening of the movements of the water-barometer seemed to Professor Daniell to foreshadow the cessation of a gale. During comparatively calm weather, very energetic vertical movements of the atmosphere may be safely grouped among the most certain symptoms of approaching disturbances on a grander scale.

Professor Hennessy read a paper "On Anonymous Publications."

The Rev. Samuel Haughton, F. R. S., Fellow of Trinity College, Dublin, read a paper—

ON THE TIME OF HIGH WATER IN DUBLIN BAY, ON GOOD FRIDAY, THE 23RD APRIL, 1014, THE DAY OF THE BATTLE OF CLONTARF.

Some time ago I was asked by the Rev. Dr. Todd to calculate for him the time of occurrence of high water, on the 23rd April, 1014, the day of the battle of Clontarf; as he believed that such calculation would throw important light on the accounts that exist of that famous battle.

The following is a brief account of the calculation and of its result. This result confirms in a remarkable manner the ancient account of the battle, with which I was unacquainted previous to making known to Dr. Todd the solution I had arrived at. I believe that, in consequence of the exact information obtained by the Academy in 1851 of the Irish

tides, that I am able to guarantee the result of my calculation of the time of high water, within a few minutes:—

From twelve o'clock, noon, of the 23rd April, 1014, to noon of the 12th December, 1860, allowing for the change of style and leap years, there were 309,223 real days.

The synodical period of the moon is 29.530588715 days, and new moon occurred on the 12th December, 1860, at 47.6 minutes after noon. Multiplying the length of the synodical month by 10472 months, we find

$$29{\cdot}530588715 \times 10472 = 309244{\cdot}325 \text{ days.}$$

From which, subtracting the number of days from 23rd April, 1014, to 12th December, 1860, or 309223 days, we find

$$21{\cdot}325 \text{ days, or } 21^{d}\ 7^{h}\ 48^{m}$$

It follows from this calculation that new moon occurred at

April, . . .	23^{d}	$0^{h}\ 47.6^{m}$—1014, A. D.
Minus . . .	21^{d}	$7^{h}\ 48^{m}$
Or, at . . .	1^{d}	$16^{h}\ 59{\cdot}6^{m}$—April, 1014, A. D.

i. e., at 5 o'clock on the morning of the second of April.

Therefore full moon occurred at

April, . . .	1^{d}	16^{h}	$59{\cdot}6^{m}$
Plus . . .	14	18	21·6
	16^{d}	11^{h}	$21{\cdot}^{m}2$

Therefore the astronomical, or true full moon, occurred at 21 minutes past eleven at night of the 16th April, 1014.

Calculating by the established rules, the calendar or ecclesiastical full moon occurred on the 18th April, 1014 (Sunday), which would therefore make Easter Day fall on the 25th April, and make the 23rd April Good Friday, agreeable to the traditions of the battle of Clontarf.

I shall now show that the calculation of the tides makes it quite certain that the date 1014 falls in with all the physical circumstances related of the battle.

It appears from the calculation that I have given already that

The age of the moon at noon on the 23rd April, 1014, was 21.292 days, or $21^{d}\ 7^{h}$ nearly.

The tide was therefore a neap tide, and the moon in her third quarter.

From the Academy's observations, it appears that on such a day of the moon's age, at the spring equinox, the tide at Kingstown is full at

$5^{h}\ 22^{m}$ in the morning,

from which it follows that the tide along the Clontarf shore, when not

obstructed by embankments and walls, could not have differed many minutes on the 23rd April, 1014, from

$5^h\ 30^m$ A. M.;

the evening tide being full in at

$5^h\ 55^m$ P. M.

In the following narrative, the full tide in the morning is said to have coincided with the sunrise: and as the sun rises from $5^h\ 30^m$ to $4^h\ 30^m$ in the month of April, the truthfulness of the narrative becomes strikingly evident. The extract is taken from the "Wars of the Gaedhil with the Gaill;" or, "The Wars of the Irish with the Danes and other Foreigners," a work which Dr. Todd is editing in the original Irish, with a translation and notes, and which will form one of the series of Historical Chronicles of Great Britain and Ireland, now in course of publication under the authority of the Government. The following narrative occurs in ch. cvii. of this work:—

CVII.—"However, now, they continued in battle array and fighting from sunrise to evening. This is the same length of time as that which the tide takes to come, and to flood and to ebb. For it was at the full tide the foreigners came out to fight the battle in the morning, and the tide had come to the same place again at the close of the day, when the foreigners were defeated; and the tide had carried away their ships from them, so that they had not at the last any place to fly to, but into the sea, after all the mail-coated foreigners had been killed by the Dal Cais. An awful rout was now made of the foreigners and of the Laighin (Leinstermen), closely and simultaneously, and they shouted their respective cries, and whoops of rout, and retreat, and running; but they could only fly to the sea, because they had no other place to retreat to, seeing they were cut off between it and the head of Dubhghall's Bridge; and they were cut off between it and the wood on the other side. They retreated therefore to the sea, like a herd of cows in heat, from sun, and from gadflies, and from insects; and they were pursued closely, rapidly, and lightly; and the foreigners were drowned in great numbers in the sea, and they lay in heaps and in hundreds, confounded, after parting with their bodily senses and understanding, under the powerful, stout, stern mauling, and under the tremendous, hard-hearted pressure with which the Dal Cais, and the Connachtmen, and as many as were also there of the nobles of Erinn, pursued them."

I shall leave to Dr. Todd and others, well informed of the circumstances and localities of the battle of Clontarf, to draw further conclusions from the calculation I have presented to the Academy. To my mind it appears to throw considerable light on the foregoing narrative, and to establish conclusively that portions of it, at least, must have been written from the testimony of actual eye-witnesses, as none others could have invented the fact that the battle began at sunrise, and that the tide was then full in. The importance of the time of tide became

evident at the close of the battle, at 6 P.M., when the returned tide prevented the escape of the Danes from the Clontarf shore to the north bank of the Liffey.

Sir W. R. Hamilton and the Rev. Dr. Todd made some remarks on the foregoing paper.

MONDAY, MAY 27, 1861.

The VERY REV. CHARLES GRAVES, D. D., President, in the Chair.

A LETTER was read from Major-General Sir Thomas R. Larcom, relative to the Treasury Minute concerning Treasure Trove in Ireland. Whereupon

IT WAS RESOLVED,—That the respectful thanks of the Royal Irish Academy are due, and are hereby presented, to the Lords of her Majesty's Treasury for the liberal manner in which they have provided for the preservation of articles of Treasure Trove, and for the favour they have done the Academy in making it the depository of such objects.

IT WAS ALSO RESOLVED,—That the Royal Irish Academy, in acknowledgment of his Excellency the Lord Lieutenant's gracious interference on its behalf, in reference to the articles of Treasure Trove in Ireland, is bound, and takes the present early opportunity to tender its grateful acknowledgments of the same; and begs to assure his Excellency that it will deem it a privilege to renderits best as sistance and co-operation in furthering a measure so likely to conduce to the advancement of antiquarian studies and the extension of the National Museum.

IT WAS ALSO RESOLVED,—That the President be requested to communicate to Major-General Sir Thomas A. Larcom the Academy's sense of the value of his services in regard to the arrangements lately made concerning Treasure Trove in Ireland, which are so likely to conduce to the furtherance of antiquarian studies, and the advantage of an Institution in whose welfare he has always taken such a lively interest.

The REV. DR. TODD, V. P., read the following paper:—

SOME REMARKS ON THE HISTORY OF THE BATTLE OF CLONTARF, IN CONNEXION WITH MR. HAUGHTON'S DETERMINATION OF THE TIME OF HIGH WATER IN DUBLIN BAY ON GOOD FRIDAY, APRIL 23, 1014.

HAVING met with a statement in an ancient authority, to which Mr. Haughton has already called the attention of the Academy, that on the day of the battle of Clontarf, the time of high water coincided with the hour of sunrise in Dublin Bay, it occurred to me that this circumstance afforded a means of testing the accuracy of the narrative. I knew that Mr. Haughton had undertaken, and in part executed, the arduous task of reducing the tidal observations collected some years ago under the auspices of the Academy, and that he had also, for a reason which he will himself have an opportunity of explaining to you this evening, paid

particular attention to the tides of Dublin Bay. I therefore proposed to him to investigate the question—at what hour of the day the tide was full on the shore of Clontarf on Good Friday,* April 23, 1014; but, at his own request, I did not tell him what the hour, as stated in the MS. was, but simply that I wished to test the accuracy of the narrative of the battle of Clontarf contained in the ancient tract called "The Wars of the Gaedhil with the Gaill," i. e., of the Irish with the Danes and other Norsemen, which I am engaged in editing, as one of the series of Chronicles in course of publication under the direction of the English Master of the Rolls.

The result of a very laborious calculation, communicated to the Academy by Mr. Haughton, at its last meeting, was highly satisfactory. It completely confirmed the statement of the MS., showing that the morning tide was full on the shore of Clontarf at sunrise, when the battle began, at half-past five, A.M.; and that the evening tide, which so materially aided in the defeat of the Danes, took place at 5.55, P.M.

The narrative states that, at the hour of the evening tide, the foreigners, retreating in disorder to the shore, found their ships carried out to sea beyond their reach, and were suddenly overwhelmed by the rising tide. The victorious forces, under the command of Brian, pressed upon them vigorously, taking possession of the wood of Clontarf, on the N.E., and of "the head of Dubhgall's Bridge," on the west; "the foreigners, therefore," to use the words of the narrative, "could only fly to the sea, and were there drowned in great numbers; and they lay in heaps and in hundreds, confounded, after parting with their bodily senses and understanding, under the powerful and tremendous pressure" with which they were pursued by the Irish.†

Mr. Gilbert, in his History of Dublin,‡ has shown that Dubhgall's Bridge,§ was "the Old Bridge" leading from Bridgefoot-street to Oxmantown, the Norse quarter of Dublin; and this continued to be the only bridge over the Liffey, from about the year 1000 until a second was erected, in 1670. See Mr. Haliday's valuable paper on the ancient name of Dublin, in vol. xxii. of the Transactions of the Academy.

It appears, therefore, that, at least towards the close of the day, the battle extended from the wood of Clontarf to the Old Bridge, then called Dubhgall's Bridge, and consequently may have been quite visible

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* Dr. Dasent, "Story of Burnt Njal," Introd., vol. i., p. cxcv., tells us that, in 1014, Good Friday fell on the 18th April; but the 18th April, 1014, was Palm Sunday, the Dominical letter being C.

† "Danish Wars," ch. cvii., pp. 191, *sq.*

‡ Vol. i., ch. ix., p. 319, *sq.*

§ We know nothing of the Dubhgall, who seems to have given his name to this bridge. The word signifies "black foreigner," and was the appellation usually given by the Irish to the Danes, in contradistinction to the Fingall, "white foreigners," or Norwegians. The name is still preserved amongst us in the form of Dougall, Mac Dougall, and Doyle. From the proximity of the Oxmantown, or Ostman-town, the bridge may have been called Dubhgall, or Dane's Bridge; but the word is in the singular number, as if Dubhgall was the the proper name of a man: Droichead Dubhgaill, "Dougall's bridge," not Droichead na nDubhgall, or "The bridge of the Danes."—Gilbert, *ibid.*

from the walls of the city. There, on the battlements, as the ancient narrative more than once tells us, stood the Danish women and the garrison, left for the defence of the city under Sitric, the Danish king, and watched from the towers of Dublin the progress of the fight.

Another minute particular, recorded in the narrative, and probably derived from the testimony of eye-witnesses, is, that a strong north-easterly wind prevailed during the day, as it still very commonly does during the month of April, in Dublin, and drove into the eyes of the spectators the dust, fragments of hair and clothes, and sparks of fire occasioned by the conflict.

Both the Irish and Icelandic authorities have agreed to give to this battle the name of "the battle of Brian," from the Sovereign of Ireland, who led the Irish forces on the occasion, and who is generally known by the *soubriquet* of Brian Borumha. This name is derived, as some have thought, from Beal-Borumha, a fort on the Shannon, not far from Kincora, the ancient royal residence of the Kings of Munster; but others, with more probability, suppose the title to be derived from the Boroimhe or cow-tribute exacted by Brian from the chieftains of Leinster as the pledge of their submission, when he assumed the sovereignty of Ireland.

Brian had been a warrior from his youth up, and had often been reduced to great extremity in his predatory expeditions against the Munster Danes and the tribes of Connaught. When his elder brother, Mathgamhain, or Mahon, was treacherously murdered, having been betrayed by Donovan, Lord of Hy Figeinte, into the hands of Molloy, King of Desmond, and Ivar, King of the Danes of Limerick, Brian became King of Thomond, or North Munster, and took ample vengeance for his brother's slaughter. Molloy and Donovan were both slain, Limerick was sacked, and its Danish occupants overthrown with great slaughter. This was in the year 978. Soon afterwards Brian became King of all Munster, or of Leth Mogha, as the southern half of Ireland was called.

About this time Maelsechlainn, or Malachy, King of Meath, defeated the Danes of Dublin with great slaughter, in the battle of Tara, A. D. 979, and immediately after succeeded to the throne of Ireland in succession to Domhnall, son of Muirchertach MacNeill, who had just died. Malachy was of the race of Hy Neill, a family from which the Kings of Ireland had been chosen without a single exception, for upwards of five centuries. He was of the southern branch of that family, and it had grown into a custom, from which only one deviation had occurred in nearly three hundred years preceding Malachy's accession, that the Sovereign should be chosen alternately from the northern and southern O'Neills. His hereditary right to the throne was therefore indisputable, as his predecessor had been of the northern branch of the family; and therefore Tighernach, one of our most independent annalists, does not hesitate to give the name of rebellion to the revolution which dethroned him, and placed Brian in his seat.

This revolution, the result of might, not of right, was mainly due to the jealousy of his northern and more powerful kinsmen. Although they

had no love for Brian, and although Malachy had succeeded to the throne according to the hereditary right and usage, nevertheless they refused him all assistance; and Malachy, rather than see his people slaughtered in a hopeless contest, submitted at length to the superior force of Brian. The result was, that the O'Neills lost altogether the sovereignty, which might have been retained in the family, had Aodh or Hugh O'Neill consented, by uniting against Munster, to support the rights of his kinsman. As it turned out, Malachy was the last legitimate king of the race from which the sovereigns of Ireland had been chosen ever since the age of St. Patrick.

There is scarcely one of our native kings so well known by name to the English public as this Malachy; every school-girl in the United Kingdom who can sing an Irish melody has heard of the times "when Malachy wore the collar of gold which he won from the proud invader." But there is scarcely one of our native kings whose actions are so little known, or whose character has been so much maligned, even by our native historians, as this same Malachy.

He is accused of treachery, of having violated all his engagements and treaties with Brian; and it is even said that Brian was called upon to dethrone him, and to take upon himself the supreme authority by the earnest solicitations of the princes and estates of Connaught.* Nay, we are told that at the battle of Clontarf Malachy had made a private treaty with the enemy, and at the commencement of the action actually deserted, with his whole army, and remained inactive during the remainder of the battle.†

This latter calumny, although it has been countenanced by Keating, on the authority of the "Danish Wars," is destitute of all probability. It has proceeded altogether from the partizans of Brian; and it is curious to observe that Bishop O'Brien, one of the latest of those partizans, after the lapse of almost eight centuries, still retaining the spirit of clanship to the founder of his name, repeats all the stories of Malachy's bad faith with much greater acrimony and much more minute detail than any of those who had lived nearer to the scene of action.

The insinuation that Malachy was naturally inclined to ally himself with the Danes because Gluniarn, or "Iron Knee," King of the Danes of Dublin, was his half-brother, is particularly unfair.‡ It is quite true that Gluniarn was Malachy's half-brother; but alliances matrimonial and political between the Irish and Danish families were at that time very common, and Brian himself was as closely connected with the Danish royal family of Dublin as Malachy was.

Olaf, or Amhlaoibh, as his name is written by the Irish authorities, is called Olaf Quaran, in the Njal Saga (Olaf Kuaran§ in other Sagas),

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* See Dr. O'Brien's "Law of Tanistry illustrated," in Vallancey's Collectanea, Part IV., p. 520.

† Ibid, pp. 525-6, 529.

‡ Ibid, p. 516.

§ Landnámabók, Part I., k. 19 (Islendinga Sögur, vol. i., p. 49. Copenhag. 1829). Saga Olaf's Tryggvasonar (Fornmanna Sögur, tom. x., p. 255. Copenhag. 1835).

a title which seems not to be understood by the northern antiquarians. In Irish history he is called Amlaff *Cuarain*, or Olaff of the Sandle; for *Cuaran* (as Mr. Curry informs me) is a word still used in Ireland to denote a shoe fastened by a thong, which leaves the upper part of the foot bare. Dr. Dasent, however, in his recently published translation of the Njal Saga, translates the name *Olaf Rattle*, assuming the word to be Icelandic.* This chieftain, immediately after his defeat at Tara, fled to Hy or Iona, where he soon after died. The Four Masters (A. D. 977-980) say that he died there "after penance and a good life;" from which it would seem that he had embraced Christianity. Keating makes no mention of his conversion, and asserts that he was driven out of Ireland. But even in that case, if he was free to choose, it is not likely that he would have selected Hy as his place of retreat, had he not been influenced by religion.

His sons, Ragnall and Gluniarn, were the leaders of his army at the battle of Tara, where the former was slain. It is not said who Ragnall's mother was; but we are told that Olaf had married Donflaith, daughter of Muirchertach MacNeill, of the Leather Cloaks, mother of Malachy, by whom he had Gluniarn; he was also subsequently (we may presume) married to Gormflaith, by whom he had Sitric, who was King of the Danes of Dublin at the time of the battle of Clontarf, and had probably succeeded to the throne after the death of Gluniarn, in 989; this Sitric, as we shall see, was afterwards married to Brian's daughter.

The history of this lady Gormflaith, or Gormlaith, called Kormlada in the Njal Saga, strikingly illustrates what has been said as to the frequency of matrimonial alliances between the Danish and Irish families. She was an Irish princess, the grand-daughter of Finn, Lord of Offaly, who was slain in 928, and sister of the Maelmordha, or Maelmurry, King of Leinster, who was slain at the battle of Clontarf. She is said in the Icelandic account of Brian's battle to have been "the fairest of all women, and best gifted in everything that was not in her own power; but it was the talk of men that she did all things ill, over which she had any power."† She was successively the wife of Amlaff or Olaf Cuarain, of Malachy, and of Brian. She was probably married to Malachy about 980, after the flight of Olaf; and having been divorced by Malachy, was married by Brian,—if, indeed, her connexion with those chieftains can be said to have been that of legal matrimony. The Njal Saga says expressly that she had no issue by Brian; but the "Wars of the Gael with the Gaill" followed by the Four Masters, assert that she was the mother of Donogh, Brian's youngest son. She is also said to have had a son by Malachy, named Conchobhar or Connor. But it is difficult to reconcile with the dates given in the Annals the statement that she was the mother of Brian's son Donogh or Dunchadh, unless we suppose him illegitimate, or born before her marriage with Brian. The Four Masters record the death of Dubhchobhlaigh, a wife of Brian, in 1009; therefore Brian could

* The Latin translations of the Njal Saga and of the Saga Olaf's Tryggvasonar, leave the word untranslated.

† Dasent, "Story of Burnt Njal," ii. 323.

not have been legally married to Gormlaith before that year; and if Donogh was born in Christian wedlock, he could not have been much more than three years old in 1014, at the battle of Clontarf; but he is mentioned by the Four Masters as having been in command of an army in the south of Ireland that very year ;* and, after Brian's death, he seems to have lost no time in contesting with his brother Tadhg the succession to the crown. Before the year had expired, the two brothers fought a battle, in which Donogh was defeated.†

The fact, therefore, that there had been matrimonial alliances between the Danish kings of Dublin and Malachy's family is, as I have said, very unfairly urged as a proof of that chieftain's disloyalty. Similar alliances existed also between the same kings of Dublin and the family of Brian. If the Danish King Gluniarn was the son of Malachy's mother, the Danish King Sitric was Brian's son-in-law, and the son of Brian's mistress, or wife; and that mistress, or wife, was the widow of the Danish King Olaf Cuarain, and the mother of Brian's son, Donogh. If it be a reproach to King Malachy that he was half-brother to the Danish chieftain Gluniarn, it is equally a reproach to Donogh, son of Brian, that he was half-brother to the Danish chieftain Sitric.

Not less unfounded is the insinuation that the weakness and incompetency of Malachy's government induced the provincial sovereigns of Ireland to call upon Brian to take upon himself the crown. Nothing can be more contrary to the facts of history. The government of Malachy, both before the revolution which dethroned him, and after he had resumed the sovereignty, upon Brian's death, was remarkable for activity and vigour. Immediately after the battle of Tara, we read that he marched against Dublin: a siege of three days and three nights put him in possession of the town and of its costly spoils. He proclaimed liberty to all the prisoners and hostages that were found in the fortress, amongst whom was Domhnall Claen, King of Leinster; and delivered the north of Ireland from the tribute and taxes, which the Danes, by the possession of those hostages, were enabled to exact.

By this time Brian had been declared King of all Munster, or Leth Mogha, the southern half of Ireland; and Malachy, alarmed at the rapid growth of his power, invaded the territory of the Dal-Cais, the tribe-name of Brian's family, and destroyed the ancient oak-tree under which the chieftains of the Dal-Cais were wont to be inaugurated, and which stood on the fair-green of Magh Adhair, now Moyre, near Tullagh, in the county Clare.

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* From the curious poem quoted by the Four Masters at 1030, in which the three "leaps" of Gormflaith, i.e. her three marriages, are spoken of, it seems to follow that she was first married to Olaf, then to Malachy, and last to Brian. This squares very well with the history. But the Njal's Saga, at least in Dr. Dasent's translation, says "Brian was the name of the king who first had her to wife," as if she had been the wife of Brian before she was married to Olaf Cuarain. The Latin version, however, does not bear out this translation: it simply says that "there was a king, named Brian, whose wife she was, although at that time put away by him."—*Havinæ*, 1809, p. 590.

† Four Masters, p. 781.

The next year we find him in alliance with his half-bróther Gluniarn, the Danish chieftain of Dublin, who had submitted to his power, and now joined him in an attack upon Domhnall Claen, King of Leinster, who had so recently been liberated by Malachy, but who now rose in insurrection against him, aided by the Danes of Waterford. A battle was fought, in which Malachy was victorious. This was A. D. 982, according to the Four Masters.

Next year Brian invaded Meath, to revenge the insulting destruction of the oak-tree of Magh Adhair; and Malachy soon after retaliated by plundering Connaught, then in alliance with Brian, destroying its islands, killing its chieftains, and reducing Mayo to ashes.*

Some three or four years of predatory warfare followed, during which Brian's resources seem to have been occupied in opposing an inroad of the Connaught chieftains, who had now revolted against him, aided by the Danes of Wexford. A new invasion of Norsemen had also attacked the coast of Dalaradia (county of Down), and plundered the venerable abbey of Hy, or Iona. This and the continued rebellion of the people of Leinster may have given Malachy also sufficient employment. The Dublin Danes were thus enabled to recover their independence. Gluniaran, in 989, was murdered by a drunken slave; and the same year Malachy besieged the Castle of Dublin, which held out for twenty nights. It appears that even at that early period the supply of water in Dublin was defective. The canals did not exist, and the "Vartry scheme" was not yet thought of. There were no quays on the banks of the Liffey, and the tide flowed over the plain now occupied by Irishtown, Merrion-square, College-green, and Dame-street, up to the very walls of the Castle. The Danish defenders of the fortress were reduced to the necessity of drinking this foul and brackish water, and were at length starved into submission.

Brian continued to harass the territories of Malachy by the same kind of rude and predatory warfare, for some years; but was defeated, with all the forces of Munster, at Aenach Tete, now Nenagh, Co. Tipperary, in 994. Immediately afterwards Malachy marched again to suppress an insurrection of the Danes of Dublin, and it was on this occasion that he carried off the "collar of gold," or, more properly, *ring* of gold, which Moore's verse has rendered so celebrated. This ring is called by our annalists "the ring of Tomar,"—Tomar being, in all probability, an ancestor of the Dublin Danes, whose ring they had brought with them, when they set out for Ireland. The holy ring (*baugr*) was essential to every temple of the Pagan Danes. It lay on the altars, and upon it all solemn oaths were taken.† "The sword of Carlus," another Danish national relic, was also taken from them by Malachy on the same occasion. We know nothing of the "sword of Carlus." But if the conjecture of our learned associate, Mr. Haliday, be correct, and he can support it by some ingenious arguments, the Ring of Tomar is now in the

* Four Masters, A. D. 984.

† Dasent's "Story of Burnt Njal," vol. i., p. xxxviii.

Museum of the Academy. It is a large ring of gold, with another smaller ring running upon it, intended apparently for suspension.

About this time, Maolmorda, or Maolmurry, brother of Gormlaith, mother of Sitric, joined the Danes of Dublin, in order to secure their assistance in defence of his pretence to the crown of Leinster against the more legitimate claim of Donnchadh, son of Domhnall Claon. This alliance, together with the success of Malachy's campaigns, appears to have made a change in the politics of the Munster chieftains. For in 997, or 998, "to the great joy of the Irish," as the Four Masters say, we find Brian and Malachy uniting their forces against the Danes of Dublin. The terms of this alliance, as stated in the "Wars of the Gaedhil with the Gaill," were these:—That Malachy should restore all hostages or prisoners who were Brian's subjects or allies; that Brian should be acknowledged as King of all Munster; and that Malachy should be recognized by him as King of Leth Cuinn, or the northern half of Ireland, "without war or trespass from Brian."

Two years after this treaty, the Danes of Dublin, with Maelmordha, who had usurped the sovereignty of Leinster, revolted, after having taken Donnchadh, the legitimate king of Leinster, prisoner. They met the united forces of Malachy and Brian at Glen-mama,* a place near Dunlavan, the fortress of the Kings of Leinster, in the county of Wicklow; and a bloody conflict ensued, in which, after much slaughter on both sides, the Danes were completely defeated. The victorious troops marched without resistance to Dublin. The Castle was taken, and the town plundered. Brian remained encamped in the city, "from great Christmas to little Christmas,"† or, according to another account, from Christmas Day to the Feast of St. Bridget (Feb. 1).‡ During this period Brian was not idle. He plundered a great part of Leinster, cut down woods, and cleared passages through the country, with a view, no doubt, to future military operations.

On the day of the battle of Glen-mama, Murchadh, son of Brian, found the Leinster chieftain Maelmordha, after the defeat of his allies, concealed in the foliage of a yew-tree. He was, of course, taken prisoner. The King of Dublin, who is called, in the wars of the Gaedhil and Gaill, Amlaibh, or Olaf, but more correctly, by the Four Masters, Sitric, son of Amlaibh, or Olaf, fled to the north of Ireland, expecting to receive protection from the northern O'Neills. In this, however, he was disappointed; and before the end of the year he "submitted to Brian's

* This place has not been identified. The name signifies "Valley of the gap," and seems to point to some natural gap or pass in the mountains. Mr. O'Donoghue is wrong (Mem. of the O'Briens, p. 20, note) in supposing the name to mean "Valley of the defeat," and to have been derived from the battle here spoken of. The place was called Glen-mama long before. See Circuit of Muirchertach Mac Neill, pp. 86, 87.

† i. e. from Christmas day to the Epiphany.—"Wars of Gaedhil," &c., p. 113. But the Four Masters seem to understand by *Little Christmas* the octave of Christmas, for they say that Brian remained in Dublin a week only.

‡ "Wars of the Gaedhil and Gaill," p. 117.

own terms," and consented to hold the fortress of Dublin as Brian's vassal. A similar alliance was made with Maelmordha. Brian recognized him as King of Leinster, in opposition to the hereditary claim of Donnchadh, son of Domhnall Claen; and he also became Brian's vassal.

It was probably about this time, or soon after, that Brian formed his matrimonial alliance with Gormlaith, the widow of Olaf, and mother of Sitric, King of Dublin; although, as we have seen, he must have had a less legitimate intimacy with her some time before, if she was the mother of his son Donogh. About this time, also, he probably gave his daughter in marriage to Sitric. At all events, in a few months after the battle of Glen-mama, Brian was in alliance with those who had been his enemies in that deadly conflict, the Dublin Danes, and Maolmordha, the brother of Gormlaith.

And now he was strong enough to set at nought his treaty with Malachy. The very same year he raised a powerful army, gathered from South Connaught and Ossory, in addition to his own Dal-Cassian forces. His new allies, the Danes of Dublin, and the King of Leinster, lent their aid. He entered the territories of Malachy, and proceeded as far as Tara. His Danish cavalry had been sent forward before the rest of the army, but were met by King Malachy in person, and entirely routed. "Pœne omnes occisi sunt," say the Annals of Ulster. Tighernach calls this the first "treacherous turning of Brian against Malachy," ımpoḋ ꞇpe meḃaıl. But the author of the Wars of the Gaedhil and Gaill makes no mention whatsoever of this transaction.

From this brief summary of the history of the two chieftains, it will be seen with what gross injustice Malachy is accused of incapacity and breach of faith. If this latter accusation belongs to either party, it must assuredly fall upon Brian; by him, and not by Malachy, was the treaty violated, whereby the two princes consented to divide the sovereignty of Ireland,—Malachy recognizing Brian as king of Leth Mogha, and Brian acknowledging Malachy as king of Leth Cuinn.

But now the superior power of Brian and his restless ambition carried the day. Malachy submitted, and in the year 1002, Brian was recognized as King of all Ireland, and Malachy became simply king of Meath, or Tara. The new monarch soon after set out on an expedition, to demand hostages from all the petty princes, especially in the north, who were likely to disturb his government; and having thus secured their submission, and recommended himself to the clergy, by recognizing the jurisdiction of Armagh, and by great liberality to the churches, a period of peace ensued, which was very unusual in Ireland at that time. The Munster historians have doubtless exaggerated greatly both the duration and the amount of this peace. It was then the lady, according to the legend celebrated by Moore,* adorned with gems, and bearing upon her

* See what Moore himself, in his character of historian, has said of this romantic legend.—"Hist. of Ireland," vol. ii., pp. 103-4.

wand a costly ring of gold, walked unmolested from one extremity of Ireland to the other:—

"Lady! dost thou not fear to stray,
So lone and lovely, through this bleak way?
Are Erin's sons so good, or so cold,
As not to be tempted by woman or gold?"

"Sir Knight, I feel not the least alarm,—
No son of Erin will offer me harm;
For though they love woman and golden store,
Sir Knight, they love honour and virtue more."

It was then also that Brian is said to have made roads and bridges, erected round towers, built and restored churches, strengthened fortresses, and improved harbours in every part of Ireland; it was then also that he enacted many useful laws, and promoted, in various ways, the arts of civilization and peace.

Amongst other things, we are told* that surnames were instituted by him, which seems apocryphal, although it is perhaps true that in his time the patronymics which have since become surnames began to be assumed by the principal Irish families.†

But notwithstanding these halcyon days of peace, honour, and virtue, the Annals exhibit their usual records of assassinations, outrage, battles, and plunder; nor does chronology allow time sufficient for the golden age of Brian, so celebrated by his eulogists, between his becoming King of Ireland in 1002 and his death in 1014. His circuit of Ireland, made to demand hostages and secure the peaceful submission of the minor chieftains, is dated by the Four Masters 1005, and is not by them represented to have been so completely successful as the romantic histories of his reign would make us believe.

But we must come now to the battle of Clontarf. It was probably two, or perhaps three years, before that event that Maolmordha, King of Leinster, arrived at Cencoradh,‡ or Kincora, where Brian then resided in his hereditary mansion. Gormlaith was there at the time, in the character of Brian's wife. Maelmordha had brought with him three large pine-trees, fit to make masts for ships, probably constituting his annual tribute, or a part of his tribute, as one of Brian's vassals. He wore also on the journey a coat or tunic, which Brian had given him, with a border of gold, and silver buttons. This was, perhaps, also a token of vassalage. On the road a dispute having occurred between his men, Maelmordha himself stepped in to save one of the trees from falling. In the effort he made, one of the buttons of his tunic broke. On his arrival at Brian's palace, he applied to his sister Gormlaith to replace the button. She appears to have just then conceived that hatred of her husband Brian which the Njal Saga attributes to her. She took her brother's

* Keating.

† See Dr. O'Donovan's Introduction to the Topographical Poems of O'Duggan and O'Heerin, now in course of publication by the Irish Archæological and Celtic Society, in which a curious and valuable history of Irish surnames will be found.

‡ The word signifies "The head of the weir."

tunic and cast it into the fire, reproaching him with meanness of spirit and cowardice for submitting to be the vassal or servant of any one. An accidental circumstance aided her influence, and drove Maelmordha to revolt. Murchadh, or Morrogh, Brian's son, sat down to play a game of chess with his cousin Conaing, son of Donncuan, Brian's brother. Maolmordha stood by, and suggested a move by which Morrogh lost. Irritated by this, Morrogh said to Maolmordha, "This was like the advice you gave the Danes at Glen-mama, which lost them the battle." "Well," said Maolmordha, in great wrath, "I will soon give them advice again, and then they shall not be defeated." "You had better take care," said the other, "that they have a yew-tree ready for your use."

After this insult the King of Leinster took his departure, deeply offended; and when Brian sent a servant after him with a soothing message, he smashed the servant's head with a stick, and pursued his way. It is probable that Gormlaith accompanied him, or followed him soon after; for we find her next in the court of her son Sitric in Dublin, directing his councils, and organizing the opposition against Brian.

The Sagas throw great light on the motives which led the foreign Norsemen to join the enterprise of Sitric. In 1013, Svein, the Danish invader of England, died, leaving to his son Cnut to continue among the Saxons the Danish dynasty which he had founded. The establishment of a similar dynasty in Ireland was the bait offered by Sitric to the chieftains whose aid he sought. To Sigurd, Earl of Orkney, he promised the sovereignty of Ireland and his mother's hand; this was about Christmas, and it was agreed that Earl Sigurd should come with all his host to Dublin by Palm Sunday.*

On his return to Dublin, Sitric explained to his mother the bargain he had made, and she expressed herself well pleased; but sent him off again to seek two vikings on the west coast of the Isle of Man, directing him to engage their services, whatever price they asked.

These were two brothers, Ospak and Brodir. Ospak was a heathen, but Brodir had been a Christian, and had been ordained a deacon. He had, however, apostatized, and at the time when Sitric met him, "he had thrown off his faith," to use the language of the Saga, as translated by Dr. Dasent, "and had become God's dastard, and now worshipped heathen fiends; and he was, of all men, most skilled in sorcery." He was clad in a coat of mail of magical virtue, "which no steel could bite." He was tall, and had such long black hair, that he tucked his locks under his belt.†

He also stipulated that he should have the hand of Gormlaith, and be King of Ireland; and Sitric made no difficulty in agreeing to these conditions, on the understanding that the arrangement should be kept secret from Earl Sigurd; and so Brodir also agreed to come to Dublin by Palm Sunday.

Ospak, however, was dissatisfied. He had ten ships, and Brodir twenty. He escaped at night by stratagem, notwithstanding the efforts

* Dasent, "Story of Burnt Njal," vol. ii., pp. 327, 328.
† Ibid, p. 328

made by Brodir to detain him. He sailed round Ireland, entered the Shannon, and joined Brian at Kincora. He embraced Christianity, apparently as the necessary consequence of his deserting the cause of the Norsemen; in the words of the Saga, "he took baptism, and gave himself over into the King's hands."*

Whilst these negociations were going on, or perhaps a little before, the Leinster men, aided by Flaithbertach, or Flaherty O'Neill, son of Muirchertach, and grandson of Muirchertach of the Leather Cloaks, made an inroad upon Malachy, but were repulsed. In revenge, Malachy, on his own resources, attacked the Dublin Danes, and plundered as far as Ben Edair, or Howth. There, however, he was met by the whole force of Maelmordha, King of Leinster, and of the Danes of Dublin. The army of Malachy was cut to pieces; and his son Flann, surnamed the Albanach, or the Scotchman, was amongst the slain.† Malachy then appealed to Brian, and demanded the protection to which, as a vassal, he had an undoubted right. This was in the year 1012 or 1013, and we can scarcely require a more conclusive refutation of the calumny that Malachy was faithless to the cause of Brian on the plains of Clontarf. His whole life had been spent in endeavouring to keep in check the power of the Danes of Dublin and their allies of Leinster. He had lost his crown by the alliance of the Danes of Dublin with Brian, and he had just smarted from a sharp defeat in battle by the Danes of Dublin, in which his eldest son had fallen. Every motive, therefore, was combined to make him both zealous and loyal to the battle in which the power of the Danes of Dublin was finally crushed; and in fact it is evident that, if Malachy kept his forces for a time aloof from the battle, as the narrative of the combat states, he did so from policy. He waited until the impetuous troops of his allies had broken the ranks of the Danes, and then he rushed on with a decisive stroke, in which he enjoyed the luxury of a complete revenge for his recent loss. The Four Masters must have been well aware of the calumny that Malachy had been in league with Sitric and his allies. That calumny is to be found in the "Wars of the Gaedhil with the Gaill," and other authorities which the Four Masters had before them; nevertheless, the Four Masters not only make no mention of that calumny, but expressly tell us that, after the death of Brian and the slaughter of his choicest captains, the forces of the enemy were completely routed "by dint of battling, bravery, and striking," by Maelseachlainn (i. e., Malachy) from the river Tolka to Dublin, "against the Danes and men of Leinster," in which conflict Maelmordha himself was slain, with all the principal chieftains of Leinster. There cannot, therefore, be a doubt, as Mr. O'Donoghue, the latest historian of the battle, has remarked, that the completion of the victory, and its pretensions to be regarded as decisive, were in a great measure, due to the prudence and valour of Malachy.‡

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* Dasent, "Story of Burnt Nijal," p. 332. † "Wars of Gaedhil and Gaill," p. 149.

‡ O'Donoghue, "Memoir of the O'Briens," p. 33; and compare also Moore, "History of Ireland," vol. ii., p. 114.

It is unnecessary to go more minutely into the history of the battle; and I shall therefore conclude by noticing briefly the opinion expressed by Dr. Dasent,* that at Clontarf, in Brian's battle, "the old faith and new faith met in the lists, face to face, for their last struggle." Sitric and his mother, Gormlaith, did not scruple to call to their aid the Viking Brodir, the apostate Christian deacon, the heathen sorcerer. Sigurd, Earl of Orkney, caused to be borne "in front of his battle array his famous raven banner, wrought by his mother with mighty spells, which was to bring victory to the host before whom it fluttered, but death to the man by whose hands it was borne."

Brodir had predicted that, if the battle was fought on Good Friday, Brian would be victorious; but that he would be victorious at the expense of his life. On a day so sacred in the Christian calendar, all that the demon gods of Paganism could do was to revenge Brian's victory with his blood; and Brodir was himself the instrument of this vengeance. It is evident, therefore, that the fight, as described in the Saga, was regarded as a conflict between the expiring spells of Paganism and the higher power of the purer faith. "The struggle of the two faiths," as Dr. Dasent well remarks, "is carried on throughout the day, until at last the champions of neither creed can claim a complete victory"—the spells and soothsayings of the old faith, now brought into immediate conflict with a new and better creed, "were powerless to win the day, and could only avail to make the battle drawn."

And we find the same thing intimated, not obscurely, in the Irish version of the story. Among Brian's champions, according to the narrative given in the "Wars of the Gael and Gaill," the ancient belief in the Irish fairy mythology still lingered in the minds of some, the sincerity of whose Christianity cannot be doubted. Dunlaing O'Hartigan, and Morrogh, Brian's son, are both represented as retaining some lingering faith in the supernatural power and existence of the Heathen deities. Dunlaing states that he had received from those Pagan Deities offers of "life without death, without cold, without thirst, without hunger, without decay," if he would abandon Brian's cause; whilst, on the other hand, he was assured by them that certain death would be his fate that day, as well as the fate of Morrogh, if he entered the battle. But, nevertheless, he preferred that fate to all the Pagan promises of joy and happiness,—including, strange to say, "delight beyond any delight of the delights of the earth, until the judgment, and heaven after the judgment," because he had pledged his word to Brian's cause, and was resolved never to abandon that cause, even with the certainty of immediate death. Morrogh replies—"Often was I, too, offered in hills and in fairy mansions this world and these gifts: but I never abandoned, for one night, my country nor my inheritance for them."†

So true it is that this battle was regarded by both sides as a conflict in which the expiring spells of Paganism were engaged in their last

* "Story of Burnt Njal," vol. i., p. clxxxix. *sq.*
† "Wars of Gaedhil and Gaill," pp. 171, 173.

struggle with Christianity. So true, also, is the remark of Dr. Dasent, that "the pure doctrines of Christianity were then merely the possession of a few, while the creed of the common herd was little more than a garbled blending of the most jarring tenets and wildest superstitions of both faiths."*

It is remarkable that Sitric, the Danish king, is represented as having taken no part in the battle, remaining during the day within the walls of Dublin, probably with a strong reserve; and no attempt appears to have been made to assail the fortress, or to dislodge Sitric and his garrison. So far as the field of Clontarf was concerned, therefore, Dr. Dasent is correct in saying that the forces of Paganism were powerless to win the day, and could only avail to make the battle drawn. But the subsequent action, under Malachy, on the banks of the Tolka, rendered the victory complete on the Christian side, by the overthrow and slaughter of the Leinster chieftains, with the remnant of the Danish forces, who had attempted to rally after the battle. Sitric, however, appears to have still maintained possession of the Castle of Dublin; the Danish power in Ireland, weakened as much by want of union as by the prowess of the native chieftains, still continued formidable, until, by frequent intermarriages and the mutual interests of both parties, the Danes became absorbed amongst the native population; and when the Norman invaders established themselves in Ireland, nearly a century and a half after the battle of Clontarf, they found the Irish and the posterity of the Norsemen in close alliance, and ready to unite in resisting the establishment in the country of the new colony. The Cotters or Mac Ottirs, the Mac Ivars, the Mac Dubhgalls, the Mac Lochlinns, the Harolds, the Macauleys, and other descendants of Danish families, had become as Irish as the Irish themselves.

Dr. Petrie made some observations on the foregoing paper; and stated that the late celebrated Daniel O'Connell had always taken the same view of the character of Brian Borumha which Dr. Todd had now advocated.

The Rev. Samuel Haughton, F. R. S., Fellow of Trinity College, Dublin, read the following paper:—

On the true height of the tide at Ireland's Eye on the evening of the 6th September, 1852, the day of the murder of Mrs. Kirwan.

The following facts relative to the tide at Ireland's Eye were ascertained by me in December, 1852, in consequence of the reports of Mr. Kirwan's trial, published in the Dublin newspapers, containing statements as to the time and height of the tide on the evening of the 6th September, which carried with them internal evidence of their inaccuracy. For example, it was given in evidence that the hour of high water on the evening of that day was half-past three o'clock, and that the range of

* "Story of Burnt Njal," vol i., p. cxcviii.

the tide was nine feet. I knew, from the tidal observations of the Academy, of which I had the custody, that both these statements were erroneous; and, as they both seemed to be considered of importance in the trial, I resolved to make the measurements requisite to ascertain the truth with precision. I have never yet made the results I arrived at public, as they did not affect the result of the trial, for a reason which will be stated; and I now bring them before the Academy as an illustration of the importance of the tidal observations made by that body, and to show the valuable uses to which those observations may be applied. In bringing forward this subject, I have no wish to accuse those who conducted the prosecution of any negligence in procuring the best scientific information available, nor to express any opinion as to the course adopted by the Lord Lieutenant, in commuting Mr. Kirwan's sentence, after his conviction for the murder of his wife.

On the 18th December, 1852, low water occurred exactly at 10 A. M. (Dublin time), at Ireland's Eye; and on the same morning, by simultaneous observations on the tide-gauge at Kingstown, it was found to occur there at $9^h\ 53^m$, showing that the tide at Ireland's Eye is seven minutes later than that at Kingstown. By careful levellings made forwards and backwards by Professor Downing, it was found that the top of the "Body Rock" was 1·26 feet higher than the zero of the tide-pole used on the 18th December. The following table contains the quarter-hour observations made on this occasion at Ireland's Eye and Kingstown:—

Hour.	Height of Tide at Ireland's Eye.	Height of Tide at Kingstown.	Difference.
9·0 A. M.	0·60 ft.	6·25 ft.	5·65 ft.
9·15 ,,	0·43 ,,	6·00 ,,	5·57 ,,
9·30 ,,	0·21 ,,	5·82 ,,	5·61 ,,
9·45 ,,	0·20 ,,	5·85 ,,	5·65 ,,
10·0 ,,	0·20 ,,	5·75 ,,	5·55 ,,
10·15 ,,	0·18 ,,	5·80 ,,	5·62 ,,
10·30 ,,	0·21 ,,	5·85 ,,	5·64 ,,
10·45 ,,	0·44 ,,	5·95 ,,	5·51 ,,
11·0 ,,	0·56 ,,	6·20 ,,	5·64 ,,
			5·60 ft.

The interval from high water at Kingstown to that at Ireland's Eye being thus found to be seven minutes, and the zero of the tide-gauge at Kingstown being ascertained to be 5·604 feet below the zero of the tide-pole at Ireland's Eye, we have, since the top of the "Body Rock" is 1·26 feet above the zero of the tide-pole, the following result:—

	Feet.
Height of zero of the tide-pole above zero of gauge, .	5·604
Height of "Body Rock" above zero of pole, . . .	1·260
Height of "Body Rock" above the zero of the Kingstown tide-gauge, ...	6·864

On the day of Mrs. Kirwan's death, 6th September, 1852, the moon's age at noon was $21^d.9$ and her declination 20° 1′ 54″ N. The tide of the evening of this day is, therefore, comparable with that of the morning of the 18th September, 1851, when the moon's age at midnight preceding was $22^d.1$, and her declination 19° 51′ 14″·8 N.

Calculating the times of high water, low water, and half ebb, from the Academy's observations at Kingstown for the 18th September, 1851, I find that on the evening of the 6th September, 1852,

High water at Ireland's Eye occurred at $4^h\ 37^m$ P. M.
Low water, ... 10·14 ,,
Half ebb, ... 7·25 ,,

and that the range of the tide on that day was only 6·7 ft., the moon being in the commencement of her fourth quarter; and, therefore, the tide being neap. Introducing into the tidal observations at Kingstown the difference between the top of the "Body Rock" and the zero of the gauge, or 6·864 ft.,—I find the following Table to give the true heights of the Tide at Ireland's Eye on the 6th September, 1852, referred to the "Body Rock" as the zero; and I have placed beside the true heights the heights alleged in Court during the trial of Mr. Kirwan.

Heights of Water above Top of "Body Rock," 6th September, 1852.

Time.	True Height.	Height alleged in Court.	Difference.
High Water,	+ 4·84 ft.	+ 7·00 ft.	+ 26·0 in.
6·30 P. M.	+ 3·11 ,,	+ 2·50 ,,	− 7·3 ,,
7·0 ,,	+ 2·37 ,,	+ 1·75 ,,	− 7·4 ,,
7·15 ,,	+ 1·85 ,,	+ 1·375 ,,	− 5·7 ,,
7·30 ,,	+ 1·84 ,,	+ 1·00 ,,	− 4·0 ,,
Low Water,	− 1·86 ,,	− 2·00 ,,	− 1·7 ,,

Fortunately for the interests of justice, the time of Mrs. Kirwan's death coincided very nearly with the time of half ebb of the tide, $7^h\ 25^m$, P. M., when the real height of the water above the "Body Rock" only exceeded that alleged on the trial by 5 inches. Had the critical moment been near the time of high water, the evidence given would have been in error by upwards of 2 feet; and as the exact height of the water was considered of great importance by both the Crown and the prisoner's counsel, a substantial injustice would have been done to one side or the other by the admission of erroneous evidence on a scientific question of so great delicacy and importance.

Some remarks were made by Professor Hennessy, Charles Davis, M. D., Robert Mallet, Esq., and Sir Henry T. Brownrigg.

Mr. Haughton explained.

MONDAY, JUNE 10, 1861.

VERY REV. DEAN GRAVES, D.D., President, in the Chair.

THE following gentlemen were elected Members of the Academy:—George W. Abraham, LL.D., and the Rev. Thaddeus O'Mahony.

The REV. WILLIAM REEVES, D.D., read the following paper:—

ON AUGUSTIN, AN IRISH WRITER OF THE SEVENTH CENTURY.

WE are indebted to editorial laxity for the preservation of two very important tracts bearing upon the ecclesiastical history of Ireland. Had it not been that some old compiler of Venerable Bede's works was led, by a supposed similarity of style or other deceptive indication in Probus' Life of St. Patrick, to include it among the biographical pieces of that esteemed writer,* and had not John Hervagius been content to commit to print the professed works of Bede as he found them thus collected, without any attempt to discriminate between what was genuine and what was spurious, the literary world would, in all probability, have never been made acquainted with the existence of this memoir, nor would Colgan have had a source whence to draw the earliest and most curious of the lives in his sevenfold illustration of St. Patrick's history.

So, likewise, had not the identity of name misled the compiler of St. Augustin's works, it is exceedingly probable that our Irish Augustin, whose style and date were so far removed from those of his patristic namesake, would long since have been blotted out of the book of remembrance, and our early church literature would have lost the most respectable component in its scanty sum. Certainly the literary reliques of the young prophet owe their preservation to their being *nominally* blended with those of the old.

St. Augustin, Bishop of Hippo, died in the year 430; but another ecclesiastic,† a native of Ireland, of the same name, and connected with the same province, flourished two centuries later; and the accident which afforded to him a supposed identity with his predecessor saved from oblivion the composition of an obscure writer, whose Scotic origin was almost certain to insure his literary extinction.

The third volume of the various editions of St. Augustin's works, from

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* The ambiguous import of the word *probus* in a MS. where proper names were not distinguished by capitals, probably disguised the author's name, and led Hervagius to print the colophon of the tract thus:—"Ecce habes, frater Pauline, a me humili probo, postulatum nostræ fraternitatis indicium." Bedæ Opp. tom. iii., col. 334 (Basil. 1563). In Abp. Ussher's copy (Library Trin. Coll. Dubl., S. d. 17) there is a marginal note in his own handwriting:—"Non est hoc Bedæ opus; sed Probi Hiberni: ut apparet ex fine libri secundi."

† The Louvain editors prefix to the treatise the title "Incipit prologus Augustini *Episcopi* in librum de mirabilibus Scripturæ Sacræ."

Erasmus' down to the latest Paris reprint,* contains, among the *Spuria*, a composition in three books, entitled, "De Mirabilibus Sacræ Scripturæ," the prologue of which bears the superscription "Venerandissimis urbium et monasteriorum Episcopis et Presbyteris, maxime Carthaginensium,† Augustinus per omnia subjectus, optabilem in Christo salutem." In the course of the prologue, the writer mentions the injunction which his spiritual father, Eusebius, had laid upon him to compose the work; and he closes it by a modest reference to two individuals of the same church, whose names, *Bathanus*‡ and *Manchinanus*,§ indicate their Irish extraction, the former being a latinized version of the well-known name *Baetan* or *Baedan*, and the latter of the equally familiar *Mainchine*.

The period at which our author wrote the tract is ascertained from a very explicit chronological note, which not only fixes his date, but his native country. Treating of the miracle recorded in the Book of Joshua,‖ where "the sun stood still upon Gibeon, and the moon in the valley of Ajalon," he observes that this detention of the luminaries caused no disturbance in nature, because both orbs rested synchronously in their course. For if one luminary had run on while the other was at rest, it would have deranged the constituted order of months and years. The moon was arrested in her course, not that she could afford any aid to the adversaries of Israel, but, as a handmaid, to await the accompanying motion of the sun. Then he proceeds to treat of the great cycle of 532 years, namely, the product of the solar cycle of 28 multiplied by the lunar cycle of 19; and having recounted the most important events of Scripture history which marked its recurrence, he adds:—"Donec decimus inde oriens, nonagesimo secundo anno post passionem Salva-

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* The treatise is not found in the editio princeps of St. Augustin's works, by John Amorbach (Basil. 1506); but it appears in the edition of Erasmus (Par. 1531), tom. iii. fol. 150 *a*–161 *b*. Also in the Paris edit. 1555, tom. iii. fol. 159 *b*–171 *b*; Basil. edit. 1569, tom. iii. col. 705–762; Venet. 1670, tom. iii. fol. 234 *a*–252 *a*; Antwerp, 1576; "per Theologos Lovanienses," tom. iii. Append. pp. 394–410; Paris. "Opera et Studio Monachorum Ordinis S. Benedicti e Congr. S. Mauri," tom. iii. part ii. Append. col. 1–32; Antwerp, reprint, 1700, tom. iii. Append. col. 1–26; Bassani, 1797, 4to, in which edition the *spuria*, including this treatise, are thrown together in the sixteenth volume. The latest edition, Paris, 1837, 8vo, restores the tract to its original place, tom. iii., part ii., col. 2716–2719.

† The Benedictine editors, in the margin, propose "*forte* Cantuariensium." See, however, what is urged in the course of this paper.

‡ So the name is written in all the MSS., except that of St. Audoen of Rouen, which reads *Barbanus*. But the Benedictine editors rightly suggest "forte *Baithanus*: qui fuit Scotus episcopus, apud Bedam, lib. 2, Hist. c. 19." We find *Baithanus* in Adamnan, Vit. S. Col. ii. 24 (ed. Reeves, p. 137); and he latinizes the name of king "Baedan filius Maic Erce" by *Baitanus Filius Maic Erce*, ib. i. 12 (p. 40). Baoithin, on the other hand, is latinized *Baitheneus*. Baithanus or Baitanus of Bede is Baetan of the Four Masters, 663.

§ The name appears further on in the form *Manichæus*. The Rouen MS. here reads *Manchianus*, which is a nearer approach to the Irish form.

‖ Chap. x. 12, 13.

toris, Alia et Sparsa consulibus, peractis cursibus, consummatur. Post quem undecimus a consulatu Paterni et Torquati ad nostra usque tempora decurrens, extremo anno Hiberniensium moriente Manichæo inter cæteros sapientes, peragitur. Et duodecimus nunc tertium annum agens, ad futurorum scientiam se præstans, a nobis qualem finem sit habiturus ignoratur."

The tenth cycle ended in the ninety-second year after the Crucifixion, that is A. D. 120, if, as usual, we antedate this occurrence by four years. Adding to this 532, we get the year 652 as the close of the eleventh cycle, in which the writer says Manichæus the Wise died in Ireland. Now, this Manichæus is none other than the Irish *Mainchine*,* concerning whom Tighernach, the annalist, writes at 652, "Dormitacio Manchene Ab Menedrochaidh;" or, as the Annals of Ulster, at the preceding year, "Obitus Maenchein abbatis Menedrochit." The place of which Manichæus was abbot is now known as Mondrehid, a townland, having an ancient cemetery and remains of a church, in the parish of Offerlane, in the Queen's County.†

This remarkable coincidence, which was observed by Archbishop Ussher,‡ affords a wonderfully strong external testimony to the accuracy of our domestic annals.

The author of the treatise adds, that the year in which he wrote was the third of the twelfth great cycle, that is, 655.§ In his notice of the tenth cycle, he places its close in the consulships of *Alia* and *Sparsa*, which names, as the Benedictine editors observe in the margin, should be *Aviola* and *Pansa*. This contraction of Aviola into Alia, and the prefixing of *S* to Pansa, is not foreign to the genius of Irish pronunciation. Manius Acilius Aviola and Caius Cornelius Pansa are set down as consuls in the Fasti Consulares of Noris‖ at A. U. C. 875, or A. D. 122, which year is adopted by Muratori,¶ and from him transferred to the tables in L'Art de Verifier les Dates.** There is a difficulty, however, in reconciling what our writer says of the opening of the eleventh cycle, namely, "in the consulship of Paternus and Torquatus." Now, in

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* We have two names very like each other, namely, Manchan and Mainchein. The former is the root of Lethmanchain, now Lemanagan, in the King's County; the latter is best known through Mainchin mac Sedna, now St. Munchin of Limerick. Colgan observes that Manchan, Manchen, and Manchin, are diminutives of *Manach*. Acta Sanctor, p. 832 *b*, n. 1.

† Ordnance Survey, sheet 16, S. W. corner.

‡ Brit. Eccl. Antiquitates, cap. 17 (Works, vol. vi., pp. 542, 543, 606). He thus calculates:—532 × 11 = 5852; from which if we subtract 5200, the year of the Nativity we get 652.

§ The Benedictine editors differ from Ussher's computation: "de cyclis disserens ostendit liquido se post 660 Christianum scripsisse hos libros." Cave says: "Scripsit anno 657." Hist. Liter. i. p. 294. Oudin is very vague: "Incertus author post annum 530, an etiam 700 vivisse perhibetur."—Comment. de Script. i. col. 944.

‖ Appended to his *Annus et Epocha Syromacedonum*, p. xvii.

¶ Annali d' Italia, tom. i., p. 282.

** Vol. i., p. 353.

all the consular lists, from Onuphrius Panvinius* down, including those just mentioned, as well as Pagi,† Quintus Arrius Pætinus and Lucius Venuleius Apronianus are represented as the consuls for the year of the city 876, or A. D. 123; and Manius Acilius Glabrio and Caius Bellicius Torquatus for the succeeding year. Thus, it would seem that our author borrowed from some chronicle which made Pætinus *Paternus*, and brought up Torquatus from the succeeding year to be associated with him. The difficulty, however, is removed by Cassiodorus, the contemporary of Theodoric the Great, whose chronicle was written a century before our author's time. The Emperor Adrian came to the throne the 9th of August, 117. Under his reign Cassiodorus places as the first consuls Verus and Augur; that is, for the year 118. The next in order are Aviola and Pansa; that is, for 119; and the next, Paternus and Torquatus.‡ Thus we are able, on the score of authority, to justify our author's statement.

With reference to the title *Mirabilia Sacræ Scripturæ*, the writer thus explains his use of it:—"Cuncti vero laboris hoc magnopere intentio procurat in omnibus rebus in quibus extra quotidianam administrationem aliquid factum videtur, non novam ibi Deum facere naturam sed ipsam quam in principio condidit gubernare ostendet." "Illa igitur inusitata gubernatione, cum res per voluntatem potentiam gubernatoris ostendunt, quod per efficacium quotidianæ administrationis non faciunt, in Scripturis *mirabilia* memorantur."

He lays it down as the principle of his treatise that God rested on the seventh day from all his work, that is, of creation. But that while *creatio* was once and for ever terminated on this day, the *gubernatio* of the Deity never ceases; and that all the mirabilia or miracles are not new creations, or even interferences with nature, but only certain unusual developments of the secrets of nature:—"Non creare ibi novam naturam, sed gubernare olim creatam Deus putandus est. Sed ita potens est in gubernatione creaturæ qui condidit, ut veluti naturam novam creare videatur, cum abditis naturæ sinibus, quod in illa latebat, depromit."

With this profession, he proceeds then to deal with the principal mirabilia of the Bible, which he divides into three books:—1, The Law, to the death of Moses; 2, the Prophets, the rest of the Old Testament; 3, the New Testament.

His style is for the most part clear and flowing, and he evinces, by the variety of his references and the ingenuity of his applications, not only an intimate acquaintance with sacred literature, but considerable originality of thought. Sometimes he enters into the discussion of speculative questions, such as the fall of angels; sometimes into physico-religious inquiries. Thus, when treating of the Deluge, he starts the question, Why terrestrial animals suffered more than the aquatic?

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* Fasti Consulares, p. 59.

† Critica in Baronium, tom. i., p. 607 *a*. Funccius, at A. D. 125, has "Petinus, sive Paternus, ut Cassiodorus habet, et Cassius."—Chronologia, p. 97.

‡ Opera, tom. i., p. 388 *a* (Ed. Garet).

Again, he inquires, in what way the life of amphibious creatures, as lutri (otters) and vituli marini (seals) was preserved, whose nature assigned the water to hunt in, but required dry land for the purposes of sleep, nourishment, and rest. When discussing, as he does at some length, the question whence the waters of the Deluge came, and whither they returned, he incidentally makes mention of Ireland, and furnishes us with the earliest known record of the wild animals of the island :— "Nec contra naturam terræ est, superpositos humores semper consumere; præsertim cum hæc Deus in potestate etiam sanctis suis tribuit, quemadmodum Heliæ et Helisæo dedit in nubecula. Maria quoque extra terminos antiquos crescere consuescunt, et terrarum spatia diminuunt atque præscindunt, sicut et senes nostro adhuc tempore viventes, vidisse se confirmant. Unde etiam insulas quæ ab initio conditi orbis, ut multi affirmant, non fuerant, processu temporis faciunt, dum propinqua promontoria marinis finibus a continenti terra dividunt. Per quod intelligit, quod illæ feræ quæ insularum orbibus includuntur: non humana diligentia devectæ, sed in illa divisione insularum a continenti terra repertæ esse probantur. Quis enim, verbi gratia, *lupos, cervos, et sylvaticos porcos, et vulpes, taxones, et lepusculos, et sesquivolos in Hiberniam deveheret?* Vel qualiter tunc domesticam manum portantes ita effugerant, ut omnia genera hæc per silvas nunc oberrare videantur?" Thus, wolves,* deer, wild boars, foxes, badgers, hares, and rabbits, or weasels,† are stated to have been the wild animals of Ireland in the middle of the seventh century.‡

Our author further observes that the question of the eruption and retirement of the waters of the Deluge is continually suggested by the daily flowing and ebbing of the tide :—"Quemadmodum hanc inundationem unde venit, aut quo recedit nescimus; ita etiam recessum diluvii ignoramus. Hæc namque quotidiana inundatio bis in die a tempore ad tempus, per horas viginti-quatuor semper peragitur, et per alternas hebdomadas Ledonis et Malinæ vicissitudo comitatur. Sed Ledo§ sex horas inundationis, et totidem recessus habet: Malina vero grandis per quinque horas ebullit, et per septem horas littorum dorsa retegit. Quæ tan-

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* Erasmus observes in his *censura :* "quum hoc genus animantis nec in Hibernia dicitur inveniri, nec in Anglia." To which is appended, in Ussher's copy of the Paris edition, 1555, a MS. note by Baron Hilton :—"Falso, ut cætera tenet Erasmus, in Hybernia non esse lupos; experientia contrarium convincitur," fol. 159 *ba* (Libr. Trin. Coll. Dubl. BB. dd. 2).

† Sesquivoli is the word in the original, of whose occurrence this is the only known instance. Ducange gives the word, but refers to this passage for it, not venturing on further explanation than "animal quadrupes!" We find *Squirolus* denoting a 'squirrel;' but it is doubtful whether the term is ancient, and whether squirrels were indigenous to Ireland.

‡ There is no mention of bears, although some remains of them have been found in Ireland. See Proceedings, vol. iv., pp. 416, 418; vol. vii., p. 192.

§ *Ledo* denotes the neap-tide; *malina*, the spring-tide. These words are first found in Marcellus Empiricus, who flourished in the fourth century. See Ussher's Brit. Ec. Ant., cap. 15 (Works, vol. vi., pp. 214–216).

tam concordiam cum luna ostendit, ut antequam luna nascatur, tribus diebus et duodecim horis semper incipiat, et post nascentis lunæ principia, alios tres dies, et duodecim horas consuescit habere: similiter et ante plenilunium tribus diebus et duodecim horis incipit, et post totidem temporis cursus sui terminum consumit. Sex vero uniuscujusque temporis Malinas, veris scilicet et æstatis, autumni et hyemis, secundum lunarem supputationem, hoc est, simul omnes viginti-quatuor unusquisque communis annus habet, exceptis videlicet embolismis, qui viginti-sex Malinas retinent; et uniuscujusque de predictis temporibus mediæ duæ, videlicet æquinoctiales, et aliæ quando dies vel nox cursus sui terminum consumit, solito validior ac inundatione altior fieri consuescit. Interpositis vero spatiis iterum tantumdem semper Ledo intermittitur. Ac vero rationabilis hujus perseverantiæ inundatio, quo recedit, mentibus nostris occultata est; non minorem profectum nescientibus præparat scientia hominis. Nam qui veram sapientiam cupit, ad æternum regnum, ubi nulla est ignorantia, festinare contendat, et interim cum insigni gentium magistro dicat, Ex parte cognoscimus, et ex parte prophetamus."

To reconcile the transformation of Lot's wife into a pillar of salt with his maxim that nothing is done against nature in any creature of God, he observes that the existence of salt in the human system is indicated by traces of it in tears, and other secretions; adding, that the Ruler of the world, when He wishes to convert the whole into a part, infuses into the whole the principle which lay concealed in an inconsiderable part. And hence, when He desired to turn Lot's wife into a pillar of salt, that exceedingly minute portion of salt which existed in the system overspread the whole body.

In reference to the plague of blood, he answers the question, "Quomodo Deus naturæ gubernator naturaliter aquam in sanguinem mutavit?" by observing, that water, the material of all liquids, is converted by the vine into wine, by the olive into oil, by animal bodies into milk, blood, and the twenty-three fluids of the human frame; so that the only remarkable feature is, that what was usually performed by a slow process, was in the present instance executed in a moment according to the laws of nature by the order of the all-powerful Ruler.

That an iron axe-head should swim in water* he endeavours to show is not contrary to nature, but only an unusual stretch of it. For if a stone, he observes, which two men cannot lift be immersed in water, one man can hold it up with a rope. Whence it appears that, though water cannot entirely, yet it can, to some extent, support heavy bodies, and that therefore the power with which it is partially endowed God can increase to a greater degree.

The preceding examples will serve to give an idea of the manner in which the writer deals with his subject. They are not characterized by the depth or acuteness of St. Augustine's genius, and therefore have for

* 2 Kings, vi. 6.

a long period been referred to another author, though still included among the great Father's works. Thomas Aquinas, Erasmus, and Baronius, have successively pointed out its inferiority; and the Louvain editors, followed by the Benedictines, have removed all possibility of misconception in the matter. Among Irish writers—Henry Fizsimon,* Ussher,† Ware,‡ and Lanigan,§ lay claim to the essay as the work of an Irishman, but fail in ascertaining the writer's name, having either employed an early edition of St. Augustine's works, in which the prologue containing the writer's name is wanting,‖ or else, having conceived that Augustine was a very unlikely name to be borne by an Irishman.¶ It is, no doubt, of rare occurrence in the catalogue of Irish names, for the natives were very sparing in their use of foreign appellations. There are, however, a few instances of the adoption of Scripture names, as Abel,*[a] Daniel,†[a] Joseph,‡[a] Philip,§[a] Thomas,‖[a] and of ecclesiastical, as Clemens,*[b] and Helair or Hilary.†[b] Even of the name in question we have a few examples. Augustin, abbot of Bangor, who is commemorated in the calendars of Tallaght, and Marian Gorman,‡[b] died, according to the Annals of Ulster, in 779. Augustin was abbot of Hy in 1164,§[b] and another of the same name, of Lisgoole, in 1329. The name may have been introduced at the Christianization of the country, for one of Palladius' companions was Augustinus;‖[b] and St. Patrick had subsequently a disciple called Augustin, whose church was on Inisbeg.*[c] The name, therefore, presents no difficulty to the supposition that the Augustin who wrote the treatise *De Mirabilibus Sacræ Scripturæ* was an Irishman.

The Benedictine editors in their *Admonitio* prefixed to the tract confess that the writer "videtur se gente Anglum sive Hibernum indicare;" but they cannot conceive how such could be connected with the church of Carthage, and therefore in a marginal reading they propose to read *Cantuariensium*,†[c] instead of *Carthaginensium* in the text, and in their

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* Catalogus Præcipuorum Sanctorum Hiberniæ (Antwerp, 1621).

† Works, vol. vi., p. 542.

‡ Irish Writers, Works, vol. ii., p. 35.

§ Eccles. Hist. of Ireland, vol. iii., pp. 54, 56.

‖ The Prologue is wanting in the Paris edition, 1531; Basil. 1569; Venet. 1570.

¶ Dr. Lanigan conjectures that it is an error for Aengussius or Eugenius. Eccles. Hist., vol. iii., p. 58.

*[a] Four Masters, A. D. 742, 749, 807, 920, 1159.

†[a] Ibid, 659, 731, 768, 777, &c.

‡[a] Ibid, 780, 789, 811, &c.

§[a] Irish Calendars, Mar. 4; Colgan, Acta SS. p. 457 *b*.

‖[a] Four Masters, A. D. 789, 803; Irish Calend. 4 Dec.

*[b] Ibid, An. 824, 826.

†[b] Ibid, An. 802; Irish Calendars, Sept. 7.

‡[b] At the 27th of October. He is omitted in the Calendar of Donegal.

§[b] Annals of Ulster.

‖[b] Book of Armagh, fol. 2 *ab*; Colgan, Trias Thaum., pp. 13 *b*, 18 *b*, 48 *b*.

*[c] Vit. Trip. iii. 22, 25 (Trias Thaum., p. 155 *a*).

†[c] Dr. Lanigan regards this as a manifest erratum; and probably a mistake for *Cluanensium* or *Corcagiensium* (Eccl. Hist. iii., p. 57). His conjecture, however, is utterly un-

preface declare concerning these three books, "quos ab ipso non Carthaginensium, sed Cantuariensium vel Cambrensium (si tamen vox jam in in usu erat) vel Kilkennensium, &c., monasteriorum Presbyteris nuncupatos fuisse suspicamur." This statement is reprinted in the Antwerp edition of 1700, and the Parisian impression of 1837. But in the quarto edition of Bassano, 1797, the far-fetched and very improbable suggestion of *Cambrensium vel Kilkennensium* is wisely expunged. The notice, however, of the treatise which Cave gives is not very creditable to either his judgment or research—"Angli cujusdam, vel Hiberni, ut videtur opus. Autor erat Augustinus quidam monachus Cantuariensis, seu potius Cambrensis, id est Hibernus."*

These writers considered that the name Augustin, as borne by a native of the British Isles, suited the church of Canterbury better than that of Carthage, as they could hardly conceive an Englishman, much less an Irishman, at this early date attaining distinction in so remote a quarter. But they seem to have forgotten the extraordinarily erratic character of the ancient Irish Christians, and how widely in Europe their traces are discoverable. And if history does not supply us with any direct notice of their connexion with the African church, the defect can be reasonably accounted for in the obliteration of local records by the Saracenic invasion, which commenced soon after our author's date, and reduced the once flourishing church of Africa to misery and extinction. A further objection to the proposed substitution of *Cantuariensium* for *Carthaginensium* is that *Doruvernensium* would be the more likely term were Canterbury intended, as *Cantuarii* is applied by Bede to the inhabitants rather the place. We must by all means reject the emendation, and retain the reading which is found in all the manuscripts and printed copies. The probability that the monastic system of Ireland had its model in Egypt, and the mention of Egyptians who visited Ireland in the Litany of Aengus, are quite sufficient to justify the supposition that the ecclesiastical migrations of the Irish may have included the heats of Africa as well as the cold of Iceland. The narrative in Sulpicius Severus' Life of St. Martin would certainly prepare the mind to regard an after visit of an Irishman to the same region as no unlikely event.†

Though there are some passages in the treatise which are difficult to interpret,‡ and indicate the ignorance or carelessness of the copyist, still

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tenable, both for want of authority, and especially because such a grouping of churches under one name implies a diocesan distribution, which was unknown in Ireland till many centuries afterwards.

* Historia Literaria, vol. i., p. 294 *a* (Oxon. 1740). Casimir Oudin's notice is not more satisfactory. See his Commentarius de Scriptoribus Ecclesiasticis, tom. i. col. 944 (Lips. 1722.)

† Sulpicii Severi Dialogus i. Opera, p. 541 (Ed. Hornii).

‡ As, at the close of the prologue: "Ab uno enim vestrum, id est, Bathano, post patrem Manchinanum si quid intelligentiæ addidi, et ab altero ut credo saliva oris ejus vicem laborum causam suscepi."

it may be justly regarded as a most creditable monument of learning and religious feeling, at a period when the Irish church was about at her best. In its style we observe a great superiority over the Latin of Columbanus, the Book of Armagh, and even Adamnan; and we are naturally inclined to attribute the excellence to foreign association. The composition which most resembles it in tone and vigour is the admirable Paschal Epistle of Cumian, written about twenty-five years before.*

In a theological point of view, this is the most interesting relique of Irish learning; and, though we may well conceive that our numerous monasteries with their numerous *Ferleighinns* produced many works of even greater merit, still we have to deplore the merciless rule of barbarism which swept away all domestic evidences of advanced learning, leaving scarcely anything on record at home but legendary lore, and has compelled us to draw from foreign depositories the materials on which to rest the proof that Ireland of old was really entitled to that literary eminence which national feeling lays claim to, and general consent is disposed to concede.

The Rev. H. Lloyd, D. D., read the following communication from Professor Hansteen, of Christiania:—

ON THE AMPLITUDE OF THE DAILY VARIATION OF THE MAGNETIC DIP IN CHRISTIANIA BETWEEN 10 A. M., AND AN HOUR BEFORE SUNSET, FROM 1844 TO 1859.

"In the following Table *n* is the number of days in each month upon which the dip has been observed at its maximum in the morning, and at its minimum in the afternoon. *Variation* is the difference between *inclinatio antemeridiana* and *postmeridiana*, which has, without exception, been always positive.

Month.	*n*	Variation.
January, ...	18	+ 0′·382
February,. . . .	17	+ 0 ·329
March,.	25	+ 0 ·974
April, ...	36	+ 2 ·365
May, ...	48	+ 3 ·155
June, ...	59	+ 3 ·231
July, ...	30	+ 2 ·787
August, ...	37	+ 1 ·766
September, . . .	36	+ 1 ·831
October, ...	18	+ 1 ·227
November, . . .	18	+ 0 ·928
December, . . .	15	+ 0 ·239

* Ussher, Sylloge Epist. Hbi. xi. (Works, vol. iv., p. 432).

"The observation of the true magnetic dip does not depend upon any difficulty in *reading* the position of the needle when it is in equilibrium; but only upon the question, if when the horizontal axis has been elevated from the agates, it *always returns* to the *same points of division*. With large needles, like those of Gambey, with good lenses opposite both ends of the needle, when the axis has been elevated from the agates, and the needle makes oscillations of 30, 40, or 50 minutes, I observe three consecutive extremes,—a minimum α, a maximum β, and a minimum γ. Each of these can be observed correctly to a minute. The true position in equilibrio is then $\frac{1}{2}\left[\frac{\alpha+\gamma}{2}+\beta\right]$. In the oscillation of the needle, and its mechanical moment, every obstacle, such as a little friction and small irregularities in the pivots of the axis, is overcome. Observing the same three extremes at the other end of the needle before a new elevation of the axis, I then take the mean of these two means. In the same position of the needle, I repeated this formerly four times; so that in the eight different positions of the needle and limb I had thirty-two readings of each end of the needle. As I found by long experience that the four means, in every position, differed very little from each other, I have in the latter two years diminished them to three.

"With your little circle, with microscopes, it is necessary to *wait* till the needle is *quiet*, and to direct the wire to the upper point of the needle, and read both verniers, then to the lower point, and read again. But when the needle makes only an angle of 3, 4, or 5 minutes with the true position of equilibrium, its moment is so weak, that the least effect of friction, and irregularity in the pivots, can stop it in a false position. I therefore regard the microscopes as unnecessary, and even injurious. It is true that a correct dip depends also upon the skill and experience of the observer; and I confess that for a dilettante, who makes an observation for the first time, the microscope may be agreeable, as it gives an imaginary correctness.

"The above-cited facts of the daily variation, observed with Gambey's instrument, without microscopes, are a clear proof of this. I have not seen that any observer with the small Barrow has detected the daily variation, and its gradual increase from the winter to the summer solstice.

"From April, 1859, there has arisen a period of great perturbations, with flashings of polar light (Aurora Borealis), and great spots in the sun. The daily variation is still always positive, but extraordinarily great: it has once amounted to $1^\circ 2'$; and the variations of the Bifilar have been great in proportion. As the latter instrument is always observed by an assistant twice in the same hour with my observations of the dip, I will give some examples:—

1859.	Daily Variation.		
	Dip.	Bifilar.	
April 21, . . .	+ 27′·47	− 485·0	Aur. Bor. evening.
„ 22, . . .	+ 7 ·04	− 131·7	Ditto.
June 8, . . .	+ 17 ·02	− 295·9	Aur. Bor. could not be seen for the crepusculum.
July 11, . . .	+ 16 ·66	− 268·5	
„ 19, . . .	+ 12 ·33	− 181·7	
August 22, . .	+ 7 ·51	− 133·9	21, Vehement Aur. Bor. evening;
„ 29, . .	+ 11 ·76	− 179·1	28, and midnight.
September 2, .	+ 82 ·03	− 801·3	
October 18, . .	+ 19 ·69	− 355·7	Aur. Bor. 17, 18, 20, evening.
„ 21, . .	+ 16 ·21	− 259·1	
1860.			
February 21, .	+ 4 ·08	− 168·2	Aur. Bor. evening.
May 24, . . .	+ 8 ·97	− 180·8	

"Every time that I saw in the evening observation, in my tent, an extraordinarily *small dip*, I was sure that the Bifilar marked a *strong horizontal intensity*, which never failed. The Bifilar variation above given is the difference of parts of the scale (forenoon – afternoon). For instance:—

		Dip.	Bifilar.
September 2, .	10h 23m A. M.,	71° 29′·01	637·56
„ .	4h 16m P. M.,	70 26 ·98	1438·91
	Difference, . .	+ 1 2 ·03	− 801·35

"One part of the scale of the Bifilar = $\frac{1}{13970}$ of the horizontal intensity.

"HANSTEEN."

Dr. Lloyd communicated also to the Academy the following extract from a letter from Professor Hansteen, dated April 17, 1861:—

"At our interview in Christiania, in July, 1860, I communicated to you the mean *daily variation* of the magnetic dip in this place between its maximum at 10 A. M., and its minimum, about half an hour before sunset, for every month in the year, deduced from different years between 1844 and 1859. This variation, which at the winter solstice was only a fraction of a minute, increased very regularly to a little more than three minutes towards the summer solstice, and decreased again as gradually towards December.

"In order to ascertain if there is a *monthly variation* of the dip in the course of the year, I began, from April, 1855, to observe the dip in its daily maximum and minimum, generally five or six days about the middle of each month, to this year. The mean of the daily maximum and minimum, is contained in the following Table:—

	1855.	1856.	1857.	1858.	1859.	1860.	1861.	Means. 1856—1860.
January, . .	.....	71° 25′·858	71° 23′·386	71° 25′·114	71° 22′·754	71° 21′·561	71° 20′·183	71° 23′·735
February, . .	.....	26 ·544	24 ·233	24 ·110	22 ·824	20 ·645	21 ·330	23 ·671
March, . . .	.....	25 ·558	24 ·164	24 ·478	22 ·727	23 ·657	21 ·891	24 ·117
April, . . .	71° 27′·935	24 ·622	23 ·771	24 ·057	20 ·095	21 ·823	19 ·582	22 ·875
May, ...	26 ·050	23 ·835	23 ·942	23 ·205	20 ·072	20 ·331	.....	22 ·277
June, . . .	26 ·032	23 ·635	22 ·794	22 ·585	20 ·201	20 ·678	.....	21 ·978
July, ...	.. ..	23 ·724	23 ·133	22 ·158	20 ·866	20 ·783	.....	22 ·133
August, . .	25 ·820	23 ·640	23 ·806	21 ·506	22 ·220	20 ·785	.....	22 ·291
September, .	27 ·225	24 ·660	25 ·612	22 ·998	23 ·427	21 ·868	.....	23 ·713
October, . .	26 ·796	25 ·337	24 ·774	23 ·784	23 ·068	21 ·739	.....	23 ·740
November, .	26 ·870	24 ·047	24 ·849	22 ·701	22 ·913	21 ·613	.....	23 ·224
December, . .	25 ·235	24 ·078	23 ·458	23 ·340	21 ·633	21 ·248	.....	22 ·751
Mean, . .	71° 26′·433	71° 24 ·268	71° 23′·994	71° 23′·336	71° 21′·817	71° 21′·894		

"From the last column in the foregoing Table, it is clear that there is a maximum at the Equinoxes, in March and at the end of September, and a minimum at the Solstices, in June and December. The greatest variation is between March and June, and is equal to 2′·139. The mean yearly decrease between 1856 and 1860 = 0′·718; but between the incomplete year 1855, and 1860, it is 1′·008.

"Three days after your departure from Christiania, I was going in a steamer along the coast to Trondhjem, sent by the University to represent it, as its senior member, at the coronation of the king and queen. I made observations of the magnetical intensity and dip in Bergen and in Trondhjem on different days. I shall only communicate the latter, with former observations by different observers.

TRONDHJEM.

Inclination = i; Horizontal Intensity = H.

t.	Observer.	i.	Formula.	Δ.	t.	Observer.	H.	Formula.	Δ.
1823·70	Sabine,	74° 43′·05	74° 44′·80	− 1′·75	1825·5	Hansteen,	1·3425	1·3423	+ 2
1825·50	Hansteen,	− 40′·70	− 37′·65	+ 3′·05	1832·59	Hansteen,	1·3579	1·3586	− 7
1832·57	Hansteen,	− 10′·75	− 12′·97	− 2′·22	1838·47	Boeck,	1·3707	1·3702	+ 5
1838·51	Meyer,	73° 57′·31	73° 56′·18	+ 1′·13	1860·59	Hansteen,	1·3992	1·3992	0
1860·61	Hansteen,	− 25′·50	− 25′·65	− 0′·15					

$$i = 74° 21′·362 - 3′·4005\ (t - 1830) + 0′·051509\ (t - 1830)^2.$$
$$H = 1·3410 + 24·925\ (t - 1825·0) - 0·24116\ (t - 1825·0)^2.$$

These formulæ give the following values for the yearly decrease of dip and intensity:—

t.	Δ i.	Δ H.
1825	− 3′·915	+ 24·9
1830	− 3·400	+ 22·5
1835	− 2·885	+ 20·1
1840	− 2·370	+ 17·7
1845	− 1·855	+ 15·3
1850	− 1·340	+ 12·9
1855	− 0·825	+ 10·5
1860	− 0·310	+ 8·0

"The minimum of dip = 73° 25′·38, and corresponds to the epoch t = 1862·97. The maximum of intensity = 1·4054, corresponding to the year 1876–7. The total and vertical intensity can be calculated from the computed results, or from the observed quantities."

Dr. Lloyd observed that there could be no doubt of the excellence of the observations recorded in the foregoing communication: they afforded abundant proof, both of the perfection of the instruments employed by Professor Hansteen, and of his skill in using them. But the fact that the diurnal variation of the inclination has not been observed with the English dip circles could not, he thought, be fairly adduced in proof of their inferiority to the French instruments; inasmuch as this element is obtained by us more completely by other instrumental means. By means of the balance magnetometer (combined with the bifilar magnetometer) not only the range, but the *whole course* of the diurnal variation of the inclination, has been completely determined at Dublin; and the same thing is true of other places at which both these instruments have been employed. In fact, it is in this circumstance that the advantage of the British observatories over those of the Continent mainly consists, the daily observations of the latter being limited to two of the three magnetic elements.

Dr. Lloyd believed that it was unnecessary for him to enter further into the question of the accuracy attainable by the dip circles of the form now used by English observers, as the subject would be fully discussed by Mr. Stoney in a paper to be read by him to the Academy that evening. He would merely observe that Professor Hansteen seemed to be under a misconception in supposing that it was necessary, with these instruments, to observe the needle *at rest*. By the help of a small divided scale in the focus of each of the microscopes, the wires may be either *placed* in the position of equilibrium, while the needle itself is in motion, or (the microscopes being fixed) the deviation of the wires from that position may be observed, and added, with its proper sign, to the readings of the verniers. This simple addition had, in fact been made in the original instrument of this construction, which was made by Mr. Barrow for Dr. Lloyd, and according to his specifications.

Mr. G. J. Stoney read a paper—

ON THE DEGREE OF ACCORDANCE WHICH MAY BE ATTAINED IN OBSERVATIONS MADE WITH DR. LLOYD'S DIP CIRCLES.

In fixed magnetic observatories the instruments may be mounted with every appliance, however cumbersome, which contributes to accuracy; but when we mean to carry an instrument from station to station, making observations with it at each, the necessity that it be of moderate size, and not easily injured or thrown out of adjustment, debars us from many arrangements which we might otherwise make. Yet with such travelling instruments very considerable degrees of accordance have been attained, and, as I think, much more accuracy is within our reach, by attention to a small mechanical detail.

In the most sensitive of the travelling dip circles for use on shore, the needle rests by a thin and most carefully constructed transverse axis on two smooth horizontal pieces of agate, upon which the axis rolls without rubbing as the needle oscillates before coming to rest. A wonderful degree of delicate mechanical accuracy has been attained in the construction of this minute cylindrical axes, an accuracy which would

even have gone beyond the requirements of the instrument, had not Dr. Lloyd removed a source of magnetic derangement, by which all the earlier observations were disturbed.

This disturbance arose from the graduated circle of the instrument, which used formerly to be brought as close to the needle as possible. Dr. Lloyd was led, from an analysis of the observations he made in the magnetic survey of 1838, closely to test this circle; and he found that, though made of materials which were supposed to be non-magnetic, it exhibited a trace of magnetism which injuriously affected the needle. He accordingly removed the circle to a sufficient distance from the needle, and ascertained the position of the needle by two microscopes carried by an arm which traverses the circle, and thus at once got rid of the magnetic disturbance, introduced greater accuracy into the reading of the position of the needle, and secured other important advantages, into which we need not now enter.

This has again made the *mechanical* arrangements of the instrument the more defective; and I propose now to give some account of the degree of accordance which may be expected with the dip circle with which a magnetic survey of the southern half of Ireland was made in 1858, and of a slight modification of the apparatus for placing the axis of the needle on the agate planes, which would, I believe, render it possible to secure a higher degree of accordance.

In determining the magnetic dips at any station, the axis of the needle is placed in eight distinct positions upon the upper horizontal edges of parallel agate plates, on which it can roll freely, and the position of each end of the needle observed about three times in each of the eight positions.

Between each pair of readings the needle is lifted and replaced by a little frame, designed to lay the needle down with suitable precision on the edges of the agate plates. Each time that the magnet is replaced by this frame, it swings about for a short time, and the position it assumes when these oscillations are over is recorded.

The axis of the magnet is thick in the centre, where it passes through the magnet. The ends, where it is to rest on the agate plates, are most carefully turned down to a needle-like thinness; and on either side, between the thick and the thin parts, there are short pieces of intermediate thickness, which are to be placed in Ys, with which the lifting frame is fitted. The endlong adjustment of the axis is effected by the same Ys, since the thick part of the axis falls between them, resting against the sloped inner sides of the Ys by its cone-shaped ends. This little frame thus discharges distinct offices; it brings the proper parts of the axis of the needle down upon the agate plates, it places them upon the right parts of the edges of the agate plates, and it sets the magnet swinging between each pair of readings, since the frame turns on pivots at one end, and thus imparts a motion of rotation to the magnet in depositing it. When the glass case of the instrument is shut, the observer can raise and lower the magnet from without by this lifting frame.

This piece of apparatus needs to be manipulated with care. If the needle be lowered too rapidly, it comes down with a sensible impact

against the hard agate plates, and hops upon them, thus altogether deranging the adjustments which the frame was designed to secure. If, on the other hand, it be lowered too slowly, there are two sources of mischief. The two ends of the axis do not reach the agates at strictly the same instant; and in the intervening moment one end of the axis is still resting in its Y, while the other is rolling on the agate plate, and disturbing the adjustment. But the chief source of error seems to arise from the axis receiving a slight brush from the Ys in parting from them. This arises in a variety of ways, and can be reduced to its minimum only after some practice. There are some positions of the needle in which, upon some days, the effects of this friction can, by careful manipulation, be reduced to an insensible amount;* but there are other positions of the needle in which I found it impracticable, by any care or patience, to evade it; and the slight alteration of the proportions of the parts, due to the differences of temperature from one day to another, is enough to make it sometimes very troublesome in almost all positions of the needle. These remarks will help to show that which I am anxious to insist on, that this part of the instrument deserves all the care the maker can bestow on it.

As an illustration, I will transcribe two complete observations taken at the same station on consecutive days,—the first of which happened to be more than usually free from this source of error, and in the second of which it was particularly troublesome.

Parsonstown (Lord Rosse's Demesne); August 24, 1858; *from* $2\frac{3}{4}$ *to* $3\frac{1}{2}$ *P.M.*

Poles Direct. A. North End.		Poles Reversed. B. North End.	
E.	Limb. W.	W.	Limb. E.
70° 24′	109° 60′	109° 44′	70° 4′
23	59	44	5
24	60	44	5
31	60	51	18
30	60	51	18
30	60	52	17
69° 43′	109° 32′	109° 58′	70° 16′
43	32	59	15
43	31	59	14
53	36	59	21
53	36	59	20
53	35	58	20

Mean of Means or Dip = 70° − 10′·44.
Dip corrected for daily range, 70 − 11 · 4.

* I. e. insensible in an instrument reading only to minutes.

Same Station, August 25, 1858; *from* $9^h\ 40^m$ *A. M., to* $10\frac{1}{2}$.

Poles Direct. B. North End.			Poles Reversed. A. North End.		
E.	Limb.	W.	W.	Limb.	E.
70° 6′		109° 43′	109° 57′		70° 28′
6		44	57		30
8		43	58		30
17		48	56		33
18		49	57		36
19		49	57		36
70° 20′		109° 59′	109° 27′		69° 40′
18		58	28		40
20		58	25		40
23		57	31		51
21		57	31		51
24		57	29		52

Mean of Means or Dip = 70° 12′·75
Dip corrected for daily range, 70 10′· 4

In the sixteen sets of readings which make up the observation of the 24th August, that least embarrassed by the injurious action of the Ys, there is but one case in which this discordance amounts to 2′, while there are four cases of complete accordance. In the eleven others, a difference of one minute of arc occurred. On the other hand, in the observation of the 25th August, but two cases of complete accordance will be found, while the difference three times rises to 3′, and in five other cases it is 2′.

The injurious effect of the hitching produced by the Ys is equally apparent, if, instead of scrutinizing the individual observations, we combine parts of different observations, so as to bring out numbers which ought to be identical in sets. I have done this in various ways with the series of observations made in the survey of the southern half of Ireland in 1858, and found in several instances, instead of identical numbers, differences of one or two minutes, and occasionally, though rarely, of three minutes. These differences are doubtless in part due to magnetical causes; but they clearly point to a mechanical origin also, since they lean in a marked manner towards those positions of the needle in which the hitching of the Ys was most troublesome.

If anything else be necessary to show how much dip observations are effected by a careless design or construction of the lifting apparatus, it will be found in the astonishing, and to me quite unexpected, accuracy with which the needle will roll back to its position when in any fair

way displaced from it. This was tested by fastening a small plane mirror to the side of the needle with white lead, and counterpoising it with a little lump of bees' wax, so that when the needle was placed on its agate plates, the reflected image of one of Gauss's scales could be observed by a telescope. The scale was so placed that a millimetre on it corresponded to a minute of arc, and thus 10ths of a minute could be easily read by estimation. These dispositions were made in the small observatory of Trinity College for absolute determinations, in which tremors were wholly avoided, and it was possible to keep the instrument undisturbed for several days. From the observations made there, it appeared that, with a needle rolling on plates of agate, we can follow the daily range with great precision, and observe occasional disturbances, of which many were seen from one to six or eight tenths of a minute; and that when the needle is artificially swung by the attraction of a key through ranges varying from three minutes to four degrees, it returns to its position certainly within the tenth of a minute, and probably within a very small fraction of the tenth of a minute.

Hence it is plain, that if we can bring the apparatus for laying down and removing the needle to a state of mechanical perfection corresponding with that of the axis, we shall be able to use dip needles rolling on agate plates for many purposes for which they have hitherto been supposed not capable of affording determinations of the required degree of accuracy, but for which they are otherwise eminently suited.

It appears essential that the endlong adjustment should be given to the axis by a part of the apparatus distinct from the Ys. Perhaps it could be successfully made by a little edge of agate mounted so as to rise into a carefully turned V-shaped groove in the thick part of the axis. It also appears to me that the Ys should be brought to bear on the carefully turned cylindrical ends of the axis, and mounted so that they could be easily adjusted to let down the two ends of the axis strictly at the same moment; and that each Y should be formed of two plates of agate, worked to a rounded edge, and placed at an angle as obtuse as is consistent with insuring that the axis drop always to the bottom of the Y. This would very much assist the Ys to disengage themselves completely and abruptly from the axis as soon as it comes in contact with the edges on which it is to roll. I should also prefer that the frame carrying the Ys should rise vertically, and not turn on a pivot, which communicates mechanically, and always in the same direction, a rotation to the magnet in placing it on the agate plates. A swing, to be communicated afterwards by magnetic influence from without, would seem to be much better. Of course, attention should be given to the parts by which this vertical motion is to be given, to make it smooth and without shake.

With attention to these details, some of which I have tested with very promising results, it seems likely that a dip circle might be made which should allow the needle to be removed from the instrument, and replaced, without risk of any error exceeding a few seconds.

Fifteen drawings of Irish antiquities, or of things in different museums considered illustrative of ancient weapons found in Ireland, were presented by Mr. G. V. Du Noyer, as an addition to the collection of similar drawings already deposited by that gentleman in the Academy.

Two MS. volumes of a Journal kept in Dublin from 1801–4, and the Journal of a Tour in Ireland, &c., in 1804, in three volumes, were presented to the Library by Mr. James Tighe.

Thanks were returned to the donors.

The Academy then adjourned.

MONDAY, JUNE 24, 1861.

The Very Rev. Dean Graves, D. D., President, in the Chair.

The Rev. J. H. Todd, D. D., read a paper on some additional leaves of the Book of Lismore, recently recovered by his Grace the Duke of Devonshire, and exhibited the MS., in its collective form.

It was Resolved,—That the special thanks of the Academy be returned to his Grace the Duke of Devonshire for the opportunity afforded to its members of becoming acquainted with the contents of the Book of Lismore, through the Rev. Dr. Todd's description, and of personally inspecting this very curious and valuable manuscript.

Sir W. R. Hamilton, LL. D., read a paper—

ON GEOMETRICAL NETS IN SPACE.

[1.] When any five points of space, ABCDE, are given, whereof no four are supposed to be complanar, we can connect any two of them by a right line, and the three others by a plane, and determine the point in which these last intersect each other: *deriving* thus a system of *ten lines* Λ_1, *ten planes* Π_1, and *ten points* P_1, from the *given* system of *five points* P_0, by what may be called a *First Construction.*

We may next propose to determine all the new and distinct lines Λ_2, and planes Π_2, which connect the ten derived points P_1, with the five given points P_0, and with each other; and may then inquire what new and distinct points P_2 arise, as intersections* $\Lambda \cdot \Pi$ of lines and planes already obtained: all *such* new lines, planes, and points being said to belong to a *Second Construction.* And then we might proceed, on the same plan, to a *Third* Construction, and to indefinitely many others following: building up thus what Professor *Möbius*, in his *Barycentric Calculus*,† has proposed to call a *Geometrical Net in Space.*

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* Intersections $\Lambda \cdot \Lambda$ of *line with line* (when complanar) are *included* in this class $\Lambda \cdot \Pi$; and intersections $\Pi \cdot \Pi \cdot \Pi$ of *three distinct planes*, when *not* included at this stage, may be reserved for a *subsequent construction*, in which they naturally offer themselves, as of the standard form $\Lambda \cdot \Pi$.

† Der Calcul Barycentrische, Leipzig, 1827, p. 291. Some first results connected with the subject were given, according to the writer's recollection, in a Memoir by *Carnot* on *Transversals*, to which he cannot at present refer.

[2.] In general, if n denote five or any greater number of *independent* points of space, the number of the derived points of the *form* $\Lambda \cdot \Pi$, or AB·CDE, which can be obtained by what is relatively to *them* a First Construction, of the kind just now described, is easily seen to be the function,

$$f(n) = \frac{n(n-1)}{2} \cdot \frac{(n-2)(n-3)(n-4)}{2.3};$$

so that $f(5) = 10$, as above, but $f(15) = 30030$. If then the *fifteen points* P_0, P_1 were thus *independent*, or *unconnected* with each other, we might expect to find that the number of points P_2 *derived* from them, at the next stage, should *exceed thirty thousand*. And although it was obvious that many *reductions* of this number must occur, on account of the *dependence* of the ten points P_1 on the five points P_0, yet when I happened to feel a curiosity, some time ago, to determine the precise *number* of those which have been above called *Points of Second Construction*, and to assign their chief geometrical relations to each other, and to the fifteen former points, it must be confessed that I thought myself about to undertake the solution of a rather formidable Problem. But the motive which had led me to attack that problem, namely the desire to try the efficiency of a certain system of *Quinary Symbols*, for points, lines, and planes in space, which the *Method of Vectors* had led me to invent, inspired me with a hope, which I trust that the result of the attempt has not altogether failed to justify. And, in the present communication, I wish first to present some outline of what may be called perhaps a *Quinary Calculus*, before proceeding to give, in the second place, some sketch of the results of its application to the geometrical *Net in Space*.

PART I.—*On a Quinary Calculus for Space.*

[3.] Let ABCDE be (as in [1.]) any five given points of space, whereof no four are situated in any common plane; then, by decomposing ED in the directions of EA, EB, EC, we can always obtain an equation of the form,

$$a \cdot \mathrm{EA} + b \cdot \mathrm{EB} + c \cdot \mathrm{EC} + d \cdot \mathrm{ED} = 0, \tag{1}$$

in which the coefficients *abcd* have determined ratios. And if we next introduce a fifth coefficient e, such that

$$a + b + c + d + e = 0, \tag{2}$$

and add to (1) the identity

$$(a + b + c + d + e)\,\mathrm{OE} = 0, \tag{3}$$

in which o is any arbitrary point (or origin of vectors), we arrive at the following equivalent but more symmetric form,

$$a \cdot \mathrm{OA} + b \cdot \mathrm{OB} + c \cdot \mathrm{OC} + d \cdot \mathrm{OD} + e \cdot \mathrm{OE} = 0, \tag{4}$$

in which *abcde* may be called the *five* (*numerical*) *constants* of the given

system of *five points*, A . . E, although only their *ratios* are important, and (as above) their *sum* is *zero*.

[4.] Let P be any other point of space, and let $xyzwv$ be coefficients satisfying the equation,

$$(x - v)\, a \,.\, \text{PA} + (y - v)\, b \,.\, \text{PB} + (z - v)\, c \,.\, \text{PC} + (w - v)\, d \,.\, \text{PD} = 0\,; \quad (5)$$

then, adding the identity,

$$v\,(a \,.\, \text{PA} + b \,.\, \text{PB} + c \,.\, \text{PC} + d \,.\, \text{PD} + e \,.\, \text{PE}) = 0, \quad (6)$$

which results from (4), we obtain this other symmetric formula,

$$xa \,.\, \text{PA} + yb \,.\, \text{PB} + zc \,.\, \text{PC} + wd \,.\, \text{PD} + ve \,.\, \text{PE} = 0, \quad (7)$$

which may also be thus written,

$$\text{OP} = \frac{xa \,.\, \text{OA} + yb \,.\, \text{OB} + zc \,.\, \text{OC} + wd \,.\, \text{OD} + ve \,.\, \text{OE}}{xa \quad + yb \quad + zc \quad + wd \quad + ve}, \quad (8)$$

o being again an arbitrary origin; and the *five new and variable coefficients*, $xyzwv$, whereof the *ratios of the differences* determine the *position of the point* P, when the five points A . . E are given, may be called the *Quinary Coordinates of that Point* P, with respect to the given system of five points.

[5.] Under these conditions, we may agree to write, briefly,

$$\text{P} = (x, y, z, w, v), \text{ or even } \text{P} = (xyzwv), \quad (9)$$

whenever it seems that the omission of the commas will not give rise to any confusion; and may call this form a *Quinary Symbol of the Point* P. But because (as above) only the ratios of the differences of the coefficients or coordinates are important, we may establish the following *Formula of Quinary Congruence*, between two *equivalent Symbols* of one *common point*,

$$(x'\, y'\, z'\, w'\, v') \equiv (xyzwv), \quad (10)$$

$$\text{if } x' - v' : y' - v' : z' - v' : w' - v' = x - v : y - v : z - v : w - v\,; \quad (11)$$

reserving the *Quinary Equation*,

$$(x'\, y'\, z'\, w'\, v') = (xyzwv), \quad (12)$$

to imply the coexistence of the *five* separate and ordinary equations,

$$x' = x,\ y' = y,\ z' = z,\ w' = w,\ v' = v. \quad (13)$$

We shall also adopt, as abridgments of notation, the formulæ,

$$t\,(x, y, z, w, v) = (tx, ty, tz, tw, tv); \quad (14)$$

$$(x' \,..\, v') \pm (x \,..\, v) = (x' \pm x, \,..\, v' \pm v); \quad (15)$$

and shall find it convenient to employ occasionally what may be called the *Quinary Unit Symbol*,

$$v = (11111)\,; \quad (16)$$

although *this* symbol represents *no determined point*, because both the denominator and numerator of the expression (8) vanish, by (2) and (4), when the five coefficients *xyzwv* become each equal to unity.

[6.] With these notations, if Q and Q' be any *other* quinary symbols, and t and u any two coefficients, we shall have the congruence,

$$Q' \equiv Q\,, \quad \text{if} \quad Q' = tQ + uU\,; \tag{17}$$

the *two points* P and P′, which are denoted by these *two symbols*, in this case *coinciding*. Again the equation,

$$Q'' = tQ + t'Q' + uU, \tag{18}$$

is found to express that Q, Q', Q'' are symbols of *three collinear points*; and the *complanarity of four points*, of which the symbols are Q, Q', Q'', Q''', is expressed by this other equation of the same form,

$$Q''' = tQ + t'Q' + t''Q'' + uU. \tag{19}$$

[7.] If then a *variable point* P be thus *complanar* with *three given points*, P_0, P_1, P_2, its coordinates [4.] must be connected with theirs, by five equations of the form,

$$x = t_0x_0 + t_1x_1 + t_2x_2 + u\,; \;\ldots\; v = t_0v_0 + t_1v_1 + t_2v_2 + u\,; \tag{20}$$

whence, by elimination of the four arbitrary coefficients $t_0t_1t_2u$, a *linear equation* is obtained, of the form

$$lx + my + nz + rw + sv = 0, \tag{21}$$

with the general relation

$$l + m + n + r + s = 0 \tag{22}$$

between its coefficients; and this equation (21) may be said to be the *Quinary Equation of the Plane* $P_0P_1P_2$. The five new coefficients *lmnrs* may be called the *Quinary Coordinates of that Plane;* and the plane itself may be denoted by the *Quinary Symbol*,

$$\Pi = [l, m, n, r, s], \text{ or briefly, } \Pi = [lmnrs], \tag{23}$$

when the commas can be omitted without confusion.

If R, R', . . be symbols of this form, for planes Π, Π', . . , then the equation

$$R' = tR, \tag{24}$$

in which t is an arbitrary coefficient, expresses that the *two planes* Π, Π' *coincide;* the equation

$$R'' = tR + t'R' \tag{25}$$

expresses that the *three planes* Π, Π', Π'' are *collinear*, or that the *third* passes *through the line of intersection* of the *other two;* and the equation

$$R''' = tR + t'R' + t''R'' \tag{26}$$

expresses that the *four planes* Π, Π', Π'', Π''' are *compunctual* (or *concur-*

rent), or that the *fourth* passes *through the point of intersection* of the *other three*.

[8.] It is easy to conceive how problems respecting *intersections of lines and planes* can be resolved, on the foregoing principles. And if we define that a point P, or plane Π, is a *Rational Point*, or a *Rational Plane*, of the *System* determined by the *five given Points* A . . E, or that it is *rationally related* to those five points, when its *coordinates* are equal (or proportional) to *whole numbers*, it is obvious, from the nature of the *eliminations* employed, that a *plane* which is determined as containing *three rational points*, or a *point* which is determined as the intersection of *three rational planes*, is itself, in the above sense, *rational*. We may also say that a *right line* Λ is a *Rational Line*, when it is the line P . P which *connects* two rational points, or the *intersection* Π . Π of two rational planes: and then the intersection of a rational line with a rational plane, or of two complanar and rational lines with each other, will be a rational point.

[9.] When any two points, P, P′, or any two planes, Π, Π′, have symbols which differ only by the *arrangement* (or *order*) of the five coefficients or coordinates in each, those points, or those planes, may then be said to have one *common type*; or briefly, to be *syntypical*. For example, the five *given* points are thus syntypical, because (omitting commas, as in [5.]) their symbols are,

$$A = (10000),\ B = (01000),\ C = (00100),\ D = (00010),\ E = (00001). \quad (27)$$

In general, any two syntypical points, or planes, admit of being *derived* from the five given points, by precisely *similar processes of construction*, the *order* only of the *data* being *varied*; and in the *most general* case, a *single type* includes 120 *distinct points*, or *distinct planes*, although this *number* may happen to be diminished, even when the coordinates are all unequal: for example, the type (12345) includes only *sixty* distinct points, because, by (17), we have in this case the congruence,

$$(12345) \equiv (54321). \quad (28)$$

[10.] The *anharmonic function* of any group of four collinear points ABCD being denoted by the symbol (ABCD), and defined by the equation,

$$(ABCD) = \frac{AB}{BC} \cdot \frac{CD}{DA} = \frac{AB}{CB} : \frac{AD}{CD}, \quad (29)$$

it will be found that if $P_0 \ldots P_3$ be thus *any four collinear points*, of which therefore, by (18), the quinary symbols $Q_0 \ldots Q_3$ are connected by two linear relations, of the forms,

$$Q_1 = t_0 Q_0 + t_2 Q_2 + uU,\ Q_3 = t'_0 Q_0 + t'_2 Q_2 + u'U, \quad (30)$$

then the *anharmonic of this group of points* is given by the formula,

$$(P_0 P_1 P_2 P_3) = \frac{t_2 t'_0}{t_0 t'_2}, \quad (31)$$

of which the applications are numerous and important.

And in like manner, if $\Pi_0 \ldots \Pi_3$ be *any four collinear planes*, of which consequently, by (25), the symbols $R_0 \ldots R_3$ are connected by two other linear relations, such as

$$R_1 = t_0 R_0 + t_2 R_2, \quad R_3 = t'_0 R_0 + t'_2 R_2, \tag{32}$$

we have then this other very useful formula of the same kind, for the *anharmonic of this pencil of planes*,

$$(\Pi_0 \Pi_1 \Pi_2 \Pi_3) = \frac{t_2 t'_0}{t_0 t'_2}; \tag{33}$$

it being understood that the anharmonic function of such a *pencil* is the same as that of the *group* of *points*, in which its *planes* are *cut* by any rectilinear *transversal*: so that we may write generally, for *any six points* A . . F, the formula,

$$(\text{EF} \,.\, \text{ABCD}) = (\text{A}'\text{B}'\text{C}'\text{D}'), \tag{34}$$

if any transversal GH cut the four planes EFA, . . EFD in the four points A′, . . D′; or in symbols, if

$$\text{A}' = \text{GH} \cdot \text{EFA}, \ldots \text{D}' = \text{GH} \cdot \text{EFD}. \tag{35}$$

[11.] The expression of fractional form,

$$\varphi(xyzwv) = \frac{l'x + m'y + n'z + r'w + s'v}{lx + my + nz + rw + sv} = \frac{f'}{f}, \tag{36}$$

in which the ten coefficients, $l \ldots s$ and $l' \ldots s'$, are supposed to be given, and to be such (comp. (22)) that

$$l + \ldots + s = 0, \text{ and } l' + \ldots + s' = 0, \tag{37}$$

may represent the quotient of any two linear and homogeneous functions, f and f', of the coordinates $x \ldots v$ of a variable point P, or rather of the *differences* of those coordinates (comp. [5.]); and if we assign any *particular* or *constant value*, such as k, to this *quotient*, or *fractional function*, φ, the equation so obtained will represent (comp. (21)) a *plane locus* for that point, which *plane* Π will always pass *through a given line* Λ, determined by equating separately the denominator and numerator of φ to zero. Hence the *four equations*,

$$f = 0, \quad f' = f, \quad f' = 0, \quad f' = kf, \tag{38}$$

which answer to the four values,

$$\varphi = \infty, \quad \varphi = 1, \quad \varphi = 0, \quad \varphi = k, \tag{39}$$

represent a *pencil of four planes* $\Pi_0 \ldots \Pi_3$, of which the quinary symbols (23) may be thus written:—

$$R_0 = [lmnrs]; \; R_2 = [l'm'n'r's']; \; R_1 = R_2 - R_0; \; R_3 = R_2 - kR_0; \tag{40}$$

and of which the *anharmonic* is consequently, by (33), the same *quotient*,

$$(\Pi_0 \Pi_1 \Pi_2 \Pi_3) = (k = \varphi =) \frac{f'}{f}, \tag{41}$$

as before. We have therefore this *Theorem*:—

"The Quotient of any two given homogeneous and linear Functions, of the Differences of the Quinary Coordinates of a variable Point in Space, can always be expressed as the Anharmonic of a Pencil of Planes, whereof three are given, while the fourth passes through the variable Point, and through a given Right Line, which is common to the three former Planes."

[12.] For example, we find thus that

$$\frac{x-v}{w-v} = (\text{BC . AEDF}); \quad \frac{y-v}{w-v} = (\text{CA . BEDF}); \quad \frac{z-v}{w-v} = (\text{AB . CEDF}); \qquad (42)$$

and that

$$\frac{x-v}{y-v} = (\text{CD . AEBF}); \quad \frac{y-v}{z-v} = (\text{AD . BECF}); \quad \frac{z-v}{x-v} = (\text{BD . CEAF}); \qquad (43)$$

the product of these three last anharmonics of pencils being therefore equal to positive unity, so that we have, for *any six points of space*, ABCDEF, the general equation,

$$(\text{AD . BECF}) \cdot (\text{BD . CEAF}) \cdot (\text{CD . AEBF}) = 1. \qquad (44)$$

If then we *suppress the fifth coefficient, v, in the quinary symbol* (9) *of a point* P, which comes to first substituting, as the congruence (10) permits, the differences $x-v$, $y-v$, $z-v$, $w-v$, and $v-v$ or 0, for x, y, z, w, and v, and then writing simply $x, \ldots w$ instead of $x-v, \ldots w-v$, and omitting the final zero, whereby the quinary symbol (00001) for the fifth given point E (27) becomes first $(-1, -1, -1, -1, 0)$, or (11110), and is then reduced to the *quaternary unit symbol* (1111), we shall *fall back on that system of anharmonic coordinates in space*, of which some account was given in a former communication* to this Academy: the *anharmonic* (or *quaternary*) *symbol of a plane* Π being, in like manner, *derived from the quinary symbol* (23), by simply *suppressing the fifth coefficient*, or coordinate, *s*. *Anharmonic coordinates*, whether for *point* or for *plane*, are therefore *included in quinary ones*; but although they have some advantages of *simplicity*, it appears that their *less perfect symmetry*, of reference to the *five given points* A . . E, renders them less adapted to investigations respecting the *Geometrical Net in Space*, which is constructed with those *five* points as data: and that therefore they are less fit than *quinary* coordinates for the purposes of the present paper.

[13.] Retaining then the *quinary form*, we may next observe that although, *when the five coefficients l . . s are given*, as in [7.], and the *coordinates x . . v* of a *point* P are *variable*, the *linear equation* $lx + \ldots + sv = 0$ (21) may be said to be the *Local Equation of a Plane*, namely of the *plane* $[l \ldots s]$, considered as the *locus of the point* $(x \ldots v)$; yet if, on the contrary, we *now* regard $x \ldots v$ as *given*, and $l \ldots s$ as *variable*, the *same linear*

* See the Proceedings for the Session of 1859–60.

equation (21) expresses the *condition* necessary, in order that a *variable plane* $[l \ldots s]$ may pass *through a given point* $(x \ldots v)$; and *in this view*, the formula (21) may be considered to be the *Tangential Equation of that given Point*. Thus the very simple equation,

$$l = 0, \tag{45}$$

expresses the condition requisite for the plane $[l \ldots s]$ passing through the given point (10000), or A (27); and it is, in that sense, the tangential *equation of that point*: while $m = 0$ is, in like manner, the equation of B, &c. This being understood, if we suppose that F and F′ denote two given, linear, and homogeneous functions of the coordinates $l \ldots s$ of a variable plane Π, we may consider the four equations,

$$F = 0, \quad F' = F, \quad F' = 0, \quad F' = kF, \tag{46}$$

as the tangential equations of *four collinear points*, P_0, P_1, P_2, P_3, whereof the three first are entirely given, but the fourth varies with the value of the coefficient k, although always remaining on the line A of the other three; and then it is easy to deduce, from the formula (31), by reasonings analogous to those employed in [11.], the following *anharmonic of the group*:

$$(P_0 P_1 P_2 P_3) = k = \frac{F_1}{F}. \tag{47}$$

We have therefore this new *Theorem*, analogous to one lately stated: —

"*The Quotient of any two given, homogeneous, and linear Functions, of the Quinary Coordinates of a variable Plane, may always be expressed as the Anharmonic of a Group of Points; whereof three are given and collinear, while the fourth is the Intersection of the variable Plane with the given Line on which the other three are situated.*"

[14.] For example, if we wish in this way to *interpret the quotient* $m : n$, of these two coordinates of a *variable plane* Π, or $[lmnrs]$ (23), as denoting the *anharmonic of a group of points*, the three first points P_0, P_1, P_2 of that group (47) have here for their tangential equations,

$$n = 0, \quad m - n = 0, \quad m = 0, \tag{48}$$

whereof the *third* has recently been seen [13.] to represent the given point B, and the *first* represents in like manner another given point, namely C, of the initial system: while the *second* represents the point (0, 1, − 1, 0, 0), or briefly $(01\bar{1}00)$, if, to save commas, we write $\bar{1}$ for − 1. To *construct* this last point, let us write

$$A' = (01100) \equiv (10011), \text{ and } A'' = (01\bar{1}00); \tag{49}$$

then, by (18), these two new points A′ and A″ are each *collinear* with B, C, or are on the *line* BC; and they are, with respect to that line (or to its extreme points) *harmonically conjugate* to each other, because the formula (31) gives easily, by the *first* symbol for A′, the *harmonic equation*,

$$(BA'\,CA'') = -1; \tag{50}$$

but also the *second* (or congruent) symbol for A′ shows, by (19), that A′ is in the *plane* ADE; we may therefore write the *formula of intersection*,

$$A' = BC \cdot ADE, \tag{51}$$

whereby this point A′ is entirely determined; and then the point A″, as being its harmonic conjugate with respect to B and C, or as satisfying the equation (50), is to be considered as being itself a known point. We have thus assigned the three first points P_0, P_1, P_2, of the *group* (47), namely the points C, A″, B; and if we denote by L the point BC · Π in which the variable plane Π, or $[l \,..\, s]$, intersects the given line BC, so that

$$L = (0, n, -m, 0, 0), \text{ or briefly, } L = (0\, n\, \bar{m}\, 0\, 0), \tag{52}$$

writing $\bar{m}$ for $-m$, then the fourth point P_3 is L; and the required *formula of interpretation* for the quotient $m : n$ becomes,

$$\frac{m}{n} = (CA''BL). \tag{53}$$

In like manner, if we write

$$B' = (10100),\ C' = (11000),\ B'' = (\bar{1}0100),\ C'' = (1\bar{1}000), \tag{54}$$

and

$$M = (\bar{n}0l00),\ N = (m\bar{l}000), \tag{55}$$

in which $\bar{n} = -n$, and $\bar{l} = -l$, so that M = CA · Π, N = AB · Π, and

$$B' = CA \cdot BDE,\ C' = AB \cdot CDE,\ (CB'AB'') = (AC'BC'') = -1, \tag{56}$$

we shall have these two other formulæ of interpretation, analogous to (53),

$$\frac{n}{\bar{l}} = (AB''CM),\ \frac{l}{m} = (BC''AN); \tag{57}$$

and therefore,

$$(AB''CM) \,.\, (BC''AN) \,.\, (CA''BL) = 1. \tag{58}$$

[15.] Again, if we denote by Q, R, S the intersections DA · Π, DB · Π, DC · Π, so that

$$Q = (\bar{r}00l0),\ R = (0\bar{r}0m0),\ S = (00\bar{r}n0), \tag{59}$$

where $\bar{r} = -r$; if also we introduce seven new points syntypical [9.] with the three points A′B′C′, and seven others syntypical with A″B″C″, as follows:

$$A_1 = (10001),\ B_1 = (01001),\ C_1 = (00101),\ D_1 = (00011); \tag{60}$$

$$A_2 = (10010),\ B_2 = (01010),\ C_2 = (00110); \tag{61}$$

$$A'_1 = (1000\bar{1}),\ B'_1 = (0100\bar{1}),\ C'_1 = (0010\bar{1}),\ D'_1 = (0001\bar{1}); \tag{62}$$

$$A'_2 = (100\bar{1}0),\ B'_2 = (010\bar{1}0),\ C'_2 = (001\bar{1}0); \tag{63}$$

so that, by principles already established, we shall have the seven relations of intersection,

$$A_1 = EA \cdot BCD,\ B_1 = EB \cdot CAD,\ C_1 = EC \cdot ABD,\ D_1 = ED \cdot ABC, \tag{64}$$

$$A_2 = DA \cdot BCE,\ B_2 = DB \cdot CAE,\ C_2 = DC \cdot ABE, \tag{65}$$

and the seven harmonic relations,

$$(EA_1AA'_1) = (EB_1BB'_1) = (EC_1CC'_1) = (ED_1DD'_1) = -1, \tag{66}$$

$$(DA_2AA'_2) = (DB_2BB'_2) = (DC_2CC'_2) = -1, \tag{67}$$

by means of which 14 last relations these 14 new points can all be geometrically constructed; we shall then be able to interpret, on the recent plan [13.], the three new quotients, $l : r$, $m : r$, $n : r$, as anharmonics of groups, as follows:

$$\frac{l}{r} = (DA'_2AQ);\ \frac{m}{r} = (DB'_2BR);\ \frac{n}{r} = (DC'_2CS); \tag{68}$$

with the analogous interpretations,

$$\frac{l}{s} = (EA'_1AX);\ \frac{m}{s} = (EB'_1BY);\ \frac{n}{s} = (EC'_1CZ);\ \frac{r}{s} = (ED'_1DW), \tag{69}$$

if X, Y, Z, W denote the intersections $EA \cdot \Pi$, $EB \cdot \Pi$, $EC \cdot \Pi$, $ED \cdot \Pi$, so that

$$X = (\bar{s}000l),\ Y = (0\bar{s}00m),\ Z = (00\bar{s}0n),\ W = (000\bar{s}r), \text{ where } \bar{s} = -s. \tag{70}$$

[16.] As regards the *notations* employed, it may be observed that although we have often, as in (9) or (27), &c., *equated a point*, or rather its *literal symbol*, A or P, &c., to the *corresponding quinary symbol* (10000) or $(xyzwv)$, &c., of that point, yet in some formulæ, such as (17) (18) (19), in which we had occasion to treat of *linear combinations* of such quinary symbols, we substituted *new letters*, such as Q, Q', for P, P', &c., in order to avoid the apparent strangeness of writing such expressions* as $tP + t'P'$, &c. To *economise symbols*, however, we may agree to *retain the literal symbols first used*, for any system of given or derived points, but to *enclose them in parentheses*, when we wish to employ them as *denoting quinary symbols in combination with each other;* writing, at the same time, for the sake of uniformity, (U) instead of v, as the *quinary unit symbol* (16). And thus, if we agree also that an *equation* between *two unenclosed* and *literal symbols of points*, P and P', shall be understood as expressing that the two points so denoted *coincide*, we may write anew those formulæ (17) (18) (19) as follows:

$$P' = P, \text{ if } (P') = t(P) + u(U); \tag{71}$$

$$P'' \textit{ on line } PP', \text{ if } (P'') = t(P) + t'(P') + u(U); \tag{72}$$

$$P''' \textit{ in plane } PP'P'', \text{ if } (P''') = t(P) + t'(P') + t''(P'') + u(U). \tag{73}$$

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* Expressions of this *form* occur continually in the *Barycentric Calculus* of *Mœbius*, but with significations entirely different from those here proposed.

[17.] We may also occasionally denote a point *in the given plane* of A, B, C by the *ternary symbol*,

$$(x, y, z), \quad \text{or} \quad (xyz), \tag{74}$$

considered here as an *abridgment* of the *quinary* symbol $(xyz00)$; and the *right line* which is the *trace on that plane*, of any *other plane* Π, or $[lmnrs]$ (23), may be denoted by this *other ternary symbol*,

$$[l, m, n], \quad \text{or} \quad [lmn]; \tag{75}$$

these two last ternary symbols being *connected* by the relation,

$$lx + my + nz = 0, \tag{76}$$

if the *point* (xyz) be *on the line* $[lmn]$. And the *point* P in which any *other* line Λ, *not* situated in the plane ABC, *intersects* that *plane*, may be said to be the *trace* of that *line*.

[18.] For example, the *point* D_1 is, by (64), the *trace of the line* DE; and if we write,

$$A_0 = (\bar{1}11), \quad B_0 = (1\bar{1}1), \quad C_0 = (11\bar{1}), \tag{77}$$

then these three points are the respective traces of the three lines A_1A_2, B_1B_2, C_1C_2; because they are, by the notation (74), in the given plane, and we have, by (60) and (61), the three following symbolical equations of the form (72),

$$(A_0) + (A_1) + (A_2) = (B_0) + (B_1) + (B_2) = (C_0) + (C_1) + (C_2) = (U), \tag{78}$$

which express the three collineations, $A_0A_1A_2$, $B_0B_1B_2$, $C_0C_1C_2$.

We have also the three other collineations, AD_1A', BD_1B', CD_1C', because the quinary symbols (27) (49) (54) (60) give the equations,

$$(A) + (A') + (D_1) = (B) + (B') + (D_1) = (C) + (C') + (D_1) = (U); \tag{79}$$

and these *three lines*, $AA'D_1$, &c., are the *traces of the three planes* ADE, BDE, CDE, of which *planes* the respective *equations* (21), and *quinary symbols* (23), are

$$y - z = 0, \quad z - x = 0, \quad x - y = 0, \tag{80}$$

and

$$[01\bar{1}00], \quad [\bar{1}0100], \quad [1\bar{1}000]; \tag{81}$$

so that the *ternary symbols* of the three last *lines*, regarded as their *traces*, are simply, by (75),

$$[01\bar{1}], \quad [\bar{1}01], \quad [1\bar{1}0]. \tag{82}$$

Accordingly, whether we consider the point $A = (100)$, or $A' = (011)$, or $D_1 = (111)$, (this *ternary* symbol of D_1 being *congruent* to the former *quinary* symbol (00011) for that point (60),) we have in each case the relation $y - z = 0$ between its coordinates; and similarly for the two other lines.

[19.] As other examples, the *four planes*,

$$A_1B_1C_1, \quad A_2B_2C_2, \quad A'_1B'_1C'_1, \quad A'_2B'_2B'_2, \tag{83}$$

have for their quinary equations,

$$x+y+z=2w+v, \quad x+y+z=w+2v, \quad x+y+z+v=4w, \quad x+y+z+w=4v, \tag{84}$$

and for their quinary symbols,

$$[111\bar{2}\bar{1}], \quad [111\bar{1}\bar{2}], \quad [11\bar{1}\bar{4}1], \quad [1\bar{1}\bar{1}\bar{1}4]; \tag{85}$$

they have therefore a *common trace*, namely the line

$$[111], \text{ or } A''B''C'', \tag{86}$$

because, by (49) and (54), we may now write,

$$A''=(01\bar{1}), \quad B''=(\bar{1}01), \quad C''=(1\bar{1}0), \tag{87}$$

and the coordinates of each of these three last points satisfy the equation,

$$x+y+z=0. \tag{88}$$

Accordingly, because we have, by (60) (61) (62) (63), the three following sets of symbolical equations of the form (72),

$$\left.\begin{aligned}(A'')&=(B_1)-(C_1)=(B_2)-(C_2)=(B'_1)-(C'_1)=(B'_2)-(C'_2),\\(B'')&=(C_1)-(A_1)=(C_2)-(A_2)=(C'_1)-(A'_1)=(C'_2)-(A'_2),\\(C'')&=(A_1)-(B_1)=(A_2)-(B_2)=(A'_1)-(B'_1)=(A'_2)-(B'_2),\end{aligned}\right\} \tag{89}$$

we see that the *point* A'' is the *common trace* of the *four lines*, B_1C_1, B_2C_2, $B'_1C'_1$, $B'_2C'_2$; B'' of C_1A_1, C_2A_2, $C'_1A'_1$, $C'_2A'_2$; and C'' of A_1B_1, A_2B_2, $A'_1B'_1$, $A'_2B'_2$.

[20.] In all such cases as these, in which we have to consider a *set of three points* P, or a *set of three planes* Π, of which the *first* is *geometrically derived* from ABCDE according to the *same rule of construction*, as that according to which the *second* is derived from BCADE, and the *third* from CABDE, we can *symbolically derive the second from the first*, and in like manner the *third* from the *second*, (or again the first from the third,) by writing, in each case, the *third*, *first*, and *second coefficients*, or coordinates, in the places of the *first*, *second*, and *third*, respectively. In symbols, we may express this *law of successive derivation*, of certain *syntypical* points or planes [9.] from one another, by the formulæ,

$$\text{if } P(ABC)=(xyzwv), \text{ then } P(BCA)=(zxywv), \text{ and } P(CAB)=(yzxwv); \tag{90}$$

and if

$$\Pi(ABC)=[lmnrs], \text{ then } \Pi(BCA)=[nlmrs], \text{ and } \Pi(CAB)=[mnlrs]; \tag{91}$$

as has been already exemplified in the systems (27), (60), (61), (62), (63), (77), (81), (87), for *points* or *planes*, and in (82) for *lines*, considered as *traces* of planes. In all these cases, therefore, we can, with perfect clearness and *definiteness* of signification, *abridge the notation*, by

writing *only the first* (or indeed *any one*) of the *three* equations (90) or (91), and then appending an "&c."; for the *law* which has been just stated will always enable us to *recover* (or deduce) *the other two*. We may therefore briefly but sufficiently express several of the foregoing results, by writing,

$$\left.\begin{array}{l} A = (100),\ \&c.;\ A' = (011),\ \&c.;\ A'' = (01\bar{1}),\ \&c.;\ A_0 = (\bar{1}11),\ \&c.; \\ A_1 = (10001),\ \&c.;\ A_2 = (10010),\ \&c.;\ A'_1 = (1000\bar{1}),\ \&c.; \\ \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad A'_2 = (100\bar{1}0),\ \&c.; \end{array}\right\} (92)$$

$$\textit{Plane } ADE = [01\bar{1}00],\ \&c.;\ \textit{Line } AD_1A' = [01\bar{1}],\ \&c.; \qquad (93)$$

to which we may add these other symbols of planes and lines, each supposed to be followed by an "&c.":

$$\text{plane } BCD = [1000\bar{1}];\ BCE = [100\bar{1}0];\ \text{trace} = BC = [100]; \qquad (94)$$

$$\left.\begin{array}{l} \text{plane } DB'B_1C'C_1 = [\bar{1}1101];\ EB'B_2C'C_2 = [\bar{1}111\bar{1}0]; \\ \qquad\qquad\qquad\qquad\qquad\qquad \text{trace} = B'C'A'' = [\bar{1}11] \end{array}\right\} \qquad (95)$$

$$\text{plane } AB_1C_2C_1B_2 = [011\bar{1}\bar{1}];\ \text{trace} = AA'' = [011]; \qquad (96)$$

this line AA'' passing also, by (77), through the two points B_0 and C_0;

$$\text{plane } B_1C_1D_1 = [\bar{2}111\bar{1}];\ B_2C_2D_1 = [\bar{2}11\bar{1}1];\ \text{trace} = D_1A'' = [\bar{2}11]; \qquad (97)$$

$$\left.\begin{array}{l} \text{plane } A'B_1B_2 = [\bar{2}\bar{1}111];\ \text{trace} = A'B_0 = [\bar{2}\bar{1}1]; \\ \text{plane } A'C_1C_2 = [\bar{2}1\bar{1}11];\ \text{trace} = A'C_0 = [\bar{2}1\bar{1}]; \end{array}\right\} \qquad (98)$$

where it may be noticed that the symbol for $A'C_1C_2$, or for $A'C_0$, may be deduced from that for $A'B_1B_2$ or for $A'B_0$, by simply interchanging the second and third coefficients, or coordinates. It is easy to see that the quinary symbol for the plane ABC itself is on the same plan $[0001\bar{1}]$, the equation of that plane being $w = v$; and it will be remembered that, by [18.], the ternary symbol for the point D_1 in that plane is (111).

[21.] A *right Line* Λ *in Space* may be regarded in two principal views, as follows. Ist, it may be considered as the *locus of a variable point* P, *collinear with two given points* P_0, P_1; and in this view, the *symbol*

$$t_0(P_0) + t_1(P_1), \qquad \text{(comp. (72),)}$$

for the variable *point* upon the line, may be regarded as a *Local Symbol* (or *Point-Symbol*) *of the Line* Λ *itself*. Thus

$$(0tt'),\ \text{or}\ (0yz), \qquad (99)$$

may either represent *an arbitrary point on the line* BC; or, *as a local symbol*, that *line itself*. Or IInd, we may consider a line Λ as a *hinge, round which a plane* Π *turns*, so as to be always *collinear* [7.] *with two given planes* Π_0, Π_1 through the line; and then a symbol of the form

$$t_0[\Pi_0] + t_1[\Pi_1], \qquad \text{(comp. (25),)}$$

which represents immediately the *variable plane* Π, may be regarded as being *also* a *Tangential Symbol* (or *Plane-Symbol*) *for the Line* Λ. For example, the line BC may thus be represented, not only by the *local* symbol (99), but also by the *tangential* symbol,

$$[\bar{\sigma}00tu], \text{ if } \sigma = t + u, \text{ and } \sigma = -\sigma. \qquad (100)$$

In fact, this last symbol can be derived, by linear combinations, from the symbols (94) for the two planes BCD, BCE, which intersect in the line BC; and if any particular value be assigned to the ratio $t : u$, a particular *plane through that line* results. But it is time to apply these general principles to the *Geometrical Net in Space.*

PART II.—*Applications to the Net in Space: Enumeration and Classification of the Lines, Planes, and Points of that Net, to the end of the Second Construction.*

[22.] The *data* of the *Geometrical Net* are, by [1.], the *five points* ABCDE, or P_0; of which the *quinary symbols* (27) have been assigned, and shown to be *syntypical* [9.]; and also the *ternary* symbols (92) of the three first of them. Of these the symbol

$$A = (100)$$

may be taken as the *type;* and the point A itself may be said to be a *First Typical Point.*

[23.] The *derived lines* Λ_1, of *First Construction* [1.], are the *ten* following,

BC, &c.; DA, &c.; EA, &c.; and DE;

the "&c." being interpreted as in [20.]; and each line Λ_1 connecting, by its construction, *two* points P_0. Among these the line BC may be selected, as a *First Typical Line;* and its *symbols* [21.], namely,

$$(0yz), \text{ and } [\bar{\sigma}00tu],$$

whereof the former represents this line BC considered as the *locus* of a *variable point,* while the latter represents the same line considered as the *hinge* of a *variable plane,* may be taken as *types* (the *point-type* and the *plane-type*) of the *group* of the *ten lines* Λ_1.

[24.] The *derived planes* Π_1 of *first* construction are in like manner *ten;* namely,

ADE, &c.; BCE, &c.; BCD, &c.; and ABC,

each obtained by connecting *three* points P_0. Of these the last has, by [20.] the quinary *symbol,*

$$ABC = [0001\bar{1}],$$

which may be taken as a *type* of the *group* Π_1; and the plane ABC itself

may be called a *First Typical Plane*. As a verification, we see that when we make $\sigma = t + u = 0$, in the second symbol [23.], and divide by t, we are led to the recent symbol for ABC, as one of the planes which pass through the line BC.

[25.] The *derived points* P_1, of the same *first* construction, which are all, by [1.], of the *form* $A_1 \cdot \Pi_1$, are in like manner *ten*; namely the intersections,

$$BC \cdot ADE, \&c.; \quad DA \cdot BCE, \&c.; \quad EA \cdot BCD, \&c.; \text{ and } DE \cdot ABC,$$

which have been denoted in [14.] and [15.] by the letters, or *literal symbols*,

$$A', \&c.; \quad A_2, \&c.; \quad A_1, \&c.; \text{ and } D_1,$$

and for which *quinary symbols* (49) (54) (60) (61) have been assigned. Of these ten points *four*, namely A', B', C', D_1, are situated *in the plane* ABC, and have accordingly been represented [20.] by *ternary symbols* also: and we may take the particular symbol of this sort,

$$A' = (011),$$

as a *type* of this *group* P_1; understanding, however, that the *full* or *quinary type* is to be recovered from this *ternary type*, by *restoring the two omitted zeros;* so that we have, more fully,

$$A' = (01100) \equiv (10011).$$

And the *point* A' itself may be considered as a *Second Typical Point*.

[26.] We have thus denoted, by *literal* and by *quinary symbols*, whereof some have been *abridged* to *ternary* ones [17.], and have been also represented by *types* [9.], not only the *five given points* P_0, but all the *ten lines* A_1, *ten planes* Π_1, and *ten points* P_1, of what has been called, in [1.], the *First Construction*. And it is evident that we have, at this stage, *ten triangles* T_1, namely the ten,

$$ADE, \&c.; \quad BCE, \&c.; \quad BCD, \&c.; \text{ and } ABC,$$

whereof each is contained in a plane Π_1; and also *five pyramids* R_1, each bounded by *four* of these *triangles*, namely the pyramids,

$$BCDE, \ CADE, \ ABDE, \ ABCE, \ ABCD,$$

which may be called the pyramids A, B, C, D, E; each being marked by the literal symbol of *that one* of the five points P_0, which is *not a corner* of the pyramid.

[27.] It may be remarked, that *ten arbitrary lines* in space *intersect*, generally, *ten arbitrary planes*, in *one hundred points;* but that this *number* of intersections $A_1 \cdot \Pi_1$ is *here* reduced to *fifteen*, whereof only *ten* are *new;* because *each* of the *five points* P_0 *counts* as *twelve*, since in each of those points *four lines cut* (each) *three planes*, while *each* of the *ten planes contains three lines;* so that *thirty binary combinations* are *not cases*

of intersection, and *sixty* such cases conduct only to the five *old* (or given) points. This sort of *arithmetical verification* of the accuracy of an *enumeration* of *derived points*, or lines, or planes, will be found useful in more complex cases, although it was not necessary here.

[28.] Proceeding to a *Second Construction* [1.], we may begin by determining the *lines* Λ_2, whereof each connects some *two* (at least) of the *fifteen points* P_0, P_1, but *not* any two of the *five* points P_0, since otherwise it would be a line Λ_1. If the 15 points to be connected were *independent*, they would give, generally, by their binary combinations, 105 lines; but the *ten collineations of construction*,

$$BCA', \text{ \&c.}; \quad DAA_2, \text{ \&c.}; \quad EAA_1, \text{ \&c.}; \text{ and } EDD_1,$$

show that 30 of these *combinations* are to be rejected, as giving only the ten old lines. The remaining number, 75, is still farther reduced by the consideration that we have (comp. (79)) the *fifteen derived collineations*,

$$AA'D_1, \text{ \&c.}; \quad AB_1C_2, \text{ \&c.}; \quad AC_1B_2, \text{ \&c.}; \quad DA'A_1, \text{ \&c.}; \quad EA'A_2, \text{ \&c.};$$

which represent only *fifteen new lines*, of a *group* which we shall denote by $\Lambda_{2,1}$, but *count* (comp. [27.]) as 45 binary combinations of the 15 points. There remain therefore only 30 such combinations to be considered; and these give in fact a *second group*, $\Lambda_{2,2}$, consisting of *thirty lines of second construction:* namely, the *thirty edges* of the *five new pyramids* R_2,

$$C'B'A_2A_1, \quad A'C'B_2B_1, \quad B'A'C_2C_1, \quad A_2B_2C_2D_1, \quad A_1B_1C_1D_1,$$

which are respectively *inscribed* in the five former pyramids R_1 [26.], and are *homologous* to them, the five given points A . . E being the respective *centres of homology:* for example, $C' = AB \cdot CDE$, &c. The corresponding *planes of homology* will present themselves somewhat later, in connexion with the points P_2.

[29.]. On the whole, then, there are only *forty-five distinct lines of second construction* Λ_2; and these naturally divide themselves into *two groups*, of 15 lines $\Lambda_{2,1}$, and 30 lines $\Lambda_{2,2}$, as above. *Each* line of the *first group* $\Lambda_{2,1}$ connects *one* point P_0 with *two* points P_1; as each line Λ_1 had connected *one* point P_1 with *two* points P_0; but *no* line of the *second group* $\Lambda_{2,2}$ connects, at this stage of the construction, more than *two* points, which are *both* points P_1. Through *no* point P_0, therefore, can we draw *any line* $\Lambda_{2,2}$; but through *each* point P_0 we can draw *three lines* $\Lambda_{2,1}$; and each of these is determined as the *intersection of two planes* Π_1 through that point, or as *crossing two opposite edges* of that *pyramid* R_1, which has *not* the point P_0 for a corner (comp. [26.]): for example, $AA'D_1$ is the intersection of ABC, ADE, and crosses the lines BC, DE. And besides being, as in [28.], the *edges* of certain *other* and *inscribed* pyramids R_2, the 30 lines $\Lambda_{2,2}$ are also the *sides* of *ten new triangles* T_2, namely,

$$D_1A_1A_2, \text{ \&c.}; \quad C_1B_1A', \text{ \&c.}; \quad C_2B_2A', \text{ \&c.}; \text{ and } A'B'C',$$

situated *in the ten planes* Π_1, and *inscribed* in the *ten old triangles* T_1, to

which also they are *homologous*; the corresponding *centres of homology* being the ten points P_1, in the same order,

A', &c.; A_2, &c.; A_1, &c.; and D_1, as before.

The *axes of homology* of these *ten pairs of triangles* T_1, T_2, will offer themselves a little later, in connexion with points P_2.

[30.] All this may be considered as evident from *geometry* alone, at least with the assistance of *literal symbols*, such as those used above. But to deduce the same things by *calculation*, with *quinary symbols* and *types*, on the plan of the present Paper, we may observe that the symbolical equation,

$$(10000) + (01100) + (00011) = (11111),$$

considered as a type of all equations of the same form, proves by (18) or (72) that each point P_1 can, in three different ways, be combined with another point P_1, so that their joining line shall pass through a point P_0; and that thus the *group* of the 15 lines $\Lambda_{2,1}$ arises, of which the line $AA'D_1$ is a specimen, and may be called a *Second Typical Line* (the *first* such line having been BC, by [23.]). The *complete* quinary symbol of a *point* on this line is $(tuuvv)$, which is however congruent to one of the form $(tuu00)$, and may therefore be abridged to the ternary symbol (tuu), or (xyy); and the quinary symbol of a *plane* through the same line is of the form $[0mmr\bar{r}]$, or $[0t\bar{t}u\bar{u}]$; we may therefore, by [21.] (comp. [23.]) consider the two expressions,

$$(xyy), \text{ and } [0t\bar{t}u\bar{u}],$$

as being not only *local and tangential symbols* for the *particular* (or *typical*) *line* $AA'D_1$ *itself*, but also *local and tangential types* for the *group* $\Lambda_{2,1}$; or as the *point-type*, and the *plane-type*, of that group.

[31.] The two points P_1, of which the quinary symbols have been thus combined in [30.], had *no common coordinate different from zero*; but there remains to be considered the case, in which two points of that group *have* such a coordinate: for example, when the points have for their symbols,

$$(10100) \text{ and } (11000), \text{ or } (101) \text{ and } (110).$$

The *point-symbol* and *plane-symbol* of the *line* Λ_2 connecting *these* two points P_1 are easily seen to be (with the same significations of σ and $\bar{\sigma}$ as before),

$$(\sigma tu00), \text{ or } (\sigma tu), \text{ and } [\bar{t}\bar{t}tu\bar{\sigma}];$$

but no choice of the arbitrary *ratio*, $t : u$, with $\sigma = t + u$, will reduce the symbol (σtu) to denote *any one* of the 15 points P_0, P_1, except the *two* points P_1 (in this example, B′ and C′), by joining which the line is obtained; considering therefore the two last *symbols* as *types*, we see that they represent a *second group*, consisting of *thirty lines* $\Lambda_{3,2}$; but that there can be *no third group*, of *lines* Λ_2 of *second construction*. The *particular line* B′C′, which the symbols in the present paragraph represent, may be

taken as *typical* of this *second group*; and may be called (comp. [23.] and [30.]) a *Third Typical Line* of the System, or *Net*, determined by the five given points A . . E. And the *pyramids* R_1, R_2, and *triangles* T_1, T_2, of first and second constructions, of which the *literal symbols* have been assigned in [26.] [28.] [29.], might also have easily been suggested and studied, by *quinary* symbols and types alone.

[32.] As regards the *Planes* Π_2 *of Second Construction* [1.], it is easily seen that no such plane contains any *two* points P_0, or any *one* line Λ_1; for example, the *first typical line* BC [23.] *contains* the point A'; and if we *connect* it with any one of the four points A, B', C', D_1, we only get a plane Π_1, namely ABC; if with D, A_1, B_2, or C_2, we get another plane Π_1, namely BCD; and if with any one of the four remaining points E, A_2, B_1, C_1, the plane BCE is obtained. Accordingly, the general symbol $[\bar{\sigma}00tu]$, in [23.], for a plane through the line BC, gives $\sigma = 0$, or $t = 0$, or $u = 0$, when we seek to particularize it, by the first, the second, or the third of these three sets of conditions respectively.

[33.] But if we take the symbol $[0t\bar{t}u\bar{u}]$, in [30.], for a plane through the *second typical line* $AA'D_1$, and seek to particularize *this* symbol by the condition of passing through some one of the eight points P_1 which are not situated upon it, we are conducted to the following results. The points B', C' give $t = 0$, and the points A_1, A_2 give $u = 0$; these points therefore give only two planes Π_1, namely the two planes ABC and ADE, of which the line $\Lambda_{2,1}$ is the intersection. But the points B_1, C_2 give $t = u$, and the points C_1, B_2 give $t = -u$; *these points* therefore give *two planes* of a *new group*, $\Pi_{2,1}$, namely (comp. [20.]) the two following:

$$\text{plane } AA'D_1B_1C_2 = [01\bar{1}1\bar{1}]; \quad \text{plane } AA'D_1C_1B_2 = (01\bar{1}11];$$

which are of the same *type* as the plane (96), namely,

$$\text{plane } AB_1C_2C_1B_2 = [011\bar{1}1].$$

There are *fifteen* such *planes* $\Pi_{2,1}$, as the type sufficiently shows; each passes through *one point* P_0, and contains *two lines* $\Lambda_{2,1}$, containing also *four lines* $\Lambda_{1,2}$; as, for instance, the last-mentioned plane $AB_1C_2C_1B_2$, which we shall call (comp. [24.]) the *Second Typical Plane*, contains the *two* lines AB_1C_2, AC_1B_2 [28.], and the *four* lines B_1C_1, C_1C_2, C_2B_2, B_2B_1; that is to say, the *two diagonals* and the *four sides* of the *quadrilateral* $B_1C_1C_2B_2$, of which the *plane* $\Pi_{2,1}$ passes through A.

[34.] We have now exhausted all the planes Π_2 which contain any point P_0; but there exists a *second group of planes*, $\Pi_{2,2}$, each of which is determined as connecting *three* points P_1, although passing through *no* point P_0. Thus if we take the *third typical line* B'C' [31.], and the symbol $[\bar{t}ttu\bar{\sigma}]$ for a plane through it, we get indeed $t = 0$, or a plane Π_1, namely, ABC, if we oblige the plane through B'C' to contain A, or B, or C, or A', or D_1; and we get $u = 0$, or $[\bar{1}110\bar{1}]$, or a plane $\Pi_{2,1}$, namely $DB'B_1C'C_1$, as in (95), if we oblige it to contain D, or B_1, or C_1; while we

get $\sigma = 0$, or $[\bar{1}11\bar{1}0]$, or $EB'B_1c'c_2$, again as in (95), if we oblige it to contain E, or B_2, or c_2. But there remain the two points A_1 and A_2, determining the two new planes $B'C'A_1$ and $B'C'A_2$, for the former of which we have $t + \sigma = 0$, or $u = -2t$, $\sigma = -t$, and therefore have the symbol $[\bar{1}11\bar{2}1]$; while for the latter we have $u = t$, $\sigma = 2t$, and therefore the syntypical symbol $[\bar{1}111\bar{2}]$. There are *twenty planes* of this *group* $\Pi_{2,2}$, as may be at once concluded from inspection of the *type;* among which (comp. [19.]) we shall select the following,

$$\text{plane } A_1B_1C_1 = [11\bar{2}\bar{1}],$$

and call this a *Third Typical Plane.* And it is evident that these 20 planes $\Pi_{2,2}$ are the *twenty faces* of the *five inscribed pyramids* B_2 [28.], of which the *edges* have been seen to be the *thirty lines* $\Lambda_{2,2}$. On the whole, then, there are only *thirty-five planes* Π_2 of *second construction;* which thus divide themselves into *two groups,* of *fifteen* and *twenty,* respectively.

[35.] To *verify arithmetically* (comp. [27.] [28.]) the *completeness* of the foregoing *enumeration* of the *planes* Π_2, we may proceed as follows. In general, *fifteen independent points* would determine 455 planes, by their *ternary combinations;* but the 25 *collineations* [28.], which give only the *lines* Λ_1, $\Lambda_{2,1}$, *account* for 25 such combinations, leaving only 430 to be accounted for, by so many *triangles.* Now each plane Π_1 contains three points P_0, and four points P_1, connected by six collineations; it contains therefore 29 $(= 35 - 6)$ triangles, and thus the ten planes Π_1 account for 290 triangles, leaving only 140, situated in planes Π_2. But each of the 15 planes $\Pi_{2,1}$ contains one point P_0, and four points P_1, connected by two collineations; it contains therefore 8 $(= 10 - 2)$ triangles, and thus 120 are accounted for, leaving only 20 ternary combinations to be represented, by triangles in other planes Π_2. And these accordingly have presented themselves, as the twenty faces $\Pi_{2,2}$ of the five inscribed pyramids B_2. It must be mentioned, that the *enumeration* and *classification* of the foregoing *lines* and *planes* had been completely performed by MÖBIUS, although with an entirely different *notation* and *analysis.*

[36.] It is much more difficult, however, or at least without the aid of *types* it *would* be so, to *enumerate* and *classify* what we have called in [1.] the *Points* P_2 of *Second Construction;* and to assign their chief *geometrical relations,* to each other, and to the *five given* and *ten* (formerly) *derived* points, P_0 and P_1. In fact, it is obvious that these *new points* P_2, being (by their definition) *all the intersections* of lines Λ_1 or Λ_2 with planes Π_1 or Π_2, which have *not already occurred,* as points P_0 or P_1, may be expected to be (comp. [2.]) considerably *more numerous,* than either the *lines* or the *planes* themselves.

[37.] The *total number* of *derived lines and planes,* so far, is exactly *one hundred;* namely, 55 lines Λ, and 45 planes Π, of first and second constructions. Their *binary combinations,* of the *form* $\Lambda\Pi$, are there-

fore 2475 in number; but as it is not difficult to prove that there are 240 distinct cases of *coincidence* of line with plane (or of a plane *containing* a line), we must subtract this from the former number, and thus there remain only 2235 cases of *intersection*, of the kind which we have proposed to consider. *Every one*, however, of these 2235 cases, must be accounted for, either as a *given point* P_0, or as a *derived point* P_1 of *first* construction, or finally as one of those *new points* P_2, of which we have proposed to accomplish the *enumeration*, and to determine the natural *groups*, as represented by their respective *types*.

[38.] We saw, in [27.], that each point P_0, as for instance the point A, represents *twelve intersections* of the form $A_1 \cdot \Pi_1$; and it is easy to prove that the same point P_0 represents *twelve other* intersections of the form $A_1 \cdot \Pi_{2,1}$; *twelve*, of the form $A_{2,1} \cdot \Pi_1$; and *three*, of the form $A_{2,1} \cdot \Pi_{2,1}$; but none of any other form. It represents therefore, on the whole, a system of 39 *intersections*, included in the *general form* $A \cdot \Pi$; and we must, for this reason, subtract 195 ($= 5 \times 39$) from 2235, leaving 2040 *other* cases of intersection of line with plane, to be accounted for by the old and new *derived points*, P_1 and P_2.

[39.] An analysis of the same kind shows, that each of the *ten points* of *first construction*, as for example the *typical point* A′ [25.], represents *one* intersection of the form $A_1 \cdot \Pi_1$; *six*, of the form $A_1 \cdot \Pi_{2,1}$; *six*, of the form $A_1 \cdot \Pi_{2,2}$; *six*, of the form $A_{2,1} \cdot \Pi_1$; *twelve*, of the form $A_{2,1} \cdot \Pi_{2,1}$; *eighteen*, of the form $A_{2,1} \cdot \Pi_{2,2}$; *eighteen*, of the form $A_{2,2} \cdot \Pi_1$; *twenty-four* of the form $A_{2,2} \cdot \Pi_{2,1}$; and *twenty-four* others, of the remaining form $A_{2,2} \cdot \Pi_{2,2}$. It represents, therefore, in all, 115 intersections $A \cdot \Pi$; and there remain only 890 ($= 2040 - 1150$) cases of intersection to be accounted for, or represented, by the points P_2 of which we are in search. But all these 890 cases of intersection *must* be accounted for, by *such new points*, if the investigation is to be considered as *complete*.

[40.] A *first*, but important, and well-known *group* of such points P_2, consists of the *ten points* (already considered in Part I. of this Paper),

$$A'', \text{ \&c.}; \quad A'_2, \text{ \&c.}; \quad A'_1, \text{ \&c.}; \quad \text{and } D'_1,$$

namely, the *harmonic conjugates* of the *ten points* P_1, with respect to the *ten lines* Λ_1, which we shall call collectively the points, or the group, $P_{2,1}$; and among which we shall select the point

$$A'' = (01\bar{1}),$$

as a *Third Typical Point* of the *Net*. In fact, it is what we have called a point P_2, because, without belonging to either of the two former groups, P_0, P_1, it is an *intersection* $\Lambda_1 \cdot \Pi_{2,2}$; or rather, it represents *six* such intersections, of the line BC with planes of second construction, and of the second group: namely, with two such through B′C′, two through B_2C_2, and two through B_1C_1, being pairs of faces [28.] of three pyramids R_2, inscribed in those three pyramids R_1, which have been distinguished, in [26.], by the letters A, D, E. The same point A″ is also the intersection of the same line BC with *three* planes $\Pi_{2,1}$; namely, with the three

which connect, two by two, the three lines $B'C'$, B_2C_2, B_1C_1, and contain the three points A, D, E. It is also, in *six* ways, the intersection of one or other of these three last lines $A_{2,2}$, with a plane Π_1; in *three* ways, with a plane $\Pi_{2,1}$; and in *twelve* ways, with a plane $\Pi_{2,2}$; so that a *single point* $P_{2,1}$ represents *thirty intersections* of the form $A \cdot \Pi$; and the *group* of the *ten* such points represents 300 such intersections. We have therefore only to account for 590 (= 890 − 300) intersections $A \cdot \Pi$, by *other groups* $P_{2,2}$, &c., of points of *second construction*.

[41.] A *second group*, $P_{2,2}$, of such points P_2, has already presented itself, in the case of the *traces* A_0, B_0, C_0 [18.], of the *lines* A_1A_2, B_1B_2, C_1C_2, on the plane ABC. The *ternary* symbol of the point A_0 has been found (77) (92) to be $(\bar{1}11)$; its *quinary* symbol is therefore $(\bar{1}1100)$, which is *congruent* (10) with (20011); hence in the *full*, or *quinary sense* [9.], this point A_0 is *syntypical* with the following *other point, in the same plane* ABC,

$$A''' = (211),$$

which we shall call a *Fourth Typical Point*, and shall consider as representing the *group* $P_{2,2}$; this group consisting of *thirty* such *points*, namely of two on each of the 15 lines $A_{2,1}$.

[42.] Each of these thirty points $P_{2,2}$ represents *seven intersections* of line with plane; namely, two of each of the three forms, $A_{2,1} \cdot \Pi_{2,1}$, $A_{2,1} \cdot \Pi_{2,2}$, $A_{2,2} \cdot \Pi_{2,1}$, and one of the form $A_{2,2} \cdot \Pi_1$. For example, the typical point A''', which is the intersection of the *two lines* $AA'D_1$ and $B'C'$, is at the same time the intersection of the former line $A_{2,1}$ with each of four planes Π_2 which contain the latter line $A_{2,2}$; being also the intersection of this last line $B'C'$ with a plane Π_1, namely ADE, and with two planes $\Pi_{2,1}$ which contain the first line $AA'D_1$. The *group* $P_{2,2}$ represents therefore 210 intersections $A \cdot \Pi$; and there remain only 380 (= 590 − 210) intersections of this standard form, to be accounted for by *other groups* of *second construction*, such as $P_{2,3}$, &c.

[43.] In investigating such *groups*, we need only seek for *typical points*; and because every such *point* is on a *line* of one of the *three forms*, A_1, $A_{2,1}$, $A_{2,2}$, we may confine ourselves to the *three typical lines*,

$$BC,\ AA'D_1,\ B'C';\ \text{or}\ (0tu),\ (tuu),\ (\sigma tu);$$

in which, as before, $\sigma = t + u$, and in which the ratio of t to u is to be determined. And because a line in the plane ABC intersects any *other plane* in the point in which it intersects the *line* which is the *trace* of the latter plane upon the former, we need only, for the present purpose, consider these lines, or traces: whereof there are, by what has been already seen, *seven* distinct *ternary types*, namely the following:

$$[100],\ [01\bar{1}],\ [\bar{1}11],\ [111],\ [011],\ [\bar{2}11],\ [\bar{2}1\bar{1}];$$

which answer to the *seven typical traces* of planes,

$$BC,\ AA'D_1,\ B'C',\ A''B''C'',\ AA'',\ D_1A'',\ A'C_0.$$

There are 22 (= 3 + 3 + 3 + 1 + 3 + 3 + 6) such *lines*, answering to 44 (= 3 . 2 + 3 . 3 + 3 . 4 + 1 . 2 + 3 . 1 + 3 . 2 + 6 . 1) *planes;* namely to *all* the 45 planes Π_1, Π_2, *except* the particular plane ABC, on which the *traces* are thus taken. And we have now to *combine* these *seven types of lines*, with the *three symbols of points*, (0*tu*), (*tuu*) (*σtu*), according to the general law, $lx + my + nz = 0$ (76).

[44.] The line BC is itself one of the three traces of the first type; and it intersects the twelve other traces, of the five first types, only in points which have been already considered. The line $AA'D_1$ is, in like manner, a trace of the second type; and it gives no new point, by its intersections with the eight other traces, of the three first types; but its intersection with the common trace $A''B''C''$, of the two planes $A_1B_1C_1$ and $A_2B_2C_2$ [19.], which is the only line of the fourth type, gives what we shall call a *Fifth Typical Point*, namely the following:

$$A^{IV} = (\bar{2}11); \text{ or more fully, } A^{IV} = (\bar{2}1100) \equiv (30011).$$

This last quinary symbol shows that the point A^{IV} is syntypical with this other point in the plane ABC,

$$A_1^{IV} = (31100) = (311);$$

so that this *plane* contains *six points* $P_{2,3}$, which (in the *quinary* sense) belong to one *common group*, although their two *ternary types* are *different*. In fact, the point A_1^{IV} is the common intersection of the line $AA'D_1$ with the two planes $[1\bar{2}111]$ and $11\bar{2}11]$, or $B'C_1C_2$ and $C'B_1B_2$, as the point A^{IV} is the common intersection of the same line with the two planes $[11121]$ and $[11112]$, or $A_1B_1C_1$ and $A_2B_2C_2$, as above.

[45.] There are *thirty* distinct points $P_{2,3}$, of this *third group* of *second construction;* and *each* represents *two* (but only two) intersections, which are both of the form $A_{2,1} \cdot \Pi_{2,2}$. The *group* therefore represents a system of 60 intersections $A \cdot \Pi$; and there remain only 320 (= 380 − 60) such intersections to be accounted for by *other* points, or groups, such as $P_{2,4}$, &c. It will be found that we have now exhausted all the points, or groups, of *second* construction, which are situated on lines $\Lambda_{2,1}$; but that two other groups of points P_2 may be determined on lines Λ_1, by combining the typical line BC with the two last sets of traces [43.] as follows.

[46.] Combining thus BC with D_1C'' and D_1B'', or with the traces $[11\bar{2}]$ and $[1\bar{2}1]$, we get the two following points, of a *fourth group of second construction*,

$$A^V = (021); \quad A^V{}_1 = (012);$$

whereof the former may be taken as a *Sixth Typical Point*. There are *twenty points* of this *group* $P_{2,4}$, whereof each represents *three* intersections, of the form $A_1 \cdot \Pi_{2,2}$; for example, the typical point A^V is the common intersection of the line BC with the three planes $C'A_1A_2$, $D_1A_1B_1$, $D_1A_2B_2$; the group therefore represents *sixty* intersections $A \cdot \Pi$, and there remain 260 (= 320 − 60) to be accounted for.

[47.] Again, combining BC with $C'B_0$, and with $B'C_0$, or with $[1\bar{1}2]$ and $[12\bar{1}]$, we get the two following other points, belonging to a *fifth group* of *second construction*,

$$A^{VI} = (02\bar{1}); \quad A_1^{VI} = (0\bar{1}2);$$

whereof the first may be said to be a *Seventh Typical Point*. There are *twenty* points of this new group $P_{2,5}$, whereof each represents only *one* intersection, of the form $\Lambda_1 \cdot \Pi_{2,2}$; for example, $A^{VI} = BC \cdot C'B_1B_2$. We are therefore to subtract 20 from the recent number 260; and thus there remain still 240 intersections to be accounted for, by new points P_2 upon the lines $\Lambda_{2,2}$: since the lines Λ_1 as well as $\Lambda_{2,1}$ have been exhausted, as on examination will easily appear.

[48.] The line B'C' intersects the traces BB'' and CC'' of the *fifth type* [43.] in the two following points, of a *sixth group* of *second construction*,

$$A^{VII} = (12\bar{1}); \quad A_1^{VII} = (1\bar{1}2);$$

whereof the former may be called an *Eighth Typical Point*. There are *sixty* points of this new group, $P_{2,6}$, whereof each represents *one* intersection, of the form $\Lambda_{2,2} \cdot \Pi_{2,1}$; for example, A^{VII} is the intersection of the line B'C' with the plane $BC_1A_2A_1C_2$; there remain therefore 180 (= 240 − 60) intersections $\Lambda \cdot \Pi$ to be still accounted for, by other points P_2, on the same set of lines $\Lambda_{2,2}$.

[49.] The traces D_1B'', D_1C'', which belong to the *sixth type* [43.], intersect the line B'C' in two new points, namely,

$$A^{VIII} = (321); \quad A_1^{VIII} = (312);$$

which belong to a *seventh group* $P_{2,7}$, of *second construction*, and of which the former may be regarded as a *Ninth Typical Point*. There are *sixty* points of this group, namely two on each of the 30 lines $\Lambda_{2,2}$; and each is the intersection of *one* such line with *two* distinct planes $\Pi_{2,2}$; their *group* therefore represents a system of 120 such intersections; and only 60 (= 180 − 120) intersections *remain* to be accounted for, by *other* points of this last *form*, $A_{2,2} \cdot \Pi_{2,2}$.

[50.] Accordingly, when we combine the line B'C' with the traces $A'C_0$, $A'B_0$, which are of the *seventh type* [43.], we obtain, for the intersections of that line $\Lambda_{2,2}$ with two new planes $\Pi_{2,2}$, namely with $A'C_1C_2$ and $A'B_1B_2$ (98), two new points, belonging to a new or *eighth group* $P_{2,8}$ of *second construction*, namely,

$$A^{IX} = (23\bar{1}); \quad A_1^{IX} = (2\bar{1}3);$$

whereof the former may be selected, as a *Tenth* (and, for our purpose, *last*) *Typical Point*: for the *sixty* points of this last group represent each *one* intersection, and thus account for *all* the intersections which lately *remained* [49.], after all the preceding groups had been exhausted.

[51.] We are now therefore enabled to assert that the proposed *Enumeration of the Points* P_2 *of Second Construction*, and the proposed *Classification of such Points in Groups*, have both been completely effected. For the *number* of such *groups* $P_{2,1}, \ldots P_{2,8}$ has been seen to be *eight*, represented by the 8 *typical points*, $A'' \ldots A^{IX}$; which, along with the *first given point* A, and the *first derived point* A′, make up a system of *ten types*, as follows:

$$A = (100);\ A' = (011);\ A'' = (01\bar{1});\ A''' = (211);\ A^{IV} = (\bar{2}11);$$

$$A^{V} = (021);\ A^{VI} = (02\bar{1});\ A^{VII} = (12\bar{1});\ A^{VIII} = (321);\ A^{IX} = (23\bar{1});$$

and the *number* of the *points* P_2 is (10 + 30 + 30 + 20 + 20 + 60 + 60 + 60 =) 290; so that, when combined with the points P_1, they make up a system of exactly *three hundred points*, P_1, P_2, *derived from the five points* P_0.

[52.] It is to be remembered that the three other *ternary types*,

$$D_1 = (111),\ A_0 = (\bar{1}11),\ A_1^{IV} = (311),$$

have been seen to represent points which are, in the *quinary* sense, *syntypical* with A′, A''', A^{IV}, and therefore belong to the same three groups, $P_{1,1}$, $P_{2,2}$, $P_{2,3}$; all these three points being in the plane ABC, and on the line $AA'D_1$. And it is evident that the five other points,

$$A_1^{V} = (012);\ A_1^{VI} = (0\bar{1}2);\ A_1^{VII} = (1\bar{1}2);\ A_1^{VIII} = (312);\ A_1^{IX} = (2\bar{1}3),$$

belong (as has been seen) to the same five last groups, $P_{2,4}, \ldots P_{2,8}$, as the five points above selected as typical thereof, namely the points $A^{V} \ldots A^{IX}$, and are situated on the same two typical lines, BC and B′C′. The transition from A′ to B′, C′, or from A'' to B″, C″, &c., is very easily made, by a rule already stated [20.]; and therefore it is unnecessary to write down here the symbols for *these* derived points, B′, B″, &c., or C′, C″, &c. But we must now proceed, in the remainder of this Paper, to investigate some of the chief *Geometrical Relations* which connect the points, lines, and planes of the *Net*, so far as they have been hitherto determined: namely, to the end of the *Second Construction*.

Part III.—*Applications to the Net, continued: Enumeration and Classification of the Collineations of the Fifty-Two Points in a Plane of First Construction.*

[53.] The plane ABC has been seen to contain, besides the three points P_0 which determine it, four points P_1, namely A′, B′, C′, and D_1; and it contains forty-five points P_2, namely the three points A″, B″, C″ of the group $P_{2,1}$, and six points of each of the seven remaining groups of second construction. This *plane* Π_1 contains therefore *fifty-two points* P_0, P_1, P_2; and we propose to examine, in the first place, the various *relations of collinearity* which connect these different points among themselves: intending afterwards to investigate their principal *harmonic and involutionary relations*.

[54.] The points on the *first typical line* BC [23.] are, in number, *eight;* their literal symbols being, by what precedes,

$$B,\ C,\ A',\ A'',\ A^{V},\ A_1^{V},\ A^{VI},\ A_1^{VI};$$

the ternary symbols corresponding to which have been shown to be,

$$(010),\ (001),\ (011),\ (01\bar{1}),\ (021),\ (012),\ (02\bar{1}),\ (0\bar{1}2).$$

In fact, that these eight points are all on the line BC, is evident on mere inspection of their *symbols*, which are all of the common *form*,

$$(0yz)\quad [23.].$$

[55.] The points on the *second typical line*, AA' [30.], are in number *seven:* their literal symbols being,

$$A,\ A',\ D_1,\ A''',\ A_0,\ A^{IV},\ A_1^{IV};$$

and their ternary symbols being,

$$(100),\ (011),\ (111),\ (211),\ (\bar{1}11),\ (\bar{2}11),\ (311).$$

In fact, each of these seven symbols is evidently of the form (*tuu*), or (*xyy*) [30.].

[56.] The points on the *third typical line*, B'C' [31.], are in number *ten;* namely the points,

$$B',\ C',\ A'',\ A''',\ A^{VII},\ A_1^{VII},\ A^{VIII},\ A_1^{VIII},\ A^{IX},\ A^{IX},$$

of which the ternary symbols are,

$$(101),\ (110),\ (01\bar{1})\ (211),\ (12\bar{1}),\ (1\bar{1}2),\ (321),\ (312),\ (23\bar{1}),\ (2\bar{1}3);$$

each of these ten symbols being of the form (σtu) [31.], with $\sigma = t + u$, as before.

[57.] These *three* typical *lines*, in the plane ABC, which may be denoted by the ternary symbols, [100], [01$\bar{1}$], [$\bar{1}$11], and represent a system of *nine lines* Λ_1, Λ_2 in that plane Π_1, are also three typical *traces* [43.] of *other* planes thereon; and the remaining traces of such planes are in number *thirteen*, represented by *four* other lines, as *types:* of which lines, considered as such traces, the ternary symbols have been found [43.] to be,

$$[111],\ [011],\ [\bar{2}11],\ [\bar{2}1\bar{1}];$$

answering to the literal symbols,

$$A''B''C'',\ AA'',\ D_1A'',\ A'C_0,$$

and serving as abridged expressions for the four *equations* of ternary form,

$$x + y + z = 0,\quad y + z = 0,\quad 2x = y + z,\quad 2x = y - z.$$

[58.] Each of these four last lines passes through *six* points; thus the trace [111] passes through the points $(01\bar{1})$ $(\bar{1}01)$ $(1\bar{1}0)$ $(\bar{2}11)$ $(12\bar{1})$ $(11\bar{2})$, or through $A''' B'' C'' A^{IV} B^{IV} C^{IV}$; [011] through (100) $(01\bar{1})$ $(\bar{1}11)$ $(11\bar{1})$ $(2\bar{1}1)$ $(21\bar{1})$, or $AA'' B_0 C_0 C^{VII} B_1^{VII}$; $[\bar{2}11]$ through (111) $(01\bar{1})$ (102) (120) (213) (231), or $D_1 A'' B^V C_1^V C^{VIII} B_1^{VIII}$; and $[\bar{2}1\bar{1}]$ through (011) $(11\bar{1})$ (131) (120) $(\bar{1}02)$ $(23\bar{1})$, or $A' C_0 B_1^{IV} C_1^V B^{VI} A^{IX}$; the correctness of the *ternary symbols* being evident on inspection, if the law $lx + my + nz = 0$ (76) be remembered: and the *literal symbols* being thence at once deduced, by [51.] and [52.].

[59.] *So far*, then, that is when we attend only to the *twenty-two traces* [43.] of planes Π_1, Π_2 on the plane ABC, we find a system of three collineations of eight points; three of seven points; three of ten points; and thirteen of six points each. Each collineation of the first of these four systems *counts* as 28 binary combinations of the 52 points in the plane [53.]; each of the second system counts as 21 such combinations; each of the third system as 45; and each of the fourth as 15. We therefore account, in this way, for $84 + 63 + 135 + 195 = 477$ binary combinations; but the total number is $26.51 = 1326$; there remain then 849 to be accounted for, by lines A_3 which are *not traces*, of any one of the foregoing groups.

[60.] In seeking for such new lines, it is natural to consider first those which pass through one or other of the three given points A, B, C; and the *types* of such are found to be the five following, each representing a new group of six lines A_3:

$$[021]; \quad [02\bar{1}]; \quad [03\bar{1}]; \quad [03\bar{2}]; \quad [031].$$

As *symbols*, these answer respectively to the five new *lines*:

(100) $(11\bar{2})$ $(01\bar{2})$ $(1\bar{1}2)$ $(3\bar{1}2)$,	or $AC^{IV} A_1^{VI} A_1^{VII} C^{IX}$;
(100) (112) (012) $(\bar{1}12)$ (312),	or $AC''' A_1^V B^{VII} A_1^{VIII}$;
(100) (113) (213),	or $AC_1^{IV} C^{VIII}$;
(100) (123) $(\bar{1}23)$,	or $AC_1^{VIII} B^{IX}$;
(100) $(2\bar{1}3)$,	or AA_1^{IX}.

We have thus *twelve* lines A_3, each connecting a point P_0, with *four* points P_2, and counting as *ten* binary combinations; *twelve* other lines, each connecting a point P_0 with *two* points P_2, and counting as *three* such combinations; and *six* lines, each of which connects a point P_0 with *one* point P_2, and counts as only *one* combination. In this manner, then, we account for $120 + 36 + 6 = 162$, out of the 849 which had remained in [59.]; but there still remain 687 combinations to be accounted for, by new lines of third construction, which pass through no given point.

[61.] Considering next the new lines which connect a point of the *first* construction, with one or more points of the *second*, we find these five new types,

$$[31\bar{1}];\ [12\bar{2}];\ [12\bar{3}];\ [13\bar{3}];\ \text{and}\ [13\bar{4}];$$

which as *symbols* denote the five lines,

$$\left.\begin{array}{r}(011)\,(1\bar{2}1)\,(1\bar{1}2);\ (011)\,(201)\,(2\bar{1}0);\ (111)\,(2\bar{1}0)\,(\bar{1}21);\\ (011)\,(312);\ (111)\,(\bar{1}32);\end{array}\right\}$$

or $A'\,B^{IV}\,A_1^{VII}$; $A'\,B_1^{V}\,C^{VI}$; $D_1\,C^{VI}\,C_1^{VII}$; $A'\,A_1^{VIII}$; and $D_1\,C_1^{IX}$;

but as *types* represent each a *group* of *six lines*. We thus get 18 new lines, each passing through 1 point P_1, and 2 points P_2; and 12 other lines, each connecting a point P_1 with only *one* point P_2. And these thirty lines Λ_2 account for 54 + 12 = 66 binary combinations of points; leaving however 621 such combinations to be accounted for, by new lines Λ_3, of which each must connect at least two points P_2, without passing through any point P_0 or P_1, and without being any one of the traces already considered.

[62.] The *symbol* $[\bar{2}33]$, which denotes a line passing through *two* points P_2, namely, $(01\bar{1})$ and (311), or A'' and A_1^{IV}, but through *no other* point, represents, when considered as a *type*, a group of *three* such lines; and 40 *other types*, as for example $[1\bar{3}4]$, which as a symbol denotes the line $(\bar{1}11)$ (132), or $A_0\,B^{VIII}$, are found to exist, representing each a group of *six* lines, whereof each connects in like manner *two* points P_2, but *only* those two points. We have thus a system of 243 new lines, which represent only so many binary combinations: and there remain 378 such combinations to be accounted for, by new lines Λ_3, whereof each must connect *at least three points* P_2.

[63.] For lines connecting *three* such points, and *no more*, it is found that there are *twenty types;* whereof *eight*, as for instance the type $[\bar{3}11]$, which as a symbol denotes the line $(01\bar{1})$ (121) (112), or $A''\,B'''\,C'''$, represent each a group of *three* such lines; while each of the *twelve others*, like $[1\bar{2}3]$, which as a symbol denotes the line $(\bar{1}11)$ (121) (210), or $A_0\,B'''\,C^{V}$, represents a group of *six* lines. We have thus 96 new lines, counting as 288 binary combinations: but we must still account for 90 *other* combinations, by new lines Λ_2, connecting each *more than three points* P_2.

[64.] Accordingly, we find *three new types of lines*, which *alone remain*, when all those which have been above exhibited, or alluded* to, are set aside: namely

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* It has been thought that it could not be interesting to set down *all* the *types of lines*, above referred to; especially as those which relate to lines *not* passing through *at least four points* give rise, at the present stage of the construction, to no *theorems* of *harmonic* (or *anharmonic*) *ratio*.

$$[1\bar{2}4];\ [\bar{1}24];\ [112].$$

And these represent, respectively, groups of *six*, of *six*, and of *three* new lines, and therefore on the whole a system of *fifteen* new lines, each passing *through four points* P_2, and consequently counting as *six* combinations; for example, as *symbols*, they denote the three following lines:

$$(210)\ (\bar{2}11)\ (021)\ (231),\ \text{or}\ C^{V}A^{IV}A^{V}B_1{}^{VIII};$$

$$(210)\ (2\bar{1}1)\ (02\bar{1})\ (23\bar{1}),\ \text{or}\ C^{V}C^{VII}A^{VI}A^{IX};$$

$$(20\bar{1})\ (1\bar{1}0)\ (02\bar{1})\ (11\bar{1}),\ \text{or}\ B_1{}^{VI}C''A^{VI}C_0.$$

But $6.15 = 90$; we are therefore entitled to say, that *all the* 1326 *binary combinations* [59.], *of the* 52 *points* P_0, P_1, P_2 [53.] *in the plane* ABC, *have now been fully accounted for.*

[65.] Collecting the results, respecting the *collineations in the plane* ABC, it has been found that there are 261 *lines* A_3, whereof each *connects two*, but *only two*, of the 52 *points* in that plane; and that *these lines*, which at the present stage of the construction are not properly *cases of collinearity* at all, are represented by a system of 44 *ternary types.*

[66.] There are 126 *other lines* A_3, each connecting *three* (but *only three*) *points;* they are represented by a system of 25 *types;* and account for 378 binary *combinations.*

[67.] There are 15 lines A_3, each connecting *four points* P_2; they are represented by a system of 3 types, and account for 90 combinations.

[68.] There are 12 lines A_3, each connecting *one* point P_0 with *four* points P_2; they are represented by 2 types, and represent 120 combinations.

[69.] There are 13 other lines A_3, namely the *traces of planes* Π_1 or Π_2, whereof each connects *six points*, namely a point P_0 or P_1 with five points P_2, or else six points P_2 with each other; they are represented by 4 types, and account for 195 combinations.

[70.] There are 3 lines $A_{2,2}$, each connecting *two* points P_1 with *eight* points P_2; they have one common type, and represent 135 combinations.

[71.] There are, in like manner, 3 lines $A_{2,1}$, each connecting *one point* P_0 with *two points* P_1, and with *four points* P_2, but having only *one* common type; and they represent 63 combinations.

[72.] Finally, there are (in the same plane) 3 *lines* A_1, each connecting *two points* P_0 with *one point* P_1, and with *five points* P_2; these lines also have all *one type;* and they account for 84 *combinations:* with the *arithmetical verification*, that

$$261 + 378 + 90 + 120 + 195 + 135 + 63 + 84 = 1326 = 26.51;$$

which proves that the *enumeration* is *complete.*

[73.] The *total number of distinct lines*, above obtained, is $261 + 126 + 15 + 12 + 13 + 3 + 3 + 3 = 436$; and the total number of their *ternary types* is 81. But *if we set aside* (as conducting to *no general metric relations*) *all those lines which contain fewer than four points*, there *then remain only forty-nine lines*, and *only twelve types*, to be discussed, with reference to *harmonic* (or *anharmonic*) *relations*, of the points upon those lines.

[74.] For the purpose of studying completely all *such* relations, it will therefore be permitted to confine ourselves to the *three first typical lines*, BC, AA′, B′C′, or [100], [011], [$\bar{1}$11]; the *four other typical traces*, A″B″C″, AA″, D_1A'', $A'C_0$, or [111], [011], [2$\bar{1}$1], [2$\bar{1}\bar{1}$]; and *five new typical lines* Λ_3, connecting each *at least four points*: namely the *two lines*, [021] and [02$\bar{1}$], of [60.], whereof each connects the given point A with *four* points P_2; and the *three lines* [1$\bar{2}$4], [$\bar{1}$24], [112], of [64.], of which each connects *four* other points P_2 among themselves, but does not pass through any point P_0, or P_1.

PART IV.—*Applications to the Net, continued: Harmonic and Involutionary Relations, of the Points situated on the Twelve Typical Lines, in a Plane of First Construction.*

[75.] Commencing here with the examination of the last typical lines, because they contain only *four* points each, let us adopt, as temporary symbols, of the *literal* kind, the ten following:

$$\begin{array}{llll} a = (210), & b = (\bar{2}11), & c = (021), & d = (231); \\ & b' = (2\bar{1}1), & c' = (02\bar{1}), & d' = (23\bar{1}); \\ a'' = (20\bar{1}), & b'' = (1\bar{1}0), & & d'' = (11\bar{1}); \end{array}$$

instead of the more systematic but less simple symbols, $C^{V}\ A^{IV}\ A^{V}\ B_1^{VIII}\ C^{VII}\ A^{VI}\ A^{IX}\ B_1^{VI}\ C''\ C_0$.

[76.] The three lines referred to [64.], are then the three following:

$$abcd; \quad ab'c'd'; \quad a''b''c'd''.$$

And because we have (comp. [16.]) the six symbolical relations,

$$\begin{array}{llll} (c) - (a) = (b); & (c) + (a) = (d); \\ (a) - (c') = (b'); & (a) + (c') = (d'); \\ (a'') - (c') = 2(b''); & (a'') + (c') = 2(d''), \end{array}$$

it results (31) that the three *harmonic equations* exist:

$$(abcd) = (ab'c'd') = (a''b''c'd'') = -1.$$

We have therefore this *Theorem*:—

"*Each of the* 150 *lines* Λ_3, *which connect four points* P_2, *in any one of the ten planes* Π_1, *and pass through no other of the* 305 *points* P_0, P_1, P_2, *is harmonically divided.*"

[77.] As verifications, the three right lines bb', cc', dd' concur in the point C; bd', cc', db', in B; aa'', $b'b''$, $d'd''$, in A′; and aa'', $b'd''$, $d'b''$, in a point P_3, namely in $(41\bar{1})$: the existence of which four *concurrences* of lines was to be expected, from a known principle of *homography*, as consequences of the harmonic relations [76.]. It is worth noticing, however, how simply these concurrences are here *expressed*, by the *ternary symbols* of the *points*, according to the *law* (18); or, if we choose, by the corresponding symbols of the *lines*, with the analogous law (25): for example, the three last concurrent lines, aa'', &c., have for their respective symbols, $[1\bar{2}2]$, $[011]$, and $[115] = [1\bar{2}2] + [033]$.

[78.] To examine, in like manner, the analogous relations of arrangement, on the two new typical lines [60.], namely $[021]$ and $[02\bar{1}]$, whereof each connects the given point A with four points of second construction, let us write as eight new temporary symbols of the literal kind, more convenient than the former symbols, $C^{IV}\,A_1^{VI}\,A_1^{VII}\,C^{IX}\,B^{VII}\,A_1^{V}\,C'''\,A_1^{VIII}$, the following:

$$b = (11\bar{2}), \quad c = (0\bar{1}2), \quad d = (1\bar{1}2), \quad e = (3\bar{1}2);$$
$$\beta = (\bar{1}12), \quad \gamma = (012), \quad \delta = (112), \quad \epsilon = (312);$$

so that the two lines in question are,

$$Abcde, \text{ and } A\beta\gamma\delta\epsilon.$$

We have thus the eight following new symbolical relations, A being still $= (100)$:

$$(A) - (c) = (b), \quad (A) + (c) = (d); \quad (e) - (b) = 2(d), \quad (e) + (b) = 4(A);$$
$$(\gamma) - (A) = (\beta), \quad (\gamma) + (A) = (\delta); \quad (\epsilon) + (\beta) = 2(\delta), \quad (\epsilon) - (\beta) = 4(A);$$

whence result at once the *four harmonic relations*,

$$(Abcd) = (Abde) = (A\beta\gamma\delta) = (A\beta\delta\epsilon) = -1.$$

These *two* lines from A are therefore *homographically divided*, the point A corresponding to *itself*, and b to β, &c.; and accordingly the *four right lines*, $b\beta$, $c\gamma$, $d\delta$, $e\epsilon$, *which connect corresponding points*, concur in one common point, which is easily found to be B. And other *verifications*, by such *concurrences*, can be assigned with little trouble.

[79.]. It may assist the conception of the *common law of arrangement*, of the *five points* on each of the *two typical lines* last considered, to suppose that the joining line $b\beta$ is *thrown off*, by projection, *to infinity*: or, what comes to the same thing, that the *two points* b and β, themselves, are thus made infinitely distant. For thus the harmonic equations [78.] will simply express that, *in this projected state of the figure*, the *four points*, d, e, δ, ϵ, *bisect* respectively the *four intervals*, Ac, Ad, $A\gamma$, $A\delta$; whence it is easy to construct a diagram, not necessary here to be exhibited. The consideration of the *two other lines* through the same given point A, which have $[012]$ $[0\bar{1}2]$ for their symbols, and

belong to the same two types as the two last, would offer to our notice a *pencil of four rays*, which has some interesting properties, especially as regards its *intersections* with *other* pencils, but which we cannot here delay to describe.

[80.] It may, however, be worth while to state here, as a consequence from the preceding discussion, this other *Theorem*:—

"*The* 120 *lines* Λ_3, *in the ten planes* Π_1, *whereof each connects a point* P_0 *with four points* P_2, *and with no other of the* 305 *points, although not all syntypical, are all homographically divided.*"

[81.] Proceeding to consider the arrangements of those six typical lines [58.] which contain each *six points*, we find that whether we write, as new temporary and literal symbols,

$$a = (01\bar{1}),\ b = (\bar{1}01),\ c = (1\bar{1}0),\ a' = (2\bar{1}1),\ b' = (1\bar{2}1),\ c' = (11\bar{2}),$$

or $a = (011),\ b = (11\bar{1}),\ c = (120),\ a' = (23\bar{1}),\ b' = (131),\ c' = (\bar{1}02)$,

the six points $abca'b'c'$ being in the one case on the line [111], and in the other case on the line $[\bar{2}1\bar{1}]$, we have in each case the three harmonic equations:

$$(caba') = (abcb') = (bcac') = -1.$$

We may then at once infer this *Theorem*:

"*The* 70 *lines* Λ_3, *in the ten planes* Π_1, *which are represented by the fourth and seventh typical traces of planes on the plane* ABC, *although not all syntypical* (or generated by similar processes of construction), *are all homographically divided.*"

[82.] This *common mode* of their *division* may deserve, however, a somewhat closer examination, its consequences being not without interest. When any six collinear points, $a \ldots c'$, are connected by the three equations [81.], we are permitted to suppose that their symbols are so *prepared* (if necessary), by *coefficients*,* as to give,

$$(a) + (b) + (c) = 0;$$

$$(a') = (b) - (c),\ (b') = (c) - (a),\ (c') = (a) - (b);$$

and therefore,

$$(a') + (b') + (c') = 0,$$

$$3(a) = (c') - (b'),\ 3(b) = (a') - (c'),\ 3(c) = (b') - (a').$$

Whenever, then, the three harmonic equations [81.] *exist, for a system of six collinear points,* $a \ldots c'$, *the three other harmonic equations*, formed by interchanging accented and unaccented letters,

$$(c'a'b'a) = (a'b'c'b) = (b'c'a'c) = -1,$$

* For example, in the second case [81.], we should change the symbols for c and b' to their negatives, before employing the formulæ of [82.].

are also satisfied; and *the three pairs* (or *segments*),

$$aa',\ bb',\ cc',$$

*which connect corresponding points, compose an involution.**

[83.] Under the same conditions, the two points a and a' are harmonically conjugate to each other, not only with respect to b and c, but also with respect to b' and c'; they are therefore the *double points* (or *foci*) of that *other involution* which is determined by the *two pairs* of points, bc, $b'c'$. In like manner, b, b' are the double points of the involution, determined by the two pairs, or segments, ca, $c'a'$; and c, c' are the double points of the involution determined by ab, $a'b'$.

[84.] From any one of the three last involutions [83.], we could *return*, by known principles, to the involution [82.]; we can also infer from them that the *three new pairs of points* (or *segments of the common line*), aa', bc', cb'; the three pairs, or segments, bb', ca', ac'; and the three others, cc', ab', ba', form *three other involutions*, making *seven distinct involutions of the six points*, so far: in *three* of which, as we have seen in [83.] *two* of those *six points* are *their own conjugates*.

[85.] For these and other reasons we propose to say, that *when any three collinear points* (as a, b, c) *are assumed* (or *given*), *and three other points on the same line are derived from them, by the condition that each shall be the harmonic conjugate of one, with respect to the other two, then these two sets of points are two Triads of Points in Involution.* And it is easy to extend this definition so as to include cases of two *triads* of complanar and co-initial *lines*, or of collinear *planes*, which shall be, in the same general but (as it is supposed) *new sense*, in *involution* with each other: every such *involution of triads* including, by what precedes, a *system of seven involutions* of the *old* or *usual* kind.

[86.] For example, because the two *triads of points*, $A''B''C''$ and $A^{IV}B^{IV}C^{IV}$, are thus in involution, by the equations [81.] applied to the fourth typical trace [43.], it follows that the *two pencils*, each of *three rays*,

$$D_1 \,.\, A''B''C'', \text{ and } D_1 \,.\, ABC,$$

are *triads of lines, in involution* with each other; and that, for a similar reason, the *two triads of planes*, all passing through the line DE,

$$DEA,\ DEB,\ DEC, \text{ and } DEA'',\ DEB'',\ DEC'',$$

are, in the sense above explained, in *involution*. In fact, when the point D_1 is thus taken as a *vertex of the pencils* in the plane ABC, the three harmonic equations of the first case [81.], namely,

$$(C''A''B''A^{IV}) = (A''B''C''B^{IV}) = (B''C''A''C^{IV}) = -1,$$

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* Compare p. 127 of the *Géométrie Supérieure* (Paris, 1852). In general, the reader is supposed to be acquainted with the chapter (chap. ix.) of that excellent work of M. *Chasles*, which treats of *Involution*.

or rather the three reciprocal equations (comp. [82.]),

$$(C^{IV}\,A^{IV}\,B^{IV}\,A'') = (A^{IV}\,B^{IV}\,C^{IV}\,B'') = (B^{IV}\,C^{IV}\,A^{IV}\,C'') = -1,$$

correspond simply to the elementary equations, (50), (56),

$$(CA'BA'') = (AB'CB'') = (BC'AC'') = -1,$$

which may be employed to *define* the three important points A'', B'', C'', (87), of the *first group* of *second construction* [40.], as being the (well known) *harmonic conjugates* of the points A', B', C' of *first* construction, with respect to the three *lines* of the same first construction, BC, CA, AB, on which those points are situated.

[87.] The equations [82.], which connect the *symbols* $(a)\,..\,(c')$ of the *six points*, give, by easy eliminations, these other equations of the same kind:

$$(b') = (b) + 2(c);\ -(c') = 2(b) + (c);$$

we have therefore, by (31), the following *anharmonic of the group b, b', c, c'*:

$$(bb'cc') = +4;$$

and other easy calculations of the same sort given, in like manner, the equal anharmonics,

$$(cc'aa') = +4;\ (aa'bb') = +4.$$

But in general, for any four collinear points, *a*, *b*, *c*, *d*, the *definition* (29) of the *symbol* $(abcd)$ gives easily the relation,

$$(abcd) + (acbd) = 1;$$

and hence, or immediately by calculations such as those recently used, we have this *other* set of anharmonics, with a *new* common value:

$$(bcb'c') = (cac'a') = (aba'b') = -3;$$

the *negative* character of which shows, by the same definition (29), that the segment (or interval) *aa'*, for example, is cut *internally* by *one* of the two points *b*, *b'*, or by one of the two points *c*, *c'*, and *externally* by the *other*: with similar results for each of the two other segments, *bb'*, *cc'*.

[88.] We may then say that *each of the three segments, aa', bb', cc', overlaps each of the two others*, in the sense that *any two* of them have a *common part*, and also *parts not common*: whence it immediately follows that the *involution* [82.], *to which these three segments belong, has its double points imaginary*: whereas it may be proved, on the same plan, that each of the three involutions of segments mentioned in [84.], namely *aa', bc', cb'*; *bb', ca', ac'*; *cc', ab', ba'*, has *real* double points*; and the double points of the three other involutions, determined by the three

* The determination of these double points gives rise naturally to some new theorems, which cannot conveniently be stated here.

pairs of segments, *bc*, *b'c'*; *ca*, *c'a'*; *ab*, *a'b'*, are likewise *real*, and have been assigned [83.]; namely, in each of these three last cases, the two remaining points of the system.

[89.] Now, in general, when the *foci* (or double points) of an involution of collinear segments, *aa'*, *bb'*, . . . are *imaginary*, so that *conjugate points*, *a*, *a'*, or *b*, *b'*, &c., fall at *opposite sides* of the *central point* O, it is known, and may indeed be considered as evident, that if an *ordinate* OP be erected, equal to the constant *geometrical mean* between the two distances O*a*, O*a'*, or O*b*, O*b'*, &c., then, *all the segments aa'*, *bb'*, &c., *subtend right angles, at the extremity* P *of this ordinate*. It follows, then, by what has been proved in [82.] and [88.], and by the *first case* of [81.], that *each of the three segments* $A''A^{IV}$, $B''B^{IV}$, $C''C^{IV}$, *of the fourth typical trace* [43.], *subtends a right angle at some one point*, P, *in the plane* ABC, or rather generally at *each* of *two* such points: and in like manner, by the *second case* [81.], that each of the *three other segments*, $A'A^{IX}$, $C_0B_1^{IV}$, $C_1'B^{VI}$, of the *seventh typical trace*, subtends a *right angle*, at each of two *other* points, P, P', in the same plane.

[90.] *These* results, by their nature, like *all the foregoing results* of the present Paper, are quite *independent of the assumed arrangement of the five given* (or *initial*) *points of space* A . . E, and are *unaffected by projection*, or *perspective*. In saying this, it is not meant, of course, that one *right angle* will generally be *projected* into *another*; or that the *new point* P, at which the *three new segments* $A''A^{IV}$, $B''B^{IV}$, $C''C^{IV}$, or $A'A^{IX}$, $C_0B_1^{IV}$, $C_1'B^{VI}$, *subtend* right angles, will be itself (what may be called) the *projection* of the *old point* P [89.], which was so related to the three *old segments*, denoted by the same literal symbols, when the *arrangement* (or *configuration*) of the five *initial* points is *varied*, by a process *analogous* to projection. We only assert that there will *always*, in *every state* of the Figure, or of the *Net*, be *some point* P, possessing the above-mentioned property: or rather that there will be a *circle* of such points *in space*, having for its *axis* the *line* to which the three segments belong.

[91.] To fix a little more definitely the conceptions, let A, B, C, D be supposed, for a moment, to be the *corners* of a *regular pyramid*, with E for its *mean point*, or *centre of gravity*. With this *arrangement* of the five *given* points P_0, *six* of the *derived* points P_1, namely A', B', C', A_2, B_2, C_2, *bisect* the *six edges*, BC, CA, AB, DA, DB, DC, of the given pyramid; and the *four* other points P_1, namely A_1, B_1, C_1, D_1, are the *mean points* of the *four faces*, opposite to A, B, C, D. *Six* of the ten points $P_{2,1}$, namely A'', B'', C'', A_2', B_2', C_2', are now *infinitely distant*; and the *line* $A''B''C''$ $A^{IV}B^{IV}C^{IV}$ to which three of the lately mentioned *segments* belong, becomes the *line at infinity* in the plane ABC: which might seem, at first sight, to render difficult, with respect at least to *them*, the verification of a recent theorem [89.]. That theorem is, however, verified in a very simple manner, by observing that, with the arrangement here conceived, *the three angles* $A''D_1A^{IV}$, $B''D_1B^{IV}$, $C''D_1C^{IV}$, which those *infinite* and *infinitely distant segments* may be imagined to *subtend* at the point D_1, *are all right*

angles; D_1A'', for example, being *parallel* to the *side* BC of the *triangle* ABC, which is now an *equilateral* one; while D_1A^{IV} is *perpendicular* to the same side, because it is drawn from the *mean point* D_1, and passes through the *opposite corner*, A. As another verification of the theorem [89.], it will be found that, with the arrangement here supposed, the *segments* $A'A^{IX}$, $C_0B_1^{IV}$, $C_1^{V}B^{VI}$, *of the seventh trace* [43.], *subtend right angles at the given point* B.

[92.] The *involution of the three segments* [82.] is only *one* of the consequences of the *three harmonic equations* [81.], or of what we have called in [85.] the *Involution of the two Triads, abc* and *a'b'c'*. We can therefore *infer more*, respecting the *geometrical relations* of the *six points*, even in the *general state* of the whole *Figure*, or NET, than merely that those three segments subtend *right angles*, as above, *at every point of one real circle*, which has its *centre on the common line*, and its *plane perpendicular thereto*. The *order of succession* of the six points being supposed to be the following, *ac'ba'cb'*, from which it can only differ, if at all, by changes not important to the argument, let P be, as in [90.], a point such that the angles *aPa'*, *bPb'*, *cPc'* are *right*. Then, because the *three pencils*,

$$P.\ ac'bc,\quad P.\ c'ba'b',\quad \text{and}\quad P.\ ba'ca,$$

are all *harmonic* pencils by [81.], it follows that (with the supposed *order* of the points) the lines Pc' and Pc are respectively the *internal* and *external bisectors* of the *angle aPb*; Pb and Pb', of the angle c'Pa'; and Pa', Pa, of *bPc*: the line Pc bisecting also the angle a'Pb' internally. Hence it is easy to infer the following *continued equation between angles* (which is supposed to be new):

$$aPc' = c'Pb = bPa' = a'Pc = cPb' = \frac{\pi}{6};$$

and therefore we may enunciate this *Theorem*:—"*When six collinear points form a system of two triads in involution, their five successive intervals subtend angles each equal to the third part of a right angle, at every point of a certain circle, of which the axis is their common line.*"

For example, with the particular arrangement [91.] of the five initial points A . . E, it is found that the five successive portions, C_0A^{IX}, $A^{IX}C_1^{V}$, $C_1^{V}B_1^{IV}$, $B_1^{IV}A'$, $A'B^{VI}$, of the seventh trace, subtend each an angle of *thirty degrees*, at the given point B; and the six lines D_1A'', D_1C^{IV}, D_1B'', D_1A^{IV}, D_1C'', D_1B^{IV}, if suitably distinguished from their own opposites, succeed each other at angular intervals, of the same common amount.

[93.] In general, if *three equally inclined diameters* of a circle, forming a regular and *six-rayed star*, be taken as a *given triad of lines* [85.], the *triad in involution* therewith is represented by that *other star* of the same kind, of which the diameters *bisect the angles* between those of the former star: so that if we consider any *six successive rays* of the *compound* or *twelve-rayed star*, which results from the combination of these *two*, their *successive angles* are evidently each equal to thirty degrees.

But we now see further, that if a *star* of this last kind be *cut in six points* by an *arbitary transversal* in its plane; and if these six points of section be in any manner put into perspective, by any *new* pencil and transversal: the *six new points*, thus obtained, as forming still *two triads in involution*, must admit of having their *five successive intervals seen*, from *every point* of some *new circle*, under *angles still equal each* to the same *third part of a right angle.*

[94.] We have not yet considered the arrangement of the six points on either the *fifth* or the *sixth* typical *trace* [43.]; but it is easy to do this as follows. Let $abca\beta\gamma$ denote, as new temporary symbols, either the six points of the fifth trace (comp. [58.]),

I. $a = (100)$, $b = (1\bar{1}1)$, $c = (11\bar{1})$, $\alpha = (01\bar{1})$, $\beta = (21\bar{1})$, $\gamma = (2\bar{1}1)$;

or these six other points, belonging to the sixth trace,

II. $a = (111)$, $b = (102)$, $c = (120)$, $\alpha = (01\bar{1})$, $\beta = (231)$, $\gamma = (213)$;

we shall then have, in each case, the three harmonic equations,

$$(baca) = (c\beta a a) = (a\gamma ba) = -1.$$

In *each* case, therefore, we may consider ourselves as first deriving from three points a fourth, as the harmonic conjugate of the first with respect to the other two; and then deriving a fifth point, and a sixth, as the harmonic conjugates of that fourth point, with respect, on the one hand, to the third and first points; and on the other hand, to the first and second points of the system.

[95.] Having regard merely to this *common law*, we may enunciate (comp. [80.] [81.]) this theorem:—

"*The sixty lines, in the ten planes of first construction, represented by the fourth and fifth typical traces of the planes on the plane* ABC, *although not all syntypical, are all homographically divided.*"

And this *common mode* of their *division* is such, that if the fourth point be thrown off to infinity, the first point bisects the interval between the second and third; the fifth point bisects the interval between third and first; and the sixth point bisects the interval between first and second: so that, on the whole, we have a *finite line*, *bc*, *quadrisected* in the points γ, a, β, and cut at infinity in α; whereas if, on either the *fourth* or the *seventh* trace, *one* of the six points, but only one, had been thus made *infinitely distant*, the *five others* would have presented the figure of a *finite right line*, *bisected* and *trisected*. With the equations [94.], if a, instead of a, be projected to infinity, it is then the line $\beta\gamma$ which is quadrisected, namely, in the points c, a, b. In general, with these last equations, the *first set* of three points, *abc*, can be *derived* from the *second set*, $a\,\beta\,\gamma$, by the *same rule* [94.], as that by which the second set has been derived from the first: so that there is a sense in which *these two sets* may be said to be *reciprocal triads*, although they are *not triads in involution*, according to the definition [85.].

[96.] It may be added that, on either the *fifth* or the *sixth* trace, the two points which we have called *first* and *fourth*, are the *double points* of a new *involution*, determined by the *two pairs*, *second* and *third*, *fifth* and *sixth*; or, with the recent notations [94.], that aa are the *foci* of the involution $bc, \beta\gamma$; because the three last harmonic equations conduct to this fourth equation,

$$(\beta a \gamma a) = -1.$$

[97.] And, as regards the *homography* of the divisions on the same two traces, if we denote, for the sake of distinction, the six points on the sixth trace by $a' \ldots \gamma'$, then (because $a' = a$) the *five lines* aa', bb', cc', $\beta\beta'$, $\gamma\gamma'$, or (comp. [58.]) the five lines,

$$\text{A}D_1,\ B_0B^{\text{v}},\ C_0C_1^{\text{v}},\ B_1^{\text{vii}}B_1^{\text{viii}},\ C^{\text{vii}}C^{\text{viii}},$$

ought to *concur* in some *one point* which accordingly it is easy to see that they do, namely in the point A''; in fact, with the recent signification of $a, \ldots$ and $a', \ldots$, we have the symbolic equations,

$$(a') - (a) = (b') - (b) = (c') - (c) = (011) = (\text{A}');$$

and

$$(\beta') - (\beta) = (\gamma') - (\gamma) = (022) = 2(\text{A}').$$

[98.] The *two sets of six points*, on these two traces, with one point common, are thus the points in which a certain *six-rayed pencil*, with A' for vertex, is *cut* by the two traces as transversals; the *symbols* of the six *rays* being the following:

$$\text{A}'\text{A}D_1 = [01\bar{1}];\ \text{A}'B_0B^{\text{v}} = [\bar{2}11];\ \text{A}'C_0C_1^{\text{v}} = [\bar{2}1\bar{1}];$$

$$\text{A}'\text{A}'' = [100];\ \text{A}'B_1^{\text{vii}}B_1^{\text{viii}} = [1\bar{1}1];\ \text{A}'C^{\text{vii}}C^{\text{viii}} = [11\bar{1}].$$

And from a mere inspection of these symbols, we can infer (comp. (33)) that the *first* and *fourth rays* are the *common harmonic conjugates* of the *two pairs*, *second* and *third*, *fifth* and *sixth*; or that they are the *double rays* of the *involution*, which those two *pairs of rays* determine: the theorem [96.] being thus, in a new way, confirmed.

[99.] We have now discussed the arrangements of the *points* on those *nine* typical *lines* Λ_3, whereof each passes through not less than *four*, nor more than *six*, of the 52 points in the plane ABC; but we have still *three other typical lines* to consider, namely the lines Λ_1 and Λ_2, of which each passes through *at least seven points*. Taking first, for this purpose, the typical line $\Lambda_{2,1}$, namely, $\text{A}\text{A}'$, which contains *only seven* points, whereof the ternary symbols have been assigned in [55.], and the literal symbols there given may be retained, we shall, for the moment, reserve the consideration of the two points $P_{2,3}$; but shall introduce a new and auxiliary point $P_{3,1}$ on the same line, which may be thus denoted:

$$\text{A}^{\text{x}} = (122) = \text{A}\text{A}' \cdot \text{BC}''' \cdot \text{CB}''';$$

and which may be said to *represent*, or *typify*, a *first group of third con-*

struction, containing *fifteen points, one* on each of the *fifteen lines* $\Lambda_{2,1}$; although, in the present Paper, we can only *allude* to *such* new points P_3, and cannot *here* attempt to *enumerate*, or even to *classify* them.

[100.] We have thus again *six* points, at this stage, to consider, namely the points A, A′, D_1, A‴, A_0, A^x; and their symbols easily show that they are connected by the *three* following harmonic equations,

$$(AA'D_1A''') = (AD_1A'A_0) = (A'AD_1A^x) = -1;$$

from which it follows, by [85.], that the *two triads of points*,

$$AA'D_1 \text{ and } A^xA'''A_0,$$

are triads in involution: with, of course, all the properties which have been proved, in recent paragraphs of this Paper, to belong generally to *any two* such triads. As a verification, it may be mentioned that, with the particular arrangement [91.] of the five initial points A . . E, if we determine two new points P, P′, of *third* construction, by the formulæ,

$$P = (214) = BC'''\cdot CA''', \quad P' = (241) = CB'''\cdot BA''',$$

it can be proved that each of the five successive intervals (comp. [92.]) between the six points,

$$A,\ A''',\ D_1,\ A^x,\ A',\ A_0,$$

subtends the third part of a right angle at each of these two new auxiliary points, P and P′. But with *other* initial configurations, the *coordinates* of these two *new vertices* would be different, because they are connected with *angles*, which are not generally *projective* [90.]; although, as has been already remaked, there would always be *some* new points P, or rather a *circle* of such, possessing the property in question.

[101.] We may however enunciate generally, and without reference to any such particular *arrangement* of the five initial points, this *Theorem:*—

"*On any one of the fifteen lines* $\Lambda_{2,1}$, *of second construction, and first group, the given point* P_0, *and the two derived points of first construction* P_1, *compose a triad, the triad in involution to which* [85.] *consists of the point* $P_{3,1}$, *of third construction and first group, and of the two points* $P_{2,2}$, *of second construction and second group, upon that line;*" with *seven involutions of segments* (comp. [84.]) *included* under this general relation.

For example, on the line AA′, the *three segments* AA^x, $A'A'''$, D_1A_0 form always an *involution* of the *ordinary* kind, with its *double points imaginary;* the *three other sets* of segments, AA^x, $A'A_0$, D_1A'''; $A'A'''$, AA_0, D_1A^x; and D_1A_0, AA''', $A'A^x$, form *each* an involution, with *real double points;* the points A, A^x are the *real foci* of a *fifth* involution, determined by the *two pairs* of segments $A'D_1$, and $A'''A_0$; the points A′, A‴ are, in like manner, the real double points of that *sixth* involution, which the *two other pairs*, A, D_1, and A_0, A^x, determine: and finally, D_1 and A_0 are such points, for the *seventh* involution, determined by AA′, $A'''A^x$.

[102.] Introducing now the consideration of the two lately *reserved points* $P_{2,3}$ [99.], of *second construction* and *third group* [45.], upon the typical line $A_{2,1}$, we may derive them from the point P_0, the two points P_1, and the two points $P_{2,2}$, upon that line AA', by the two following harmonic equations:

$$(AA'''A'A^{IV}) = (AA_0D_1A_1^{IV}) = -1;$$

or by these two others,

$$(AA'A_0A^{IV}) = (AD_1A'''A_1^{IV}) = -1,$$

which may indeed be inferred from the two former, with the help of the relations between the six points previously considered: for, in general, if abc, $a'b'c'$ be collinear triads in involution, and if d and d' be the harmonic conjugates of b' and c', with respect to the two pairs, ab, ac, they are also the harmonic conjugates of b and c, with respect to the two *other* pairs, ac', ab'; or in symbols,

$$(abc'd) = (acb'd') = -1, \text{ if } (ab'bd) = (ac'cd') = -1,$$

when the three harmonic equations [81.] exist. We have also, generally, under these conditions, the equation

$$(ada'd') = -1;$$

for example, on the line AA', we have

$$(AA^{IV}A^xA_1^{IV}) = -1.$$

[103.] It is scarcely worth while to remark that the 15 lines $A_{2,1}$ of the net, as being all *syntypical*, are all *homographically divided*; although it may just be noticed, as a verification, that the six lines,

$$BC,\ B'C',\ B'''C''',\ B_0C_0,\ B^{IV}C^{IV},\ B_1^{IV}C_1^{IV},$$

which connect corresponding points on the two other lines of the same group in the given plane, namely $BB'D_1$ and $CC'D_1$, *concur* in one point A''. But it may not be without interest to observe, that A^x is the *common harmonic conjugate* of A, with respect to *each* of the three pairs, $A'D_1$, $A'''A_0$, $A^{IV}A_1^{IV}$; which *three pairs*,* or segments, form thus an *involution*, with A and A^x for its *double points*. We have therefore this *Theorem*:—

"*On each of the fifteen lines* $A_{2,1}$, *the three pairs of derived points, of first and second constructions*, namely the *pair* P_1, *the pair* $P_{2,2}$, *and the pair* $P_{2,3}$, *compose an involution, one double point of which is the given point* P_0; *the other double point being the point* $P_{3,1}$, *of third construction and first group, upon the line.*"

[104.] We have thus discussed the arrangements of the points P_0, P_1, P_2, on each of the *ten* typical lines which connect not *fewer* than *four*,

* That the *two first* of these three pairs belong to an involution, with those two double points, was seen in [101.].

and not *more* than *seven* of them; but there are still *two other* typical lines to be considered, belonging to the groups A_1 and $A_{2,2}$; whereof one, as BC, passes through *eight* points [54.]; and the other, as B'C', has *ten* points upon it [56.]. Beginning with the first, we easily find that the two sets of points, $A'BC$ and $A''A_1^{v}A^{v}$, are *triads in involution* [85.]; the latter set being thus deducible from the former: while the two other points upon the line may be determined by the condition that they satisfy this *other involution of two triads*, $A''BC$, $A'A_1^{vi}A^{vi}$. With the *initial arrangement* [91.], the line $A^{vi}A_1^{vi}$ is *trisected* in B and C, and its *middle part* BC is likewise *trisected* in A^{v} and A_1^{v}; while *each* line is *bisected* in A', and *cut at infinity* in A^{ix}. And in general we may enunciate these *two Theorems*:—

I. "*On every line of first construction, the point* P_1 *and the two points* P_0 *form a triad, the triad in involution with which consists of the point* $P_{2,1}$, *and the two points* $P_{2,4}$."

II. "*On every such line* A_1, *the triad formed by the point* $P_{2,1}$, *and the two points* P_0, *is in involution with a triad which consists of the point* P_1 *and the two points* $P_{2,5}$."

[105.] Besides these *two involutions of triads*, we have *two distinct involutions* of the *ordinary* kind, into *each* of which *all the eight points enter; two* being *double points* in each. For we have these *two other Theorems*, deducible, indeed, from the two former, but perhaps deserving to be separately stated:—

III. "*On every line of first construction, the two given points are foci of an involution of six points, in which the points* P_1, $P_{2,1}$, *are one pair of conjugates, while the two other pairs are of the common form,* $P_{2,4}$, $P_{2,5}$." For example, A^{v}, A^{vi} are such a pair, on the line BC.

IV. "*On every such line* A_1, *the points* P_1, $P_{2,1}$, *are the double points of a second involution of six points, obtained by pairing the two points of each of the three other groups.*"

[106.] Finally, as regards the *remaining typical line* B'C', which connects *two points* P_1, and passes through *eight points* P_2, if we reserve for a moment the consideration of the *last pair*, $P_{2,8}$, or A^{ix} and A_1^{ix}, we have a *system of eight points upon that line, homographic with the recent system of eight points on the line* BC; being indeed the *intersections* of the line B C' with the *eight-rayed pencil*, $A.A'BCA''A_1^{v}A^{v}A_1^{vi}A^{vi}$, when taken in the order $A''C'B'A''A_1^{viii}A^{viii}A_1^{vii}A^{vii}$. No description of the arrangement of these latter *points* is therefore at this stage required: but as regards the *pencil*, it may be remarked that, by [104.], the 1st, 2nd, and 3rd *rays* form a *triad of lines, in involution* [85.] *with the triad* formed by the 4th, 5th, and 6th; and that the *triad* of the 2nd, 3rd, and 4th rays is, in the same new sense, in *involution* with the *triad* of the 7th, 8th, and 1st: from which *double involution of triads*, the *five last rays* may be *derived*, if the *three first* are *given*. We have also by [105.] a *double in-*

of the rays, considered as *paired* with *each other*, or with *themselves* (thus the second and third rays are the *double rays* of an involution of the *usual* kind), in which the first is conjugate to the fourth, the fifth to the seventh, and the sixth to the eighth; while the first and second rays are the double rays of *another* involution, in which the fourth and third, the fifth and sixth, and the seventh and eighth are conjugate.

[107.] It only remains to assign the arrangement of the *two last points of second construction*, $P_{2,8}$, with respect to the *other points*, P_1, P_2, on a line $\Lambda_{2,2}$, or to some *three* of them; or to show how A^{IX} and A_1^{IX} can be *derived*,* for example, from B′, C′, and A″: which derivation may easily be effected, on the plan already described for the fifth and sixth typical traces. In fact, if we denote the six points $A''C'B'A'''A_1^{IX}A^{IX}$ by $abca\beta\gamma$, we have the three harmonic equations of [94.]; and if, by one of the modes of *perspective*, or *projection*, mentioned in [95.], which answers to the initial arrangement [91.], we throw off the first point A″ to *infinity*, the finite line $A^{IX}A_1^{IX}$ is then *quadrisected:* being *itself bisected* at A‴, while C′ and B′ *bisect its halves*. In general, we shall have again the equations [94.], if we otherwise represent the six lately mentioned points on B′C′ by $a\beta\gamma abc$; and thus it is seen that *those six points* are *always homographic*, *in every state* of the figure, or *net*, with the six points $A''B_1^{VII}C^{VII}AB_0C_0$ on the *fifth trace* AA″, and with the six points $A''B_1^{VIII}C^{VIII}D_1B^{V}C_1^{V}$ on the *sixth trace* D_1A''; in fact they are, if taken in a suitable order, the points in which the *six-rayed pencil* [98.], with A′ for vertex, is cut by the line B′C′.

[108.] We have thus shown for each of the *twelve typical lines* [74.], in the plane ABC, how *all the points but three*, upon that line, may be derived *from those three* by a *system of harmonic equations*, not *necessarily* employing any point P_3, or other *foreign*† or merely *auxiliary point:* although it appeared that something was gained, in respect to elegance and clearness, by introducing, on the line AA′, such a point A^{X} [99.]; or by considering generally, on any one of the fifteen lines $A_{2,1}$, a point $P_{3,1}$ of *third construction*, belonging to what may perhaps deserve to be regarded as a *first group* [103.] of the points P_3, in any future *extension* [1.] of the results of the present Paper.

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* This point A^{IX} may also, by [81.], be determined on the *seventh trace*, or *seventh typical line* [74.], as the *harmonic conjugate* of A′, with respect to C_0 and C_1^{V}.

† This *non-requirement* of *foreign points* is the only remarkable thing here: for the *anharmonic function* of *every group* of *four collinear net-points* is necessarily *rational;* and whenever $(abcd)$ = any positive or negative quotient of *whole numbers*, it is *always possible* to deduce the *fourth point d* from the *three* points *a*, *b*, *c*, by *some system of auxiliary points*, derived successively from them through *some system of harmonic equations*.

PART V.—*Applications to the Net, continued: Distribution of the Given or Derived Points, in a Plane of Second Construction, and of First or Second Group.*

[109.] It will be necessary to be much more concise, in our remarks on the distribution of the *net-points* in *planes* of *second construction;* but a few general remarks may here be offered, from which it will appear that each plane $\Pi_{2,1}$ contains *forty-seven* of the 305 points P_0, P_1, P_2; and that each plane $\Pi_{2,2}$ contains *forty-three* of those points; with many cases of *collineation* for each.

[110.] We saw in [33.], that each plane $\Pi_{2,1}$ contains two lines $A_{2,1}$, which intersect in a point P_0, and may be regarded as the diagonals of a quadrilateral, of which the four sides are lines $A_{2,2}$. It contains, therefore, as has been seen, one point P_0, and four points P_1; but it is found to contain also 42 points P_2, arranged in *six groups*, as follows.

[111.] There are 2 points $P_{2,1}$, namely the intersections of opposite sides of the quadrilateral; thus, in what we have called the *second typical plane* [33.], the sides B_1C_1, C_2B_2 intersect in the point A''; and the sides C_1C_2, B_2B_1 in D_1' (62).

[112.] The plane contains also 8 points $P_{2,2}$; namely, *two* on each of the *two diagonals*, and *one* on each of the *four sides;* and it contains 4 points $P_{2,3}$, namely two on each diagonal: but it contains *no* point of either of the two groups, $P_{2,4}$, $P_{2,5}$, as a comparison of their *types* sufficiently proves, or as may be inferred from the *laws* of their construction [46.] [47.].

[113.] The same plane contains 12 points $P_{2,6}$; namely two on each side of the quadrilateral; and four others, in which the plane is intersected by four lines $A_{2,2}$; as the *types* sufficiently prove. But to show, geometrically, *why* there should be *only four such intersections*, conducting thus to new points $P_{2,6}$ in the plane, let the five inscribed pyramids [28.] be denoted by the symbols $A' \ldots E'$; then the six edges of the pyramid A' are found to intersect the present plane $\Pi_{2,1}$ in points already considered, namely in the two points $P_{2,1}$, of *meetings of opposite sides*, and in those four points $P_{2,2}$ which are situated *on the diagonals* of the quadrilateral; they give therefore *no new points.* Also, each *side* of the same quadrilateral is an *edge* of one of the *four other pyramids*, $B' \ldots E'$; but there remains, for each such pyramid, an *opposite edge:* and these are the *four lines, out of the plane*, which *intersect it* in the *four points* $P_{2,6}$, additional to the *eight points* $P_{2,6}$, which are ranged, two by two, *upon the sides.* There are thus *twelve points* of the *group* $P_{2,6}$, in any one plane $\Pi_{2,1}$; and we have now exhausted the intersections of that plane with lines $A_{2,2}$; and also, as it will be found, with the lines $A_{2,1}$, and A_1.

[114.] But there remain *eight* points $P_{2,7}$, and *eight* points $P_{2,8}$, in the plane now considered; namely *two* of *each group*, on each of the *four sides* of the quadrilateral. There are, therefore, 16 such points; which, with the 12 points $P_{2,6}$; the 4 points $P_{2,3}$; the 8 points $P_{2,2}$; the 2 points $P_{2,1}$; the 4 points P_1; and the one point P_0, make up (as has been said in [109.]) a system of 47 points, *given or derived*, in any one of the fifteen planes $\Pi_{2,1}$.

It may be remarked that with the initial arrangement [91.] of the five given points, the four points $B'C'B_2C_2$, in a new plane $\Pi_{2,11}$, are corners of a *square*, which has the point E for its *centre;* and that thus the Figure, of the 47 points in such a plane, may be thrown into a clear and elegant perspective.

[115.] As regards the distribution in a plane $\Pi_{2,2}$, such as the *Third Typical Plane* [34.], it may here be sufficient to observe, that besides containing *three lines* $A_{2,3}$, namely the *sides of a triangular face* [34.] of one of the *five inscribed pyramids* [28.], and *three points* P_1, which are the *corners* of that *triangle*, and serve to *determine the plane* [1.], it contains also *forty points* P_2, which are arranged in *groups*, as follows. *Each* of the *four first groups*, of *second construction*, $P_{2,11}$, . . . $P_{2,14}$, gives *three points* to the plane; the *fifth group*, $P_{2,5}$, furnishes only *one point;* and the *sixth*, *seventh*, and *eighth* groups, $P_{2,6}$, . . $P_{2,8}$, supply *six*, *twelve*, and *nine* points, respectively. Of these 40 points P_2, *twenty-four* are ranged, eight by eight, *on the three sides* of the triangle, as was to be expected from [56.]; and the existence of *at least* 27 *points*, P_1, P_2, in a plane $\Pi_{2,2}$, might thus have been at once foreseen. But we have also to consider the *traces*, on that plane, of the 52 *lines*, A_1, A_2, which are not contained therein. Of these lines, it is found that 36 *intersect the sides* of the triangle, and give therefore *no new points*. But the *sixteen other lines* intersect the *plane*, in so many *new* and *distinct points;* and thus the *total number* [109.], of *forty-three derived points*, P_1, P_2, in a plane $\Pi_{2,2}$, which contains *no given point* P_0, is made up.

[116.] Without attempting here to enumerate the cases of *collineation*, in either of the two typical planes Π_2, we may just remark, that while the traces of four of the planes Π_1 on the typical plane $\Pi_{2,1}$ are the four sides, and the traces of four others are the diagonals, of the quadrilateral already mentioned, the trace of a ninth plane Π_1, namely ABC, on that plane $\Pi_{2,1}$, has been already considered, as the trace AA'' of the latter on the former; but that the trace of the *tenth plane* Π_1, namely ADE, or $[01\bar{1}00]$, on $AB_1C_2C_1B_2$, or on $[0111\bar{1}]$, is a *new line*, AD'_1; which passes thus through one point P_0 and one point $P_{2,11}$, and also through two points $P_{2,2}$, namely (01120) and (01102), and through two points $P_{2,6}$, namely $(2001\bar{1})$ and $(200\bar{1}1)$: being, however, *syntypical* with the formerly considered trace AA'', and therefore leading to no new harmonic or anharmonic relations.

[117.] As a specimen of a case of collineation which conducts to such *new relations*, let us take the four following points P_2, in the second typical plane,

$$a = (01120),\ b = (00211),\ c = (0203\bar{1}),\ d = (0\bar{1}302),$$

whereof the two first are points $P_{2,2}$, and the two last are points $P_{2,8}$; and of which the symbols satisfy the equations,

$$(c) = 2(a) - (b),\ (d) = -(a) + 2(b);\ \text{whence } (adbc) = 4.$$

These four points, therefore, with which it is found that *no other* given or derived point of the system P_0, P_1, P_2 is *collinear*, do *not* form a *harmonic group*; and consequently we *cannot construct the fourth point, d*, when the *three other* points, *a*, *b*, *c* are *given*, by means of *harmonic relations alone* (comp. [108.]), unless we introduce some *auxiliary point*, or points, *e*, . ., which shall be at lowest of the *third construction*. But if we write

$$e = (12020) \equiv (01\bar{1}\bar{1}\bar{1}),\ f = (\bar{1}0220) \equiv (01331),$$

so that *e* is a point $P_{3,1}$ [99.], while *f* may be said to be a point $P_{3,2}$, we find that these two *new* or *auxiliary* points, *e*, *f*, are the *double points* of the *involution*, determined by the *two pairs*, *ab*, *cd*; because we have the two harmonic equations,

$$(aebf) = (cedf) = -1.$$

And because we have also,

$$(cabe) = (abde) = -1,$$

we need only employ the *one* auxiliary point *e*, considered as the harmonic conjugate of *a*, with respect to *b* and *c*; and then determine the fourth point *d*, as the harmonic conjugate of *a*, with respect to *b* and *e*. It may be added that *abe* and *dcf* are *triads in involution* [85.]; so that if *e* be projected to infinity, the finite line *cd* is *trisected* at *a* and *b*.

PART VI.—*On some other Relations of Complanarity, Collinearity, Concurrence, or Homology, for Geometrical Nets in Space.*

[118.] Although we have not proposed, in the present Paper, to *enumerate*, or even to *classify*, any points, lines, or planes, beyond what we have called the *Second Construction* [1.], yet *some* such points, lines, and planes have offered themselves naturally to our consideration: and we intend, in this *Sixth Part*, to consider a few others, chiefly in connexion with relations of *homology*, of triangles or pyramids which have been already mentioned.

[119.] It was remarked in [29.], that the thirty lines $A_{2,2}$ are the sides of *ten triangles* T_2, of *second construction*, which are certain *inscribed*

homologues of ten *other* triangles T_1, of *first* construction [26.]; the *ten* corresponding *centres* of homology being the ten points P_1. For example, the triangle $A'B'C'$ is inscribed in ABC, and is *homologous* thereto, the point D_1 being their *centre* of homology; because we have the three relations of *intersection*,

$$A' = D_1A \cdot BC, \text{ \&c.};$$

or because, A' being a point on BC, &c., the *three joining lines* AA', &c., *concur* in the point D_1.

[120.] Proceeding to determine the *axis* of this homology, or the right line which is the locus of the points of intersection of corresponding sides, we easily see that it is the line $A''B''C''$; because we had $A'' = BC \cdot B'C'$, &c. And because an analogous result must take place in *each* of the *ten planes* Π_1, we see that *the ten points* $P_{2,1}$ *are ranged, three by three, on ten lines* $\Lambda_{3,1}$, *in the ten planes* Π_1; namely on the *axes of homology* of the *ten pairs of triangles*, T_1, T_2, in those ten planes: which axes are the lines,

$$D_1'A_1'A_2', \text{ \&c.}; \quad C_1'B_1'A'', \text{ \&c.}; \quad C_2'B_2'A'', \text{ \&c.}; \text{ and } A''B''C'';$$

each point $P_{2,1}$ being thus *common* to *three* of them, because it is common to those *three planes* Π_1, which contain the line Λ_1 whereupon it is situated. Each point $P_{2,1}$ is also the *common intersection* of this last line with *three lines* $\Lambda_{2,2}$; we have for example, the *formulæ of concurrence*,

$$A'' = BC \cdot B'C' \cdot B_1C_1 \cdot B_2C_2.$$

[121.] The line $A''B''C''$ was seen to be the *common trace* of *two planes* $\Pi_{2,2}$, namely of $A_1B_1C_1$ and $A_2B_2C_2$, on the plane Π_1, namely ABC, in which it is situated; and a similar result must evidently hold good for *each* of the *ten lines* $\Lambda_{3,1}$. But we may add that the *three triangles* ABC, $A_1B_1C_1$, $A_2B_2C_2$, in the plane of *each* of which the line $A''B''C''$ is contained, are *homologous, two by two*, and have this line for the *common axis of homology* of each of their *three pairs;* having however *three distinct centres* of homology, namely D_1' for second and third, D for third and first, and E for first and second: with (as we need not again repeat) analogous results for the *other* lines $\Lambda_{3,1}$, of which *group* we here take the line $A''B''C''$ as *typical*. It may be remarked that the *four centres*, recently determined, are *collinear*, and compose an *harmonic group;* and that the *inscribed* triangle $A'B'C'$ is also *homologous* with *each* of the two triangles $A_1B_1C_1$, $A_2B_2C_2$, although not *complanar* with *either;* the line $A''B''C''$ being *still* the *common axis* of homology; while the *two centres*, of these two last homologies, are the two given points, D and E.

[122.] The *six points* $P_{2,2}$, in the plane ABC, have been seen to range themselves, according to their *two ternary types* [41.], into *two sets of three*, which are the *corners* of *two new triangles; one* of these, namely $A'''B'''C'''$, being an *inscribed homologue* of $A'B'C'$; while the *other*, namely

$A_0B_0C_0$, is an *exscribed homologue* of ABC; and these two new triangles are also homologous to *each other:* the *line* $A''B''C''$ being still the *common axis,* and the *point* D_1 being the *common centre* of homology. And the same thing holds good for any one of these four triangles, $A_0B_0C_0$, ABC, $A'B'C'$, $A'''B'''C'''$, in the plane Π_1 here considered, as compared with the triangle $A_1^{IV}B_1^{IV}C_1^{IV}$, whereof the corners are those three points $P_{2,3}$, which are *not* ranged on the line $A''B''C''$, as the three *other* points $P_{2,3}$, namely A^{IV}, B^{IV}, C^{IV}, have been seen to be.

[123.] It was remarked in [28.], that each of the *five pyramids* E_2 is not only *inscribed* in the corresponding pyramid E_1 [26.], but is also *homologous* therewith; the *centre* of their homology being a point P_0: thus the point E is such a centre, for the two pyramids ABCD and $A_1B_1C_1D_1$, or for those which we have lettered as E and E' [26.] [113.]. The *planes* BCD, $B_1C_1D_1$, of two corresponding *faces,* intersect in the *line* $C_2'B_2'A''$; the planes CAD, $C_1A_1D_1$ in $A'_2C'_2B''$; the planes ABD, $A_1B_1D_1$ in $B_2'A_2'A''$; and the planes ABC, $A_1B_1C_1$ in $A''B''C''$. Hence it is easy to infer that *these six points* $P_{2,1}$, namely

$$A'', B'', C'', A_2', B_2', C_2',$$

are all situated *in one plane,* which is the *plane of homology* of the *two pyramids* E and E', and which we shall denote by [E]; its *quinary symbol* being

$$[E] = [1111\bar{4}],$$

which may also serve as a *type* of the *group* [A] . . [E]. And in fact, the quinary symbols of the six points all satisfy the *equation* (comp. [19.]),

$$x + y + z + w = 4v.$$

[124.] It may be noted that the *two planes* of homology, [D] and [E], have the *line* $A''B''C''$ for their *common trace* on the plane ABC; and that the traces of the *three other planes* of the same group, [A], [B], [C], which have

$$[\bar{4}11], [1\bar{4}1], [11\bar{4}],$$

for their *ternary symbols,* pass respectively through the points A^x, B^x, C^x, (comp. [99.]), and coincide with the lines $B_1^{IV}C_1^{IV}$, &c., or with the *sides* of the last mentioned *triangle* [122.]. And it follows from [123.], that *the ten points* $P_{2,1}$ are ranged *six by six,* and that the *ten lines* $\Lambda_{3,1}$ are ranged *four by four,* in *five planes* $\Pi_{3,1}$; namely, in the five planes [A] . . [E] of *homology of pyramids.* But *these last laws* of arrangement, of points and lines, must be considered as included in results which have been comparatively long known, respecting *transversal* lines and planes in space.*

* Compare the second note to [1.].

[125.] Instead of *inscribing* a pyramid E′ in the pyramid E, we may propose to *exscribe* to the latter a *new* pyramid A`B`C`D`, or E`, which shall be *homologous* with it, the given point E being still the *centre* of homology. In other words, the *four new planes* B`C`D`, . . , A`B`C`, or $E_A$, $E_B$, $E_C$, $E_D$, are to pass *through the four given points* A, B, C, D; and the *four new lines* AA`, BB`, CC`, DD` are to *concur*, in the *fifth given point* E. The solution of this problem is found to be expressed by the following quinary symbols for the four sought planes:

$$[E_A] = [01113], \; . \; [E_D] = [11103].$$

In fact, the pyramid E`, with these four planes for *faces* is evidently *exscribed* to the pyramid ABCD, or E; and because its *corners* may be represented by these other quinary symbols,

$$A` = (30001), \; . \; D` = (00031),$$

the condition of *concurrence* is satisfied. We may remark that the plane [E] of [123.] is the plane of homology of the two last pyramids E and E`; and that this *exscribed pyramid* E` is homologous also to the *inscribed* pyramid E′, the point E being still the *centre*, and the plane [E] the *plane* of their homology.

[126.] It may be remarked that the *common trace* of the two planes E_D and D_E, on the plane ABC, is the line A″B″C″; to *construct*, then, the *exscribed pyramid* E`, we may construct the plane $E_D$ of *one* of its *faces*, by connecting the *point* D with the line A″B″C″; and similarly for the rest. Or if we wish to determine separately the *new point*, or corner, D`, which *corresponds* to the given point D, we may do so, by the *anharmonic equation*,

$$(DD_1ED`) = 3;$$

for which may be substituted* the system of the *two* following *harmonic* equations:

$$(DD_1EF) = (DD`D_1F) = -1;$$

where F is an auxiliary point, namely D_1'.

PART VII.—*On the Homography and Rationality of Nets in Space; and on a Connexion of such Nets with Surfaces of the Second Order.*

[127.] In general, *all geometric nets in space* are *homographic figures; corresponding points, lines*, and *planes*, being those which have the *same* (or *congruent*) *quinary symbols*, in whatever manner we may pass from one to another system of *five initial points*, A . . E; whereof it is still supposed that *no four are complanar*. *All* points, lines, and planes of any such *Net* are evidently *rational*, in the sense [8.] already defined,

* Compare the note to [108.].

with respect to the initial system; and conversely it is not difficult to prove that every *rational point, line,* or *plane,* in space, *is a net-point, net-line,* or *net-plane,* whatever that initial system of five points may be. It follows that although *no irrational point, line,* or *plane,* can possibly *belong* to the *net,* with respect to which it *is* thus irrational, yet it can be *indefinitely approached to,* by points, lines, or planes which *do* so belong: a remarkable and interesting theorem, which appears to have been first discovered by *Möbius;** to whom indeed, as has been already said, the *conception of the net* is due, but whose *analysis* differs essentially from that employed in the present Paper.

[128.] As regards the *passage from one net in space to another,* let the quinary symbols of some five given points $P_1 \ldots P_5$, whereof no four are in one plane, be with respect to the *given* initial system A . . E the following:—

$$P_1 = (x_1 \ldots v_1), \ldots P_5 = (x_5 \ldots v_5);$$

and let $a' \ldots e'$ and u' be six coefficients, determined so as to satisfy the *quinary equation* [5.],

$$a'(P_1) + b'(P_2) + c'(P_3) + d'(P_4) + e'(P_5) = -u'(U),$$

or the five ordinary equations which it includes, namely,

$$a'x_1 + \ldots + e'x_5 = \ldots = a'v_1 + \ldots + e'v_5 = -u'.$$

Let P′ be any sixth point of space, such that

$$(P') = xa'(P_1) + yb'(P_2) + zc'(P_3) + wd'(P_4) + ve'(P_5) + u(U);$$

then *this sixth point* P′ *can be derived from the five points* $P_1 \ldots P_5$, *by the same constructions, as those by which the point* P = (*xyzwv*) *is derived from the five given points* ABCDE. For example, if we take the five points,

$$A_1 = (10001),\ B_1 = (01001),\ C_1 = (00101),\ D_1 = (00011),\ E = (00001),$$

we have the symbolic equation,

$$(A_1) + (B_1) + (C_1) + (D_1) - 3(E) = (U);$$

if then we write $v' = x + y + z + w - 3v$, the point (*xyzwv*′) is derived from $A_1B_1C_1D_1E$, by the same constructions as (*xyzwv*) from ABCDE. In

---

* See page 295 of the *Barycentric Calculus.* As regards the theory of *homographic figures,* chapter XXV. of the *Géométrie Supérieure* of M. Chasles may be consulted with advantage. But with respect to *anharmonic ratio,* generally, it must be remarked that Professor *Möbius* was thoroughly familiar with its theory and practice, when he published in 1827; although he called it by the longer but perhaps more expressive name of Doppelschnittsverhältniss (*ratio bissectionalis*). It may be added that he denotes by (A, C, B, D), what I write as (ABCD).

particular, D is related to $A_1B_1C_1D_1E$, as the point P = (00031) is related to ABCDE; but this point P satisfies the anharmonic equation, $(DD_1EP) = +3$; if then $E_1 = D_1E \cdot A_1B_1C_1 = (000\bar{1}2)$, we must have the corresponding equation $(D_1E_1ED) = +3$: which is accordingly found to exist, and furnishes a *construction* for *exscribing a pyramid* ABCD *to a given pyramid* $A_1B_1C_1D_1$, with which it is to be *homologous*, and to have a *given point* E for the *centre* of their homology, agreeing with the construction assigned in [126.] for a similar problem of *exscription*. And in general, *from any five given points of a net*, whereof no four are complanar, we can (as was first shown by *Möbius*) *return, by linear constructions, to the five initial points* A . . E; and therefore can, in this way, *reconstruct the net*.

[129.] If we content ourselves *with quaternary* (or *anharmonic*) *coordinates* [12.], or suppose (as we may) that $v = o$, the *equation of a surface of the second order* takes the form,

$$0 = f(xyzw) = \alpha x^2 + \beta y^2 + \gamma z^2 + \delta w^2$$
$$+ 2(\epsilon yz + \zeta zx + \eta xy) + 2w\,(\theta x + \iota y + \kappa z);$$

and if the ten coefficients $\alpha \ldots \kappa$, or their ratios, be determined by the condition that the surface shall pass *through nine given net-points*, those *coefficients* may then be replaced by *whole numbers*, and the *surface* may be said to be *rationally related to the given net*, or to the *initial system* A . . E, or briefly to be (comp. [8.]) a *Rational Surface*. For example, if the nine points be $ABCDEC'A'C_2A_2$, so that, besides passing through E, the surface has the gauche quadrilateral ABCD superscribed upon it, the equation is

$$\text{I} \ldots 0 = f = xz - yw;$$

and if they be A, B, A′, B′, A_2, B_2, A_1, $A^{\text{VII}} = (12\bar{1}0)$, and F = $(120\bar{1})$, so that this new point F, like A^{VII}, belongs to the group $P_{2,6}$, the equation of the surface is then found to be,

$$\text{II} \ldots 0 = f = w^2 + z^2 - (w + z)(x + y) - 2xy.$$

[130.] In general, whether the surface of the second order be *rational* or not, it results from the principles of a former communication that any point P = (*xyzw*) of space is the *pole* of the *plane* $\Pi = [XYZW]$, if $X \ldots W$ be the *derivatives*,

$$X = D_x f,\ Y = D_y f,\ Z = D_z f,\ W = D_w f;$$

hence, in particular, the *pole of the plane* [E] *of homology* of the three pyramids E, E′, E″, [26.] [113.] [125.], of which plane the *quaternary symbol* [12.] is [1111], is the point K determined by the equations,

$$X = Y = Z = W, \text{ or } D_x f = D_y f = D_z f = D_w f;$$

and if the point E be the mean point of the pyramid ABCD, the *plane* [E] is then *infinitely distant*, and this *point* K is the *centre of the surface*.

[131.] For example, in the case of the Ist surface [129.], this *pole* K is the point $(1\bar{1}1\bar{1}) \equiv (20201)$, which belongs to the group $P_{3,1}$; and because it is *on* the plane [E], that plane *touches* the surface in that point: so that when the point E is the *mean* point of the pyramid ABCD, the surface becomes a ruled *paraboloid*. In the case of the IInd surface [129.], the pole K of [E] is always the point (1100), or c'; this point c' becomes therefore the *centre* of the surface, when E is the *mean* point of the pyramid; and the five following lines,

$$AB,\ A'B'^{vii}_1,\ B'A'^{vii},\ A_2F, \text{ and } B_2G,$$

where G is the new point $(210\bar{1})$ of the group $P_{2,6}$, which are *always chords through* c', become in that case *diameters*. It may be added that, with the initial arrangement [91.], the surface last considered becomes the *sphere*, which is described with AB for diameter; and that it *always* passes through the auxiliary point P, of *third* construction, which was mentioned in [100.].

[132.] We have then here an *example*, of a surface of the second order, which was *determined* so as to pass [129.] through *nine net-points*

$$A,\ B,\ A',\ B',\ A_2,\ B_2,\ A_1,\ A'^{vii}_1, \text{ and } F,$$

but which has been subsequently *found* to pass *also* through at least *four other points of the net*, namely

$$B_1,\ B'^{vii}_1,\ G, \text{ and } P.$$

This is, however, only a very particular *case* of a much more general *Theorem*, with the enunciation of which I shall conclude the present Paper, regretting sincerely that it has already extended to a length, so much exceeding the usual limits of communications designed for the *Proceedings** of the Academy, but hoping that some at least of its processes and results will be thought not wholly uninteresting:—

"*If a Surface of the Second Order be determined by the condition of passing through nine given points of a Geometrical Net in Space, it passes also through indefinitely many others: and every Point upon the Surface,*

---

* *Some* of the early formulæ of this Paper are unavoidably repeated from a communication of the preceding Session (1859–60), but with extended significations, as connected now with a *quinary calculus*. And in a not yet published volume, entitled "*Elements of Quaternions*," the subject of *Nets in Space* is incidentally discussed, as an illustration of the *Method of Vectors*. But it will be found that the present Paper is far from being a mere reprint of the Section on Nets, in the unpublished work thus referred to: many new *theorems* having been introduced, and the *plan* of treatment generally being different, although the *notations* have, on the whole, been retained. Besides it was thought that Members of the Academy might like to see the subject treated, in their Proceedings, without any express reference to *quaternions*: with which indeed the *nets* have not any *necessary* connexion.

which is not a point of the Net, can be included within a Geodetic Triangle on that surface, of which the corners are net-points, and of which the sides can be made as small as we may desire."

In fact, the *surface* is a *rational* one [129.], or the coefficients of its equation may be made whole numbers; and therefore *every rational line* [8.], from any *one net point*, or rational point, upon it, if not happening to *touch* the surface, is easily proved to meet it *again*, in *another rational point:* whence, with the aid of a lately mentioned principle [127.], the theorem evidently follows.

READ, a letter from G. V. Du Noyer, Esq., dated Arklow, April 20, 1861, inclosing some drawings of antiquities, and the following notes in explanation:—

"As a contribution to my portfolio of drawings in the Royal Irish Academy Library, I send the accompanying sketch of a very perfect Ogham-bearing pillar-stone, now lying on the road-side, close to and north of the old church of Castletimon, in the parish of Dunganstown, county of Wicklow, and at a distance of eight miles to the north of Arklow.

"This Pillar, which is a well-smoothed block of crystalline greenstone, measuring 4 feet 10 inches in length, is called 'The Longstone,' and is held in much veneration by the people of the neighbourhood.

"In a field to the south of Castletimon old church, and at the distance of four hundred yards south of the Ogham stone, are the ruins of what was once a magnificent cromlech, the covering stone of which measures nearly 11 feet square, by 2 to $2\frac{1}{2}$ feet in thickness, being, like the pillar, formed from a block of greenstone. Of this I also send the Academy a sketch, with a rough plan of the stones forming it, to show their original relative position. In the Ordnance Survey Map, No. 36, Co. Wicklow, these relics are erroneously grouped together, and placed on the road-side to the north of the old church, mention being made of them as 'Cromlech in ruins, called the Longstone.'"

APPENDIX.

No. I.

ACCOUNT

OF

THE ROYAL IRISH ACADEMY,

FROM 1st APRIL, 1857, TO 31st MARCH, 1858.

THE CHARGE.

			£ s. d.	£ s. d.
To Balance in favour of the Public on 1st of April, 1857 (See Vol. VI., App. No. V., p. lxxiv.),				69 16 1
Parliamentary Grant,				500 0 0
3 PER CENT. STOCK sold:				
£496 15 7	At 92⅜ and 93¼ per Cent.	458 11 9		
	144 days' Interest,	5 17 8		
		464 9 5		
	Less, Power of Attorney,	1 0 0		
			463 9 5	
200 0 0	At 92 per Cent.,	184 0 0		
354 8 2	At 92⅛ per Cent.,	326 9 11		
	156 days' Interest,	7 2 0		
		517 11 11		
	Less, Brokerage,	0 14 0		
			516 17 11	
£1051 8 9	*Total 3 per Cent. Stock sold,*			980 7 4
INTEREST ON STOCKS:				
Cunningham Fund, 3 per Cents., Half-year's Interest on £1143 19*s.* 6*d.*,		17 8 2		
Income Tax (charged, p. ix.)				
Half-Year's Interest on £1643 19*s.* 6*d.*,	24 3 2			
Less, Income Tax,	0 14 1			
		23 9 1		
Error in Interest corrected,	0 10 0			
Less, Income Tax,	0 0 3			
		0 9 9		
Total Cunningham Fund Interest,			41 2 0	
	Forward,		41 2 0	1550 3 5

	£	s.	d.	£	s.	d.	£	s.	d.
Brought forward,				41	2	0	1550	3	5
ACADEMY 3 PER CENT. CONSOLS:									
Half-year's Interest on £178 10*s.* 8*d.*,	2	13	7						
Less, Income Tax,	0	1	7						
		2	12	0					
Half-year's Interest on £353 18*s.* 6*d.*,	5	6	2						
Less, Income Tax,	0	3	1						
		5	3	1					
Total Academy Stock Interest,				7	15	1			
TOTAL INTEREST ON STOCKS,							48	17	1
INTEREST OR DISCOUNTS RECEIVED ON ACCOUNTS PAID:									
From M. H. Gill, Discount on Printing Transactions,				6	9	2			
Do. do. Catalogue of Museum,				8	4	2			
Total Discount received,							14	13	4
TRANSACTIONS, &c., sold:									
T. & W. Boone, Transactions,				18	11	0			
Mr. Magee, Transactions, vol. xxii. pt. 5,				0	10	0			
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Total Transactions, &c., sold,							24	8	0
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Jones, J. F., books, &c., £9 9*s.*, £7 7*s.*, £2 10*s.*,	19	6	0			
Gallagher, J., Thom's "Directory,"	0	13	6			
Kelly, W. B.,	0	12	6			
Total Books, Periodicals, &c., bought,	51	3	4			
Subscriptions paid:						
—— To Camden Society for 1856, £1 0 0						
—— To Crania Britannica, 1 1 0						
—— To London Palæontographical Society, for 1857 and 1858, 2 2 0						
—— To Ray Society for 1857 and 1858, 2 2 0						
Total Subscriptions paid,	6	5	0			
Pilkington, F., binding, &c., Library,	45	0	0			
Barthes and Lowell, freight and charges on books, &c., collected in London, £7 18*s.*, £2 13*s.* 5*d.*, 10 11 5						
British Steam Packet Co., 4*s.* 4*d.*, 3*s.*, 7*s.* 2*d.*, parcels, 0 14 6						
Boone, T. and W., charges, &c., on books, 1 6 2						
Chester Railway, 3*s.* 6*d.*, 5*s.* 6*d.*, parcels, 0 9 0						
Elliott and Co., parcels, 0 3 0						
Hodges, Smith, and Co., charges on books, 1 1 6						
London Steam Packet Co., 4*s.* 4*d.*, 4*s.*, 6*s.* 4*d.*, 3*s.* 10*d.*, 5*s.* 11*d.*, 4*s.* 2*d.*, parcels, 1 8 7						
Maly, B., moving books from Castle, 0 3 0						
M'Mahon, A., ditto, 0 3 0						
Pilkington, F., paper shavings, 0 9 0						
Railway Co., 4*s.* 6*d.*, 4*s.*, 0 8 6						
Sanders, G., parcel, 0 2 0						
Steam Packet Co., 6*s.* 6*d.*, £2 17*s.* 1*d.*, 3 3 7						
Tierney, J., carriage of books from Castle, 0 12 0						
Total Duty, Freight, and Charges on Books,	20	15	8			
Delany, M., Transactions bought, 3 18 0						
M'Girane, W., ditto, 0 6 0						
Total Transactions, &c., bought,	4	4	0			
Forward,	127	7	7	66	19	4

	£	s.	d.	£	s.	d.	£	s.	d.
Brought forward,				127	7	7	66	19	4
Miscellaneous Printing:									
Gill, M. H., miscellaneous printing to December 7, 1857,	42	13	10						
——, Labels for Museum, &c.,	5	2	9						
——, miscellaneous printing for Museum,	1	12	6						
Total Miscellaneous Printing,				49	9	1			
Proceedings:									
Gill, M. H., printing Proceedings, vol. vi., part 4,	46	16	8						
——, paper for ditto,	4	18	6						
Oldham, Wm., woodcuts for ditto,	1	10	0						
Pilkington, F., binding ditto,	9	16	8						
Groux, E., paid fee for exhibition of sternum, &c., for report in Proceedings,	5	5	0						
Total Cost of Proceedings,				68	6	10			
Transactions:									
Gill, M. H., printing Transactions, vol. xxiii., part ii., Dr. Hincks's Paper (No. 1),	4	15	4						
——, Rev. Dr. Wills's ditto,	9	13	8						
——, Rev. Dr. Todd's ditto,	21	18	4						
——, Rev. Dr. Hincks's ditto (No. 2),	10	13	3						
——, Rev. George Salmon's ditto,	16	4	0						
——, H. L. Renny's ditto,	7	16	8						
——, Downing's, S., ditto,	6	9	8						
Map for ditto, per Day & Sons,	10	0	0						
	16	9	8						
Gill, M. H., printing R. T. Forster's Paper,	8	5	10						
Woodcuts for ditto, per Wm. Oldham,	7	0	0						
	15	5	10						
Robinson, Jas., photographs for R. Mallet's Paper in Transactions, vol. xxiii., part 1,	2	5	0						
Pilkington, F., binding Transactions,	52	8	6						
Total Cost of Transactions,				157	10	3			
Stationery, Etc.:									
Chambers, treasurer's book,	1	15	0						
Jackson, J., ink, pens, &c.,	1	8	0						
Hendrick, cash-book, &c.,	2	17	6						
Hodges and Sons, tin box,	0	10	6						
O'Brien, M., bars and padlocks,	1	16	0						
Pilkington, F., minute-books, &c.,	6	18	0						
Tallon, J., paper, stamps, &c.	9	0	8						
Waller, J., copperplate, cards, &c.,	6	1	0						
Total Stationery, &c.,				30	6	8			
Catalogue of Museum (First Part):									
Eager, C. H., registering articles in Museum,	32	0	0						
Pearson, T., securing articles on trays,	1	7	0						
Forward,	33	7	0	433	0	5	66	19	4

	£	s.	d.	£	s.	d.	£	s.	d.
Brought forward,	33	7	0	433	0	5	66	19	4
Maguire, John, securing articles on trays,	9	8	0						
Maguire, J., ironmonger, for materials used in Museum,	8	7	10						
Total Cost of Arrangement of Museum to 20th August, 1858,				51	2	10			
Du Noyer, G. W., drawings on wood,	12	18	0						
Wakeman, W. F., ditto,	18	0	0						
Hanlon, G. A., woodcuts,	32	18	0						
Oldham, W., ditto,	15	16	6						
Virtue, S., woodcuts,	0	14	0						
Parr, H., transcribing Catalogue,	5	0	0						
Gill, M. H., printing and paper,	164	2	4						
Total Cost of Catalogue, First Part, to 20th August, 1858,				249	8	10			
Advertising in newspapers,	1	19	0						
Gill, M. H., printing advertisements,	3	10	6						
Tallon, J., lithographing circulars,	2	14	6						
Postages of ditto, and Catalogues,	2	2	3						
Total Cost of Postage and advertising First Part,				A 10	6	3			
MUSEUM, AND CATALOGUE (PART II.).									
Eager, C. H., registering articles in Museum,	6	13	4						
Parr, H., ditto,	2	0	0						
Grey, C., woodcuts,	2	5	0						
Hanlon, G. A., ditto,	6	12	0						
Oldham, W., ditto,	7	7	0						
Expended on Part II. of Catalogue. The above sums, A and B, paid out of proceeds of Part I., to 31*st March*, 1858,				B 24	17	4			
Total Books, Printing, Stationery, &c.,							768	15	8
CUNNINGHAM FUND:									
West and Sons, for gold medals granted by Council to—									
1. Edward J. Cooper, Esq., in Science.									
2. Rev. George Salmon, ditto.									
3. Rev. Charles Wall, D.D., in Polite Literature.									
4. Rev. William Reeves, D. D., in Antiquities.									
Total Cunningham Fund,							88	13	4
PHOTOGRAPHIC ROOM, ETC.:									
O'Brien, M., fitting-up, &c.,							14	15	5
REPAIRS OF HOUSE, ETC.:									
O'Brien, M., new trays, &c., in Museum,	20	3	1						
———, alterations on shelving, &c.,	10	14	4						
———, ditto in floor, and glazing same,	11	0	0						
Total Cost of Work done in Museum,				41	17	5			
Forward,				41	17	5	939	3	9

	£	s.	d.	£	s.	d.	£	s.	d.
Brought forward, ...				41	17	5	939	3	9
O'Brien, M., shelving, &c., in Library, ...				30	13	4			
———, repairs of House, &c., ...	30	13	4						
———, ditto, ...	4	3	1						
Total Cost of Repairs of House, . .				34	16	5			
O'Brien, M., shelving in Moore's Library,	0	1	4						
Boylan, J., cleaning windows, ...	2	7	10						
Bray, J., cleaning ashpit, ...	0	18	0						
Maguire, J., and Co., nails, ...	0	2	0						
Mullen, W., cleaning chimneys, . . .	0	2	6						
Murphy, J., ditto, ...	1	2	0						
Pearson, T., wire window-screens, . . .	2	2	0						
Sibthorpe and Sons, glazing windows, &c.,	3	8	6						
Total Cost of Miscellaneous Repairs of House, ...				10	4	2			
Total Cost of Repairs of House, &c., ...							117	11	4
FURNITURE AND REPAIRS:									
Daniel, P., sundries, ...				4	2	11			
Dobbyn, G., repairs of clock, ...				0	10	6			
Maguire and Trotter, baize, oil-cloth, &c., ...				1	10	11			
Merry, E., polishing furniture, ...				2	0	0			
O'Brien, M., tressels and tables, ...				11	15	0			
———, furniture, &c., ...				21	13	10			
West, F., delft-ware, ...				0	4	9			
Total Furniture and Repairs, ...							41	17	11
TAXES AND INSURANCE:									
Income Tax on £17 3*s.* 2*d.*, dividend, ...				1	2	11			
National Insurance Company, ...				10	6	0			
Patriotic ditto, ...				6	3	6			
Parish cess, ...				0	9	4			
Pipe-water rent, ...				2	17	8			
Total Taxes and Insurance, ...							20	19	5
COALS, GAS, ETC.:									
Alliance and Consumers' Gas Company, for 18 months,				40	19	11			
Brown, G., safety lights, ...				0	7	6			
Mooney, W., repairs of gas-fittings, &c., . . .				2	12	3			
Tedcastle, R., Carlisle coal, 33 tons, ...				27	3	6			
Total Cost of Coals, Gas, &c., ...							71	3	2
COALS, GAS, ETC.:									
Boyle and Co., commission, ...				0	2	4			
Walpole, E., towelling, &c., ...				3	9	7			
Browne, A., drawing up financial report, ...				5	5	0			
Clibborn, E., one year's allowance for incidentals used in cleaning the house, ...				10	0	0			
Connell, J., hire of dray, ...				0	5	0			
Gerty and Rourke, carriages to Castle, ...				5	4	0			
———, ditto, to Dr. Ball's funeral, . . .				3	2	6			
Gloves for servants at ditto, ...				0	4	0			
Johnson, J., oil, &c., ...				0	5	10			
Loughlin, M., serving notices, ...				0	2	6			
Maguire, R., sundries, ...				0	17	10			
Forward,				28	18	7	1190	15	7

				£	s.	d.	£	s.	d.
			Brought forward,	28	18	7	1190	15	7
O'Brien, M., moving Museum and preparing it for exhibition in 1853,				7	5	5			
Tallon, J., stamps for receipts, &c.,				1	0	0			
Tighe, J., transcribing addresses,				2	1	0			
Postages paid,				7	1	4			
Total Contingencies,							46	6	4
SALARIES, WAGES, ETC.:									
Carson, Rev. Joseph, D. D., Treasurer, 1857–8,				21	0	0			
Drummond, Rev. W. H., D. D., Librarian, 1857–8,				21	0	0			
Graves, Rev. Charles, D. D., Secretary, 1857-8,				21	0	0			
Jellett, Rev. J. H., Secretary of Council, 1856–7,				21	0	0			
———, ditto, ditto, 1857–8,				21	0	0			
Clibborn, Edward, Clerk, Assist. Librarian, and Curator of Museum, 1857–8,				150	0	0			
Todhunter, J., accountant, &c.,		23	0 0						
Tighe, J., ditto,		23	0 0						
				46	0	0			
Wright and Stanley, servants' hats,		1	5 0						
Maher, M., ditto, liveries,		13	0 0						
Kelly, A., house porter, &c., 52 weeks,		39	0 0						
Leigh, H., messenger, &c., ditto,		39	0 0						
Total Servants' Wages, &c.				92	5	0			
Armstrong, J., cleaning house, &c.,				11	9	6			
Total Salaries, Wages, &c.,							404	14	6
GOVERNMENT STOCKS BOUGHT ON ACCOUNT OF CUNNINGHAM FUND:									
£500 0 0	3 per Cents.,		£460 12 6						
	54 days' interest,		2 4 5						
	Commission,		0 12 6						
£500 0 0	*Total 3 per Cents. bought for Cunningham Fund account*,			463	9	5			
ON ACADEMY'S STOCK ACCOUNT:									
£45 6 8	Consols,	41 17 6							
	17 days' interest,	0 1 3							
		41 16 3							
	Transfer fee,	0 2 6							
	Brokerage,	0 1 3							
			42 0 0						
23 1 2	Consols,	20 16 9							
	53 days' interest,	0 2 0							
	Brokerage,	0 1 3							
			21 0 0						
100 0 0	Consols,	88 15 0							
	122 days' interest,	1 0 0							
	Brokerage,	0 2 6							
			89 17 6						
7 0 0	Consols,	6 4 5							
	14 days' interest,	0 1 7							
			6 6 0						
£175 7 10	*Total Consols bought for Academy account*,			159	3	6			
	Total Government Stocks bought,						622	12	11
				Forward,			2264	9	4

	£	s.	d.	£	s.	d.
Brought forward,				2264	9	4
BRITISH ASSOCIATION CONVERSAZIONE EXPENDITURE:						
Alliance and Consumers' Gas Co., gas-fittings,		0	10	8		
——, examining burners, &c.,		0	10	5		
Daniel, P., tin sconces for lights,		0	4	0		
Mooney, W., gas-fittings in garden, &c.,		12	18	3		
Alliance and Consumers' Gas Co., gas consumed,		5	12	0		
Lambert, J., candles,		0	12	0		
Johnson, J., wax ditto and artificial flowers, &c.,		2	9	6		
Tedcastle, R., coals used in Mansion House,		0	16	0		
Bain, J., hire of plants, carriage, &c.,		3	10	0		
Dameron, A., band of 17th Lancers,		5	2	0		
Clibborn, E., car-hire and petty payments,		0	15	0		
Hynes, J., hire of tents, &c.,		10	0	0		
West, J., ditto, glass, &c.,		0	17	6		
Torkington, A., ditto, furniture,		1	0	0		
——, ditto, looking-glasses,		1	0	0		
Walpole and Geoghegan, hire of linen, &c., used in covering the passages leading from the Academy to the Mansion House,		12	4	0		
Boake, W., glass, cloths, &c.,		0	4	6		
Daniel, P., dozen corkscrews,		0	6	0		
——, tacks,		0	1	7		
Gill, M. H., printing circulars, receipts, &c.,		2	6	3		
Hodges and Sons, tin boilers, &c.,		2	18	0		
Keady, T., invitation cards,		0	4	0		
Maguire and Co., garden-rake and handle,		0	1	6		
O'Brien, M., wooden framing, balcony steps in garden, and work in Round Room,		28	16	6		
Pim, Brothers, and Co., oil-cloth covers for tables,		2	9	6		
Total Cost of Arrangements,		95	9	2		
Bewley and Evans, soda-water, &c.,	£4	2	6			
Bewley and Co., tea and coffee,	6	8	9			
Fleming, W., ham, &c.,	0	15	9			
Guinness and Sons, porter,	2	0	0			
O'Brien, T., bread and cakes, &c.,	17	15	10			
Reynolds, G., pastry,	3	6	8			
Sangiovanni, Mrs., ices, &c.,	50	2	4			
Smith and Sons, sugar, &c.,	7	9	3			
Waters, P., 40 gallons of milk,	2	0	0			
Total Cost of Provisions, &c.,				94	1	1
Raymond, J. C., attendance of self and Mrs. Raymond, with assistants, &c.,	8	6	6			
Hughes, C., attendance,	2	3	6			
Maguire, J., ditto,	1	7	0			
Kelly, A., Academy porter, allowance,	1	0	0			
Leigh, S., ditto, ditto,	1	0	0			
Jones and Sons, cleaning out King's Room,	0	15	0			
Tighe, J., attendance, &c.,	0	15	0			
Armstrong, J., ditto, &c.,	0	11	6			
Mac Evoy, A., and White, P.,—10*s.* each,	**1**	**0**	**0**			
Forward,	16	18	6	189	10	3	2264	9	4

	£	s.	d.	£	s.	d.	£	s.	d.
Brought forward,	16	18	6	189	10	3	2264	9	4
Brennan, M.; Kearney, T.; Lenihan, A.; Murphy, J.; Smith, R.; Tremble, ——, 7*s.* 6*d.* each,	2	5	0						
Angeli, L.; Brown, D.; Carey, W.; Condon, T.; Farley, M.; Foye, P.; Hughes, C.; Hynes, M.; Malone, J.; Martin, J.; Rogers, T.; Ryan, P.; Singleton, J.; Williams, C.; Williams, J.,—5*s.* each,	3	15	0						
Skelly, W.,	0	4	0						
Byrne, Thos. A.; Kane, Christopher; Dolan, T.; Harvey, E. J.; Hill, J. M.; Proude, N.; Wilson, R.,—2*s.* 6*d.* each,	0	17	6						
Total Cost of Attendance,				24	0	0			
Total Cost of British Association Conversazione,							213	10	3
Getty, E., his annual subscription, paid in advance for 1858, returned to his executrix, as not being due at his death,							2	2	0
Total Discharge,							2480	1	7
Balance in favour of the Public, per this Account,							13	15	1
TOTAL AMOUNT OF CHARGE,						£	2493	16	8

GENERAL ABSTRACT OF THE MONTHLY ACCOUNTS OF THE ROYAL IRISH ACADEMY,

AS FURNISHED TO AUDIT OFFICE, FROM 1ST APRIL, 1857, TO 31ST MARCH, 1858.

DR.	£	s.	d.
To Balance on 1st April, 1857,	69	16	1
To Government Grant,	500	0	0
To Interest on Stocks,	48	17	1
To Entrance Fees,	157	10	0
To Life Compositions,	136	10	0
To Annual Subscriptions,	294	0	0
To B. A. Conversazione Fund,	215	4	0
To Publications sold,	24	8	0
To Catalogues of Museum sold,	50	12	0
To Stocks sold, produced,	980	7	4
To Discount received on Payments,	8	4	2
To Contingencies,	8	8	0
	£2493	16	8

CR.	£	s.	d.
By Books, Printing, &c.,	420	3	2
By Antiquities bought,	66	19	4
By Repairs of House,	97	8	3
By Taxes and Insurance,	20	19	5
By Salaries, Wages, &c.,	404	14	6
By Furniture and Repairs,	41	17	11
By B. A. Conversazione Expenditure,	213	10	3
By Charges against Museum Catalogues sold,	35	3	7
By Stocks bought, cost,	622	12	11
By Catalogue, Museum,	320	14	9
By Contingencies, &c.	59	3	7
By Coals, Gas, &c.,	71	3	2
By Photographic Room, &c.,	14	15	5
By Cunningham Medals,	88	13	4
By Annual Subscription,	2	2	0
In Bank of Ireland,	3	16	5
In Treasurer's hands,	9	18	8
By Balance,	13	15	1
	£2493	16	8

The Treasurer reports that there is to the credit of the Academy, in the Bank of Ireland, £353 18*s.* 6*d.* in 3 per cent. Consols, and to the credit of the Cunningham Fund £1643 19*s.* 6*d.* in 3 per cent. New Stock.

31*st March*, 1858.

(Signed), JOSEPH CARSON, D.D.,
Treasurer.

No. II.

ACCOUNT

OF

THE ROYAL IRISH ACADEMY,

FROM 1ST APRIL, 1858, TO 31ST MARCH, 1859.

THE CHARGE.

				£ s. d.	£ s. d.
To Balance in favour of the Public on 1st of April, 1858 (See Vol. VII., App. No. I., p. xii.),					13 15 1
Parliamentary Grant,					500 0 0
INTEREST ON STOCKS:					
CUNNINGHAM FUND, 3 per Cents., Half-year's Interest on £1643 19*s.* 6*d.*	24 13 2				
Less, Income Tax,	0 14 5				
		23 18 9			
Half-year's Interest on £1643 19*s.* 6*d.*,	24 13 2				
Less, Income Tax,	0 10 3	24 2 11			
Total Cunningham Fund, Interest,				48 1 8	
ACADEMY CONSOLS:					
Half-year's Interest on £353 18*s.* 6*d.*	5 6 2				
Less, Income Tax,	0 2 3				
		5 3 11			
Half-year's Interest on £440 13*s.* 11*d.*	6 12 8				
Less, Income Tax,	0 2 9	6 9 6			
Total Academy Stock, Interest,				11 13 5	
TOTAL INTEREST ON STOCKS,					59 15 1
DISCOUNT RECEIVED ON ACCOUNTS PAID:					
From M. H. Gill, Discount on Miscellaneous Printing,				2 2 1	
Do. do. Printing Tranactions,				5 2 7	
Total Discount reccived,					7 4 8
			Forward,		580 14 10

		£	s.	d.	£	s.	d.
	Brought forward,				580	14	10
Transactions, &c., sold:							
E. Curry, Proceedings,	0 1 0						
Rev. C. Mayne, do.	0 1 0						
Mr. Warren, do.	0 15 0						
Total Proceedings sold,		0	17	0			
Hodges and Smith, Transactions,	3 15 0						
Rev. H. Lloyd, do.	7 0 0						
W. S. O'Brien, do.	0 10 0						
Total Transactions sold,		11	5	0			
Total Transactions, &c., sold,					12	2	0
Catalogues sold:							
In April 1858, 26 copies, £4 15*s.*; May, 63 copies, £11 8*s.* 10*d.*; June, 24 copies, £4 6*s.* 4*d.*; July, 23 copies, £4 5*s.*; Aug., 1 copy, 5*s.* 8*d.*; Sept., 8 copies, £1 13*s.*; Oct., 6 copies, £1 1*s.*; Nov., 31 copies, £5 12*s.*; Dec., 15 copies, £2 16*s.*; Jan., 1859, 4 copies, 16*s.*; Feb., 85 copies, £15 14*s.* 2*d.*; March, 50 copies, £9 9*s.* 8*d.*							
Total Catalogues sold,					62	2	8
Life Compositions:							
R. M'Donnell, M. D.,		21	0	0			
E. S. Clarke, M. D.,		6	6	0			
M. Longfield, LL. D.,		6	6	0			
W. T. Kent, Esq.,		6	6	0			
R. Adams, M. D.,		6	6	0			
G. A. Frazer, Esq.,		6	6	0			
Total Life Compositions,					52	10	0
Entrance Fees (£5 5*s.* each):—Brooke, T., Esq.; Brownrigg, Sir H. J., C. B.; Gages, A., Esq.; Gibson, Rev. C. B.; Goold, Ven. F.; Greene, J. R., Esq.; Hildige, J. G., Esq.; Palmer, E. T., Esq.							
Total Entrance Fees,					42	0	0
Annual Subscriptions (£2 2*s.* each).							
For 1857:—							
Aldridge, J., M. D.; Baker, A. W., Esq; Cather, T., Esq.; Clarke, E. S., M. D.; Corrigan, D. J., M. D.; D'Arcy, M. P., Esq.; Dixon, Rev. R. V., M. A.; Eiffe, J. S., Esq.; Farnham, Lord; Fitzgibbon, G., Esq.; Frazer, G. A., Esq.; Grubb, T. Esq.; Jones, P., Esq.; Lefroy, G., Esq.; Longfield, M., LL. D.; Longfield, W., Esq.; Mac Dermott, R., M. B.; Monsell, Rt. Hon. W., M. P.; Muspratt, J. S., Esq.; Nevill, P., Esq.; Preston, A., Esq.; Smith, C., Esq.; Smith, H., Esq.; Starkey, D. P., Esq.; Tighe, R., Esq.; Wills, Rev. J., D. D.; Wynne, Rt. Hon. J.							
For 1858:—							
Abeltshauser, Rev. J. G., LL. D.; Adams, R., M. D.; Alcorn, Rev. J., B. A.; Aldridge, J., M. D.; Andrews,							
Forward,					749	9	6

	£	s.	d.	£	s.	d.
Brought forward,	.	.	.	749	9	6

W., Esq.; Anster, J., LL. D.; Armstrong, W., Esq.; Atkinson, R., Esq.; Baker, A. W., Esq.; Beauchamp, H. C., M. D.; Bevan, P., M. D.; Bewley, E., M. D.; Brady, D F., M. D.; Brereton, D., M. D.; Burke, Sir J. B. (Ulster); Cane, A. B., Esq.; Carlile, H., Esq.; Cather, T. Esq.; Chapman, Sir B. J., Bart.; Clare, H., Esq.; Clarendon, F. V., Esq.; Claridge, J., Esq.; Cooke, A., Esq.; Copland, C., Esq.; Corbet, R., Esq.; Cork, Lord Bishop of, ; Corrigan, D. J., M. D.; Cotton, Ven. H.; Curry, E., Esq.; Cusack, J. A., Esq.; Davidson, J., Esq.; Davy, E. W., M. B.; D'Arcy, M. P., Esq.; Deasy, R., Esq.; De Vesci, Lord; Dixon, Rev. R. V., M. A.; Domvile, Sir C. W., Bart.; Downing, S., Esq.; Dungannon, Lord; Du Noyer, G. V., Esq.; Egan, Rev. J. C., M. D.; Eiffe, J. S., Esq.; Enniskillen, Earl of; Farnham, Lord; Ferrier, A., Esq.; Fitzgerald, Lord W.; Fitzgibbon, G. Esq.; Fleming, C., M. D.; Foot, L. E., Esq.; Frazer, G. A., Esq.; Freke, H., M. D.; Furlong, A., Esq.; Galbraith, Rev. J. A., M. A.; Gibson, J., Esq.; Gordon, S., M. D.; Grattan, H., Esq.; Griffin, D., M. D.; Grimshaw, W., Esq.; Griott, D. G., Esq.; Grubb, T., Esq.; Hamilton, G. A., LL. D.; Hanlon, C., Esq.; Hardinge, W. H, Esq.; Haughton, Rev. S., M. A.; Hayden, T., Esq.; Helsham, G. P., LL. D.; Ingram, J. K., LL. D.; James, Sir H.; James, Sir J. K., Bart.; Jellett, Rev. J. H., M. A.; Jennings, F. M., Esq.; Jones, P., Esq.; Kelly, W., M. D.; Kennedy, H., M.D.; Kent, W. T., Esq.; King, C. C., M. D.; Law, R., M. D.; Leach, Major; Leared, A., M. B.; Ledwich, T. H., Esq.; Lee, Rev. A. T.; Leeper, Rev. A. T.; Le Fanu, W. R., Esq.; Lefroy, G., Esq.; Lentaigne, J.; Longfield, Rev. G.; Longfield, M., LL. D.; Longfield, W., Esq.; Lyons, R. D., M. D.; MacCarthy, D. F., Esq.; MacCarthy, J. J., Esq.; MacClintock, A. H., M. D.; MacDermott, R., M. D.; MacDougall, W., Esq.; Madden, R. R., M. D.; Magee, J., Esq.; Massareene and Ferrard, Lord; Mollan, J., M. D.; Monsell, Rt. Hon. W.; Moore, C., M. D.; Moore, D., Esq; Moore, Very Rev. O. W., M. A.; Moore, W., M. B.; Muspratt, J. S., Esq; Neville, P., Esq; O'Donovan, J., LL. D.; O'Driscoll, W. J., Esq.; O'Flanagan, J. R., Esq.; Oldham, T., Esq.; O'Loghlen, Sir C., Bart.; Osborne, J., M. D.; Pakenham, Hon. and Very Rev. H., M. A.; Patten, J., M. D.; Pigot, Rt. Hon. D. R; Pigot, J. E., Esq.; Pratt, J. B., Esq.; Preston, A., Esq.; Read, A., M. D.; Ringland, J., M. B.; Roe, G., Esq.; Sanders, G., Esq.; Sawyer, J. H., M. D.; Segrave, O'N., Esq.; Sidney, F. J., LL. D.; Smith, C., Esq.; Smith, R. W., M. D.; Staples, Sir T., Bart.; Stapleton, M. H. M. B.; Starkey, D. P., Esq.; Stewart, H. H., M. D.; Stoney, G. J., M. A.; Stoney, B. B., Esq.; Stuart de Decies, Lord; Sullivan, W. K., Esq.; Talbot de Malahide, Lord; Tighe, R. Esq.; Tufnell, T. J., Esq.; Waller, J. F., LL. D.; Wills, Rev.

Forward,	.	.	.	749	9	6

	£ s. d.	£ s. d.
Brought forward, ...		749 9 6
J., D. D.; Wright, E. P., M. B.; Wynne, Rt. Hon. J.; Yeates, G., Esq.		
For 1859:—		
Aldridge, J., M. D.; Atkinson, R., Esq.; Burke, Sir J. B. (Ulster); Butler, Very Rev. R., M. A.; Brownrigg, Sir H. J., C. B.; Brooke, T., Esq.; Cane, A. B., Esq.; Carlile, H., M. D.; Carte, A., M. B.: Churchill, F., M. D.; Cooke, A., Esq.; Copland, C., Esq.; Cotton, Ven. H.; Cusack, S. A., Esq.; Domvile, Sir C. W., Bart.; Donovan, M., Esq.; Enniskillen, Rt. Hon. The Earl of; Farnham, Lord; Fitzgerald, Lord W.; Fitzgibbon, G., Esq; Furlong, A., Esq.; Goold, Ven. F.; Hardinge, W. H., Esq.; Hardy, S. L., M. D.; Hogan, W., Esq.; Jennings, F. M., Esq.; Kenny, J. C. F., Esq.; Kilmore, The Lord Bishop of; King, C. C., M. D.; L'Estrange, F., Esq.; Le Fanu, W. R., Esq.; Lentaigne, J., M. D.; Mac Donnell, J. S., Esq.; Maley, A. J., Esq.; Massareene and Ferrard, Lord; Muspratt, J. S., Esq.; O'Donovan, J., LL. D.; Patterson, R. Esq.; Purser, J. Esq.; Roe, G., Esq.; Stoney, G. J., Esq.; Stoney, B. B., Esq.; Stuart de Decies, Lord; Talbot de Malahide, Lord; West, J., D. D.; Wright, E. P., Esq. M. B.		
Total Annual Subscriptions, . . .	. . . .	451 10 0
CONTINGENCIES:		
Cooper, E. J., Esq., carriage of books, &c., ...	0 2 0	
Harvey, W. H., M. D., do.	0 1 6	
Robinson, Rev. T. R., D. D., do.	0 17 6	
Total Contingencies, ...	. . . .	1 1 0
TOTAL AMOUNT OF CHARGE, . . .	. . . .	£1202 0 6

THE DISCHARGE.

		£ s. d.	£ s. d.
ANTIQUITIES PURCHASED, &c. :—			
Boylan, A., crystal ball,		4 0 0	
Clibborn, T., comb from Ballinderry,		0 5 0	
Daly, M., coins,		0 1 6	
Dillon, J., bronze articles,		2 17 6	
Donegan, J., silver and gold do.,		17 11 10	
Fagan, P., iron ditto, from Ballinderry,		5 4 9	
Fottrell, S., copper figure, &c.,		6 5 0	
Geoghegan, J., brass pin,		0 2 6	
Lamb, P., iron figures,		0 5 0	
M'Clintock, R. bronze bit,		1 0 0	
Murray, R., coins,		3 0 0	
O'Donnell, J., wooden yoke, &c.,		1 5 0	
Total Antiquities Purchased,			41 18 1
BOOKS, PRINTING, AND STATIONERY:			
Hodges, Smith, and Co., books, &c.,		18 15 11	
M. Whelan, Thom's Directory,		0 13 6	
Total Books, Periodicals, &c., bought,		19 9 5	
Subscriptions paid: *to*			
Crania Britannia, Nos. 2 and 3,	£2 2 0		
Total Subscriptions paid,		2 2 0	
Pilkington, F., binding for Library,	21 14 2		
Barthes and Lowell, freight and charges on books,	4 5 0		
British and Irish Steam Packet Company, carriage of parcels,	0 13 2		
Chester Railway, do.	0 5 6		
Elliott & Co., do.,	0 3 9		
Hodges, Smith, & Co., do.,	1 17 0		
London Steam Packet Company, do.,	0 16 8		
London and N. W. Railway, do.,	0 2 0		
Glasgow Steam Packet Company, do.,	0 0 10		
Palæontographical Society, do.,	0 0 8		
W. Pamplin, do,	1 15 6		
Total duty, freight and charges on books,		31 14 3	
MISCELLANEOUS PRINTING, ETC.:			
Gill, M. H., miscellaneous printing to December 7, 1858,	£24 18 7		
—— Labels for Museum, &c.,	2 12 0		
Total Miscellaneous Printing, &c.,		27 10 7	
PROCEEDINGS:			
Natural History Review, printing Vol. VII., Parts 1, 2, 3, and 4,	£29 17 6		
Gill, M. H., printing, extra for Royal Society, &c.,	30 3 6		
Oldham, W., woodcuts,	3 2 6		
Pilkington, F., binding,	4 1 4		
Total cost of Proceedings,		67 4 10	
Forward		£148 1 1	41 18 1

	£	s.	d.	£	s.	d.	£	s.	d.
Brought forword,	.	.	.	148	1	1	41	18	1
Transactions:									
M. H. Gill, printing Vol. XXIII., Part 2, Rev. Dr. Robinson's paper, Art. viii., .	£22	16	9						
—— Rev. Dr. Lloyd's do., Art. ix., . .	7	19	9						
—— Dr. Kinahan's do., Art. x., . . .	9	5	11						
—— Messrs. Jukes and Haughton's do., Art. xi., ...	38	4	5						
—— Lieut. Renny's do., Art. xii., . .	26	9	1						
Du Noyer, G. V., drawings for Art. x., .	3	0	0						
Oldham, W., woodcuts for Art. viii., . .	6	15	0						
—— Woodcuts for Art. xi., ...	2	0	0						
Leach, Major G. A., 630 copies Map for Mr. Jukes's paper in Trans. xxiii., . .	11	3	0						
Pilkington, F., binding Transactions, and Catalogue of Museum, ...	12	6	7						
Total cost of Transactions, . . .				140	0	6			
Transactions in Stock:									
Keady, T., paper for copper plates, . .	3	4	1						
—— Impressions of ditto., ...	9	5	6						
Total cost of Transactions in Stock, .				12	9	7			
Stationery, Etc.:									
Pilkington, F., minute books, &c., . . .	3	0	0						
Tallon, J., stamps, &c., ...	4	10	0						
Total Stationery, &c., ...				7	10	0			
Total Books, Printing, and Stationery, ...							308	1	2
Charges against Catalogues sold:									
C. H. Eager, registering, ...				35	5	0			
H. Parr, transcribing, ...				10	5	0			
Du Noyer, G. V., drawing on wood, ...				10	0	0			
W. F. Wakeman, do., ...				0	10	0			
Hanlon, G. A., wood-cutting, ...				7	8	6			
Oldham, W., do., ...				6	19	6			
Pilkington, F., binding Part I. Catalogue, ...				3	6	3			
Total Charges against Catalogues sold, ...							73	14	3
Repairs of House:									
Alliance Gas Company, fittings, ...				0	7	6			
W. Mooney, do.				1	4	6			
S. Boylan, cleaning windows, ...				2	5	5			
J. Bray, cleaning ash-pit, ...				0	18	0			
J. Murphy, sweeping chimneys, ...				1	10	0			
M. O'Brien, shelving in Library, Museum, &c., . . .				8	5	2			
Sibthorpe and Son, glazing, ...				0	3	10			
Total Repairs of House, ...							14	14	5
Furniture and Repairs:									
Dobbyn and Son, repairs of clocks, ...				0	16	0			
Lambert, J., candle-lamps, ...				0	6	2			
Maguire and Trotter, carpets and oil-cloth, ...				6	16	0			
Forward,				7	18	2	438	7	11

	£	s.	d.	£	s.	d.
Brought forward,	7	18	2	438	7	11
B. Smyth, shaking carpets,	1	0	0			
P. Daniel, nails,	0	0	9			
Gratuity to men,	0	3	0			
Yeates, George, scales, &c.,	2	8	0			
Total Furniture and Repairs,				11	9	11
TAXES AND INSURANCE:						
National Insurance Company, to 25th December, 1858,	10	6	0			
Patriotic do. do. ,, ,, ,,	6	3	6			
Parish cess, Easter, 1858,	0	6	3			
Pipe-water rent, to January 1, 1859,	2	17	8			
Total Taxes and Insurance,				19	13	5
COALS, GAS, ETC.:						
Alliance Gas Company,	25	3	6			
J. Lambert, tapers, &c.,	0	6	8			
Saunders, advertising for tenders,	0	4	6			
R. Tedcastle, 35 tons coal,	25	16	3			
Alliance Gas Company, coke,	0	12	9			
Total Coals, Gas, &c.,				52	3	8
CONTINGENCIES:						
N. Butler, carriage of ancient boat to Dublin,	0	12	7			
E. Clibborn, gratuities to men,	0	2	6			
B. Smyth, carriage of the above from canal,	0	4	0			
E. Clibborn, one year's allowance for incidentals used in cleaning house,	10	0	0			
P. Hughes, twine, &c.,	0	14	10			
J. Maguire, hardware, &c.,	2	9	2			
M. O'Brien, packing boxes,	0	9	0			
Walpole and Geoghegan, towels, &c.,	0	6	6			
Postages, &c.,	6	18	2			
Total Contingencies, &c.,				21	16	9
SALARIES, WAGES, &c.:						
Carson, Rev. J., D. D., Treasurer,	21	0	0			
Drummond, Rev. W. H., D. D.,	21	0	0			
Graves, Very Rev. Charles, D. D., Secretary,	21	0	0			
Jellett, Rev. J. H., M. A., Secretary of Council,	21	0	0			
Clibborn, Edward, Curator of Museum, &c.,	150	0	0			
Doyle, E. W., accountant, &c., £25 0 0						
Tighe, J., ,, ,, 16 0 0						
	41	0	0			
Kelly, A., house-porter, 52 weeks, 39 0 0						
Leigh, S., messenger, &c., 39 0 0						
Foley, H. and Co., buttons for liveries, 0 15 0						
Mahon, M., servants' liveries, 13 0 0						
Ditto., ditto, great coats, 5 0 0						
Wright and Oxley, hats, 1 5 0						
Walpole and Geoghegan, blanket, 0 7 6						
Total Servants' Wages, &c.,	98	7	6			
Forward,	373	7	6	543	11	8

							£	s.	d.	£ s. d.
					Brought forward,		373	7	6	543 11 8
					Armstrong, Jane, cleaning house, &c.,		10	17	6	
					Total Salaries, Wages, &c.,					384 5 0
					GOVERNMENT STOCKS BOUGHT ON ACCOUNT OF CUNNINGHAM TRUST FUND.					
£24	18	6			3 per Cents,	£23 17 4				
					106 days' Interest,	0 4 4				
					Brokerage,	0 1 3				
£24	18	6			*Total 3 per Cents bought for Cunningham Fund account,*					24 2 11
					ON ACADEMY'S STOCK ACCOUNT:					
£86	15	5			Consols,	83 12 6				
					37 days' interest,	0 5 3				
					Brokerage,	0 2 3				
						84 0 0				
13	2	9			Consols,	12 9 3				
					72 days' interest,	0 1 6				
					Brokerage,	0 1 3				
						12 12 0				
13	0	0			Consols,	12 9 2				
					77 days' interest,	0 1 7				
					Brokerage,	0 1 3				
						12 12 0				
£112	18	2			*Total Consols bought on Academy account,*					109 4 0
					Total Government Stock bought,					133 6 11
					Total Discharge,					1061 3 7
					Balance in favour of the Public, per this account,					140 16 11
										1202 0 6

GENERAL ABSTRACT OF THE MONTHLY ACCOUNTS OF THE ROYAL IRISH ACADEMY,

AS FURNISHED TO AUDIT OFFICE, FROM 1ST APRIL, 1858, TO 31ST MARCH, 1859.

DR.	£	s.	d.	CR.	£	s.	d.
To Balance on 1st April, 1858,	13	15	1	By Books, Printing, and Stationery,	304	7	11
To Government Grant,	500	0	0	By Antiquities purchased,	41	18	1
To Interest on Cunningham Fund,	48	1	8	By Repairs of House,	14	14	5
To Interest on Academy Stock,	11	13	5	By Taxes and Insurance,	19	13	5
To Entrance Fees,	42	0	0	By Salaries, Wages, &c.,	384	5	0
To Life Compositions,	52	10	0	By Furniture and Repairs,	11	9	11
To Annual Subscriptions,	451	10	0	By Charges against Catalogues sold,	73	14	3
To Transactions and Proceedings sold,	13	1	6	By Academy Stock bought,	109	4	0
To Catalogues of Museum sold,	62	2	8	By Cunningham Fund Stock bought,	24	2	11
To Discount on Payments,	7	4	8	By Contingencies,	25	10	0
To Contingencies,	0	1	6	By Coals, Gas, &c.,	52	3	8
				By Balance to next account,	140	16	11
	£1202	0	6		£1202	0	6

BANK OF IRELAND.
April 27, 1859.

I certify that it appears by the Books of the Bank of Ireland, there remained a Balance of £1668 18*s.* New Three per cent. Government Stock, and £466 16*s.* 11*d.* Three per cent. Consols Government Stock, to the credit of the Royal Irish Academy, on the 31st day of March, 1859. For the Governor and Company of the Bank of Ireland.

(Signed), J. R. BRISCOE,
Stock Leger Keeper.

ROBERT ROBERTS,
Transfer Office.

No. III.

ACCOUNT

OF

THE ROYAL IRISH ACADEMY,

FROM 1ST APRIL, 1859, TO 31ST MARCH, 1860.

THE CHARGE.

	£ s. d.	£ s. d.
To Balance in favour of the Public, on the 1st April, 1859 (see Vol. VII., App., No. II., p. xx.), ...	. . . .	140 16 11
PARLIAMENTARY GRANTS:		
Treasury grant in favour of Catalogue of Museum, . .	200 0 0	
Annual Parliamentary Grant, ...	500 0 0	
Total Parliamentary Grants, ...	. . . .	700 0 0
CUNNINGHAM FUND, INTEREST, 3 PER CENTS.:		
Half-year's Interest on £1668 18*s.*, 3 per Cents., ... £25 0 8		
Less, Income Tax, ... 0 10 5		
24 10 3		
Half-Year's Interest on £1695 17*s.*, 3 per Cents., ... £25 8 9		
Less, Income Tax, ... 1 7 7		
24 1 2		
Total Cunningham Fund, Interest, .	48 11 5	
ACADEMY 3 PER CENT CONSOLS:		
Half-Year's Interest on £496 17*s.* 4*d.*, ... 7 9 1		
Deduct, Income Tax, ... 0 3 2		
7 5 11		
Half-Year's Interest on £496 17*s.* 4*d.*, ... 7 9 1		
Deduct, Income Tax, ... 0 8 0		
7 1 1		
Total Academy Stock, Interest, .	14 7 0	
TOTAL INTEREST ON STOCKS, . . .	. . . .	62 18 5
Forward,	. . . .	903 15 4

	£ s. d.	£ s. d.
Brought forward,	. . . .	903 15 4
PROCEEDINGS sold:		
Rev. William Reeves, D. D., binding Proceedings, ... £0 1 0		
Aquilla Smith, M. D., ditto, ... 0 1 0		
Total Proceedings sold, ...	0 2 0	
TRANSACTIONS SOLD:		
W. B. Kelly, ... £0 15 0		
George Petrie, LL. D., ... 0 10 0		
T. and W. Boone, ... 16 15 0		
Hodges, Smith, and Co., ... 0 10 0		
Ditto, ditto, ... 1 0 0		
Total Transactions sold, ...	19 10 0	
Total Proceedings and Transactions sold, . .		19 12 0
CATALOGUES sold:		
In April, 1859, 8 copies, £1 8*s.*; May, 15 copies, £2 16*s.*; June, 5 copies, £1 2*s.*; July, 4 copies, 18*s.*; September, 2 copies, 8*s.*; October, 1 copy, 4*s.*; November, 2 copies, 10*s.*; December, 1 copy, 6*s.*; January, 1860, 2 copies, 8*s.*; February, 2 copies, 10*s.*; March, 1 copy, 4*s.*		
Total Catalogues sold, ...	. . . .	8 14 0
SUBSCRIPTIONS TO THE CATALOGUE OF THE MUSEUM. PART II., &c.		
At 10*s.* each:—		
Porter, Rev. T. H., D. D.	0 10 0	
At 16*s.* each:—		
Lyle, A., Esq.	0 16 0	
At £1 each:—		
Allman, G. J., M. D.; Botfield, B., Esq.; Brady, D. F., M. D.; Brooke, T., Esq.; Browne, R. C., Esq.; Burke, Sir J. B. (Ulster); Butcher, Rev. S., D. D.; Callwell, R., Esq.; Chapman, Sir B. J., Bart.; Cleland, J., Esq.; Corballis, J. R., LL. D.; Cotton, Ven. H., LL. D.; Croker, C. P., M. D.; Dobbin, L., Esq.; Downing, S., LL. D.; Du Noyer, G. V., Esq.; Ferrier, A., Esq.; Furlong, A., Esq.; Gibson, J., Esq.; Gough, Hon. G. S., B. A.; Griffith, Sir R., Bart.; Hardinge, W. H., Esq.; Hayden, T., Esq.; Hemans, G. W., Esq.; Hill, Lord G. A.; Hutton, T., Esq.; Hildige, J. G., Esq.; Ingram, J. K., LL. D.; Jones, Gen. Sir H. D.; Kelly, D. H., Esq.; Kelly, W., M. D.; Lawson, J. A., LL. D.; Leach, Major G. A.; Longfield, Rev. G., M. A.; Mac Carthy, J. J., Esq.; Mac Donnell, J., M. D.; M'Donnell, Rev. R., D. D.; Mac Donnell, R., Esq.; Mac Neece, Rev. T., D. D.; Moore, Very Rev. O. W.; O'Brien, W. S., Esq.; Pakenham, Hon. and Very Rev. H.; Parker, A., Esq.;		
Forward,	1 6 0	932 1 4

	£	s.	d.	£	s.	d.
Brought forward,	1	6	0	932	1	4
Phibbs, W., Esq.; Pim, J., Esq.; Pim, W. H., Esq.; Portlock, Major-Gen.; Reeves, Rev. W., D. D.; Robinson, Rev. T. R., D. D.; Salmon, Rev. G., D. D.; Senior, E., Esq.; Smith, R. W., M. D.; Staples, Sir T., Bart.; Stokes, W., M. D.; Strong, Ven. C., M. A.; Vignoles, C., Esq.; Wall, Rev. C. W., D. D.; Wright, E., LL.D.; Wright, E. P., M. B.	59	0	0			
At £1 1*s.* each:—						
Baker, A. W., Esq.; Dickinson, J., M. D.; Marsh, Sir H., Bart.; Patten, J., M. D.; Ringland, J., M. B.; Walsh, J. E., LL. D.	6	6	0			
At £2 each:—						
Clermont, Lord; Cooke, A., Esq.; Dungannon, Viscount; Enniskillen, Earl of; Guinness, B. L., Esq.; Napier, Right Hon. J., LL. D.	12	0	0			
At £3 each:—						
Cooper, E. J., Esq.; Harvey, W. H., M. D.; Kenny, J. C. F., Esq.; Kilmore, Bishop of.	12	0	0			
At £5 each:—						
Carson, Rev. J., D. D.; Colclough, J. T. R., Esq.; Farnham, Lord; Jellett, Rev. J. H., M. A.; Kildare, Marquis of; Larcom, Major-General Sir T. A.; Lloyd, Rev. H., D. D.; Talbot de Malahide, Lord.	40	0	0			
At £10 each:—						
Dunraven, Earl of.	10	0	0			
Total Subscriptions to Catalogue, , ...				140	12	0
ANNUAL SUBSCRIPTIONS (£2 2*s.* each.)						
For 1858:—						
Codd, F., Esq.; Colclough, J. T. R., Esq.; Drennan, W., Esq.; Hancock, W. N., LL. D.; O;Gorman, N. S., Esq.; O'Hagan, T., Esq.; Owen, J. H., Esq.; Smyth, H., Esq.	16	16	0			
For 1859:—						
Abeltshauser, Rev. J. G., LL. D; Alcorn, Rev. J.; Andrews, W., Esq.; Baker, A. W., Esq.; Barnes, E., Esq.; Beauchamp, H. C., M. D.; Bevan, P., M. D.; Bewley, E., M. D.; Lord Justice of Appeal; Brady, D. F., M. D.; Brereton, D., M. D.; Burrowes, J., Esq.; Cather, T., Esq.; Chapman, Sir B. J., Bart.; Claridge, J., Esq.; Codd, F., Esq.; Colclough, J. T. R., Esq.; Collis, M. H., M. B.; Corbet, R., Esq.; Cork, Lord Bishop of; Curry, E., Esq.; Davidson, J., Esq.; Davy, E. W., Esq.; D'Arcy, M. P., Esq.; Deasy, R., LL. D.; De Vesci, Viscount; Dixon, Rev. R. V.; Downing, S., LL. D.; Drennan, W., Esq.; Dungannon, Viscount; Du Noyer, G. V., Esq.; Egan, J. C., Esq.; Ferrier, A., Esq.; Fleming, C., M. D.; Foot, L. E., Esq.; Freke,						
Forward.	16	16	0	1072	13	4

	£	s.	d.	£	s.	d.
Brought forward.	16	16	0	1072	13	4
H., M. D.; Galbraith, Rev. J. A.; Gibson, J., Esq.; Gibson, Rev. C. B.; Griffin, D., M. D.; Grimshaw, W., Esq.; Griott, D. G., Esq.; Grubb, T., Esq.; Hamilton, G. A., LL. D.; Hancock, W. N., LL. D.; Hanlon, C., Esq.; Haughton, Rev. S.; Hayden, T., Esq.; Helsham, G. P., LL. D.; Ingram, J. K., LL. D.; James, Sir H. J.; James, Sir J. K., Bart.; Jellett, Rev. J. H.; Kelly, W., M.D.; Kennedy, H., M.D.; Kinahan, J. R., M.D.; Law, R., M. D.; Leach, G. A., Major; Leared, A., M. D.; Longfield, Rev. G.; Longfield, W., Esq.; Lyons, R. D., M. D.; Mac Carthy, D. F., Esq.; Mac Carthy, J. J., Esq.; Mac Causland, D., Esq.; Mac Dougall, W., Esq.; Madden, R. R., M. D.; Magee, J., Esq; Mollan, J., M. D.; Montgomery, H. B., M. D.; Moore, C., Esq.; Moore, D., Esq.; Moore, Very Rev. O. W.; Moore, W., M. B.; Nugent, A. R., Esq.; O'Donnell, Lieut.-Gen. Sir C. R.; O'Driscoll, W. J., Esq.; O'Flanagan, J. R., Esq.; O'Gorman, N. S., Esq.; O'Hagan, T., Esq., Q. C.; Oldham, T., Esq., M. A.; O'Loghlen, Sir C., Bart.; Osborne, J., M. D.; Pakenham, Hon. and Very Rev. H.; Patten, J., M. D.; Pigot, Right Hon. D. R.; Pigot, J. E., Esq.; Pratt, J. B., Esq.; Read, A., M.D.; Ringland, J., M. B.; Sanders, G., Esq.; Sawyer, J. H., M. D.; Sidney, J. F., LL. D.; Smith, R. W., M. D.; Smith, H., Esq.; Staples, Sir T., Bart.; Stapleton, M. H., M. B.; Starkey, D. P., Esq.; Stewart, H. H., M. D.; Sullivan, W. K., Esq.; Tufnell, T. J., Esq.; Wynne, Right Hon. J.; Yeates, G., Esq.	216	6	0			
For 1860:						
Barnes, E., Esq.; Bewley, E., M. D.; Lord Justice of Appeal; Brooke, T., Esq.; Burke, Sir J. B.; Burrowes, J., Esq.; Butler, Very Rev. R.; Brownrigg, Sir H. J.; Carte, A., M.B.; Cather, T., Esq.; Churchill, F., M.D.; Cork, Lord Bishop of; Cotton, Ven. H., LL.D.; D'Arcy, M. P., Esq.; Donovan, M., Esq.; Dungannon, Viscount; Enniskillen, Earl of; Farnham, Lord; Fitzgerald, Lord W.; Fleming, C., M. D.; Furlong, A., Esq.; Gages, A., Esq.; Hancock, W. N., LL. D.; Hanlon, C., Esq.; Hardy, S. L., M. D.; Hogan, W., Esq.; James, Sir H.; Kenny, J. C. F., Esq.; Kilmore, Bishop of; King, C. C., M. D.; Law, R., M. D.; L'Estrange, F., Esq.; Mac Carthy, D. F., Esq.; Mac Carthy, J. J., Esq.; Mac Donnell, J. S., Esq; Magee, J., Esq.; Maley, A. J., Esq.; Massareene, Viscount; Mollan, J., M. D.; Moore, Very Rev. O. W.; Muspratt, J. S., Esq.; O'Donnell, Lieut.-Gen. Sir C. R.; O'Donovan, J., LL. D.; Osborne, J., M. D.; Patterson, R., Esq.; Pratt, J. B., Esq.; Roe, G., Esq.; Smith, R. W., M. D.; Stoney, G. J., Esq.; M. A.; Stuart de Decies, Lord; West, Ven. J., D. D.; Wills, Rev. J., D. D.	109	4	0			
Total Annual Subscriptions, . . .	.	.	.	342	6	0
Forward,	.	.	.	1414	19	4

	£	s.	d.	£	s.	d.
Brought forward,	.	.	.	1414	19	4
ENTRANCE FEES (£5 5*s.* EACH.)						
Clarke, F., M. D.; Conwell, E. A., Esq.; Dickson, Rev. B.; Foley, W., M. D.; Haughton, J., Esq.; Moore, Captain, A. M.; Moore, W. D., M. D.; Stewart, A. J. R., Esq; Waldron, L., Esq., M. P.						
Total Entrance Fees, ...	.	.	.	47	5	0
LIFE COMPOSITIONS:						
John Anster, LL. D., ...	6	6	0			
Samson Carter, Esq., ...	6	6	0			
Rev. B. Dickson, M. A., ...	21	0	0			
Thomas Grubb, Esq., ...	6	6	0			
William Longfield, Esq., ...	6	6	0			
Duke of Manchester, ...	21	0	0			
W. D. Moore, M. B., ...	21	0	0			
H. J. Kerr Porter, Esq., ...	15	15	0			
Total Life Compositions, ...	.	.	.	103	19	0
CONTINGENCIES (DR. SIDE):						
Royal Dublin Society, carriage of parcels, ...	0	8	9			
Total Contingencies, (Dr. side), ...	.	.	.	0	8	9
TOTAL AMOUNT OF CHARGE, ...	.	.	. £	1566	12	1

THE DISCHARGE.

	£	s.	d.	£	s.	d.
ANTIQUITIES BOUGHT, MUSEUM, ETC.:						
Cardiff, J., silver coin,	0	2	6			
Carson, E., crucifixion,	0	5	0			
Clibborn, T., articles from Ballinderry,	0	2	0			
Fegan, P., ditto.,	5	5	0			
Dolan, F., gold-cupped fibula, and chain,	8	4	0			
Fermoyle, J., bronze battle axe,	1	0	0			
Hanlon, G. A., brass jug,	1	10	0			
Keating, P., Swineford, brooch,	20	0	0			
Knox, J., silver bracelet,	1	0	0			
O'Donnell, J., bronze brooch, &c.,	2	0	0			
Striner, G., brass censor,	0	2	6			
Tyrrell, Mrs., gold aisins,	8	0	0			
Wilde, W. R., do., and repairs,	3	14	8			
Do. ancient crozier of O'Brady, and drawing,	6	15	0			
Total Antiquities purchased,	58	0	8			
Boswell, J., paper for Museum trays,	0	2	0			
Dolan, M., carriage of antiquities,	0	10	0			
Gratuity to men, moving do.,	0	7	0			
O'Brien, M., breaking out and restoring bars,	0	10	0			
Do. carpenter's work,	0	7	0			
Do. gratuity to men per.,	0	6	6			
Smith, B., carriage of antiquities,	0	17	6			
Wilde, W. R., moving do.,	0	6	0			
Total Museum expenses,	3	6	0			
Total Antiquities bought, Museum, &c.				61	6	8
BOOKS, PRINTING, AND STATIONERY, ETC.:						
Barthes and Lowell, books,	4	7	0			
Connolly, T., ditto,	0	4	6			
Hodges, Smith, & Co., books, periodicals, &c.,	24	0	8			
Whelan, M., Thom's Directory,	0	15	0			
Total Books, Periodicals, &c., bought,	29	7	2			
Camden Society, subscription for 1857–9,	3	0	0			
Total Subscriptions paid,	3	0	0			
Jones, J. F., guard book,	0	15	0			
Pilkington, F., binding books,	15	10	5			
Walpole and Co., calico for drawings,	0	19	6			
Total Binding Books, &c.,	17	4	11			
Conolly, T., Irish manuscript,	0	5	0			
O'Callaghan, M., ditto,	2	0	0			
Total Irish Manuscripts bought,	2	5	0			
Barthes and Lowell, freight and charges,	2	3	6			
Boone, T. & W., ditto,	6	15	7			
British Steam-packet Co., ditto,	0	10	8			
Forward,	£9	9	9	51	17	1	61	6	8

		£	s.	d.	£	s.	d.
	Brought forward,	£9	9	9	51	17	1	61	6	8
Eliott and Co., freight and charges,		0	2	7						
Kelly, W. B.,	ditto,	0	1	0						
Mason, G.,	ditto,	0	8	0						
Great Western Railway,	ditto,	0	1	1						
Hodges Smith, and Co.,	ditto,	0	7	6						
London Steam-ship Co.,	ditto,	0	11	6						
Moran, J.,	ditto,	0	4	0						
Total Freight, Duty, and Charges on Books,					11	0	5			
Total Expenditure on Library for Books, Binding, MSS., Carriage, and Duty on Books,					62	17	6			
MISCELLANEOUS PRINTING:										
Gill, M. H., miscellaneous printing of 20th June, 1859,		11	3	9						
Total Miscellaneous Printing,					11	8	9			
PROCEEDINGS, PRINTING, BINDING, ETC.:										
Du Noyer, G., drawing heads of oxen,		2	0	0						
Gill, M. H., printing to 25th Nov., 1859,		15	8	5						
Natural Hist. Review, printing of parts 5, 6, 7, and 8,		42	5	11						
Oldham, W., woodcuts,		4	0	0						
Total Cost of Proceedings,					63	14	4			
TRANSACTIONS, PRINTING AND BINDING, ETC.:										
Gill, M. H., printing vol. xxiii., part ii.										
H. L. Renny's Appendix, &c.,	5 1 9									
Incidental printing,	2 19 9									
Rev. H. Lloyd's Paper, vol. xxiv., part i.,	11 3 2									
		19	4	8						
Von Freight, J., colouring maps for Messrs. Jukes and Haughton's Paper in vol. xxiii., part ii.,		6	17	0						
Pilkington, F., binding,		12	5	0						
Total Cost of Transactions,					38	6	8			
O'Neill, J., nine vols. bought,					1	0	0			
STATIONERY, ETC.:										
Tallon, J., receipt stamps, paper, &c.,		6	9	2						
Total Stationery, &c.,					6	9	2			
Total Books, Printing, Stationery, &c.,								183	11	5
CATALOGUE OF MUSEUM (PART I.):										
Pilkington, F., binding,		1	4	2						
								1	4	2
	Forward,							216	2	3

	£	s.	d.	£	s.	d.
Brought forward,				246	2	3
Catalogue of Museum (Part II.):						
Du Noyer, G., drawing on wood blocks,	5	12	0			
Wakeman, W. F., ditto,	7	10	0			
Hanlon, G. A., engraving wood blocks,	16	13	6			
Oldham, W., ditto,	17	6	6			
Wilde, W. R., for photograph,	0	3	6			
Parr, H., transcribing,	4	0	0			
Total Charges against Catalogue (Part II.),				51	5	6
Repairs of House, Etc.:						
Boylan, S., cleaning windows,	2	17	6			
Bray, J., ditto, ash-pit,	1	10	0			
Do. removing rubbish,	0	3	0			
Maguire and Co., spring for door, &c.,	0	13	3			
Murphy, cleaning chimneys,	1	11	6			
Total Repairs of House,				6	15	3
Furniture and Repairs:						
Dobbyn and Sons, repairs and winding clocks,	1	3	6			
Lombard, N., frame of T. Moore's picture,	2	10	0			
Torkington, A., palliass for house-porter,	0	6	6			
Walpole and Co., sheeting, &c.,	2	2	6			
Smyth, B., float, and men shaking carpets,	1	0	0			
Derham, C., Holly-sticks,	0	2	0			
Gratuity to men,	0	4	6			
Kearney, T., putting down carpets,	0	5	0			
	1	11	6			
Total, Furniture and Repairs,				7	14	0
Taxes and Insurance:						
National Insurance Company,	10	6	0			
Patriotic ditto,	6	3	6			
Parish Cess,	0	10	11			
Pipe-water rent,	2	17	8			
Total Taxes and Insurance,				19	18	1
Coals, Gas, Etc.:						
Alliance and Consumers' Gas Company,	32	12	7			
Lambert, J., wax candles, and tapers,	0	15	11			
Tedcastle and Co., 30 tons of coal,	22	17	6			
Total Cost of Coals, Gas, &c.,				56	6	0
Contingencies, Etc.:						
Bald, W., drawing large diagram,	0	7	6			
Cherry and Shield, wrapping-paper,	2	2	6			
Clibborn, E., car-hire,	0	1	6			
Clibborn, E., one year's allowance for incidentals used in cleaning the house,	10	0	0			
Daniel, P., iron wrench,	0	2	6			
Getty and Rorke, carriages to Phœnix Park,	1	19	6			
Forward,	14	13	6	388	1	1

		£	s.	d.	£	s.	d.
	Brought forward,	14	13	6	388	1	1
Hodgins, M., packing boards,		0	9	6			
Johnson, T., chemicals, &c.,		0	11	2			
Maguire, J., nails, tacks, &c.,		0	1	0			
Maguire, R., twine, &c.,		1	9	0			
O'Brien, M., arranging heads, boards, &c.,		0	17	6			
Oldham and Co., G., oil, &c.,		0	1	0			
Richmond Institution, sacks, &c.,		0	10	2			
Tighe, J., transmitting address to Earl of Carlisle, &c.,		1	0	0			
Wiseheart, J., cartridge-paper,		0	1	0			
Postages paid,		8	7	1			
Total Contingencies,					28	0	11
SALARIES, WAGES, &c.:							
Carson, Rev. Joseph, D. D., Treasurer, 1859-60,		21	0	0			
Drummond, Rev W. H., D. D., Librarian, do.,		21	0	0			
Graves, Very Rev. Charles, D. D., Secretary, do.,		21	0	0			
Jellett, Rev. J. H., M. A., Secretary of the Council, do.,		21	0	0			
Clibborn, Edward, Clerk, Assistant Librarian, and Curator of Museum, 1859-60,		150	0	0			
Doyle, E. W., accountant, &c.,		49	0	0			
Kelly, A., house-porter, &c., 53 weeks,		39	15	0			
Leigh, S., messenger, &c., 53 ditto,		39	15	0			
Meagher, M., porters' liveries,		13	0	0			
Wright and Oxley, ditto, hats,		1	5	0			
Kelly, J., shoes for messenger,		0	15	0			
Walpole and Geoghegan,		0	14	0			
Hughes, C., delivering summonses,		0	10	0			
Armstrong, J., cleaning house, &c.,		11	15	6			
Total Salaries, Wages, &c.,					390	9	6

GOVERNMENT STOCKS BOUGHT ON ACCOUNT OF CUNNINGHAM TRUST FUND.

£26	19	0	New 3 per Cents, cost,	£24	7	2			
			42 days' Interest,	0	1	10			
			Brokerage,	0	1	3			
							24	10	3
25	5	2	New 3 per Cents, cost,	23	18	0			
			46 days' interest,	0	1	11			
			Brokerage,	0	1	3			
							24	1	2
£52	4	2	*Total New 3 per Cents bought for Cunningham Fund account, cost*,						
								48	11	5

ON ACADEMY'S STOCK ACCOUNT:

£30	0	5	Consols,	26	18	11			
			118 days' interest,	0	5	10			
			Brokerage,	0	1	3			
							27	6	0
28	11	2	Consols,	27	4	9			
			Brokerage,	0	1	3			
							27	6	0
£58	11	7							
			Forward,				£54	12	0	48	11	5	806	11	6

£	s.	d.		£	s.	d.	£	s.	d.
£58	11	7	*Brought forward*, £54 12 0		48	11	5	806	11	6
16	8	2	Consols, . . . 15 13 9							
			Brokerage, . . 0 1 3							
				15 15 0						
88	14	0	Consols, . . . 83 9 9							
			55 days' interest, 0 8 0							
			Brokerage, . . 0 2 3							
				84 0 0						
6	13	0	Consols, . . . 6 5 1							
			82 days' interest, 0 0 11							
				6 6 0						
13	4	7	Consols, . . . 12 9 0							
			82 days' interest, 0 1 9							
			Brokerage, . . 0 1 3							
				12 12 0						
183	11	4	*Total Consols bought for Academy account*, ...		173	5	0			
			Total Government Stock bought, ...					221	16	5
			TOTAL DISCHARGE, ...					1028	7	11
			Balance in Bank of Ireland, ...		536	9	7			
			„ in Treasurer's hands, ...		1	14	7			
			Total Balance in favour of the Public, per this account, ...					538	4	2
			TOTAL AMOUNT OF CHARGE, ...				£	1566	12	1

GENERAL ABSTRACT OF THE MONTHLY ACCOUNTS OF THE ROYAL IRISH ACADEMY,

AS FURNISHED TO AUDIT OFFICE, FROM 1ST APRIL, 1859, TO 31ST MARCH, 1860.

DR.	£	s.	d.
To Balance on 1st April, 1859, . . .	140	16	11
To Annual Subscriptions, ...	342	6	0
To Entrance Fees, ...	47	5	0
To Life Compositions, ...	103	19	0
To Interest on Academy Stock, . .	14	7	0
To Catalogues sold, ...	8	14	0
To Catalogue Subscriptions, . . .	140	12	0
To Interest on Cunningham Fund, .	48	11	5
To Proceedings sold, ...	0	2	0
To Transactions sold, ...	19	10	0
To Contingencies, ...	0	8	9
To Government Grant, ...	500	0	0
To do. do. in aid of the publication of the Museum Catalogue, ...	200	0	0
	£1566	12	1

CR.	£	s.	d.
By Academy Stock bought, . . .	173	5	0
By Charges against Catalogues sold,	51	5	6
By Contingencies, ...	42	12	4
By Coals, Gas, &c., ...	56	6	0
By Cunningham Fund Stock bought,	48	11	5
By Furniture and Repairs, . . .	6	7	6
By Proceedings, Printing and Binding,	63	14	4
By Miscellaneous Printing, . . .	11	3	9
By Repairs of House, ...	8	1	9
By Stationery, ...	6	9	2
By Salaries, ...	390	4	6
By Transactions, Printing and Binding, ...	38	6	8
By Taxes and Insurance, ...	19	18	1
By Transactions and Proceedings bought, ...	1	0	0
By Antiquities purchased, ...	58	0	8
By Books bought, and charges, &c. .	49	12	1
By Manuscripts bought, ...	2	5	0
By Binding Catalogues, ...	1	4	2
By Balance to next account, . . .	538	4	2
	£1566	12	1

BANK OF IRELAND,
April 16, 1860.

I certify that it appears by the Books of the Bank of Ireland, there remained a Balance of £1721 2*s.* 2*d.* New Three per cent. Government Stock, and £650 8*s.* 3*d.* Three per cent. Consols to the credit of the account of the Royal Irish Academy, on the 31st day of March, 1860. For the Governor and Company of the Bank of Ireland

(Signed), J. R. BRISCOE,
Stock Leger Keeper.

ROBERT ROBERTS,
Transfer Office.

No. IV.

ACCOUNT

OF

THE ROYAL IRISH ACADEMY,

FROM 1st APRIL, 1860, TO 31st MARCH, 1861.

THE CHARGE.

	£	s.	d.	£	s.	d.
To balance in favour of the Public on the 1st April, 1860 (see Vol. VII., App. No. III., p. xxx.),				538	4	2
PARLIAMENTARY GRANT,				500	0	0
CUNNINGHAM FUND, INTEREST, 3 PER CENTS.:						
Half-year's Interest on £1721 2s. 2d., £25 16 4						
Less, Income Tax, 0 10 9						
25 5 7						
Half-year's Interest on £1748 3s. 4d., £26 4 5						
Less, Income Tax, 1 1 10						
25 2 7						
Total Cunningham Fund, Interest,	50	8	2			
ACADEMY 3 PER CENT CONSOLS:						
Half-year's Interest on £672 10s. 1d., 10 1 9						
Less, Income Tax, 0 8 5						
9 13 4						
Half-year's Interest on £694 17s. 4d., 10 8 5						
Less, Income Tax, 0 8 8						
9 19 9						
Total Academy Stock, Interest,	19	13	1			
TOTAL INTEREST ON STOCKS,				70	1	3
CATALOGUES SOLD, PART I.: In April, 1860, 1 copy, 4s.; May, 1 copy, 4s., June, 1 copy, 4s.; August, 1 copy, 4s.; September, 2 copies, 8s.; October, 2 copies, 8s.; November, 9 copies, £1 14s. 6d.; December, 5 copies, £1 2s.; January, 1861, 8 copies, £1 12s.; March, 12 copies, £2 5s.	8	5	6			
Forward,	8	5	6	1108	5	5

	£	s.	d.	£	s.	d.
Brought forward,	8	5	6	1108	5	5
CATALOGUES SOLD, PART II.:						
In January, 1861, 43 copies, £11 12*s.* 6*d.*; February, 28 copies, £7 5*s.*; March, 109 copies, £26 13*s.* 9*d.*	45	11	8			
Total Catalogues sold, ...				53	16	9
SUBSCRIPTIONS TO THE CATALOGUE OF THE MUSEUM. PART II., &c.						
At £1 each:—						
Atkinson, Rt. Hon. R., Lord Mayor; Baillie, Rev. J. K., D. D.; Brooke, T., Esq.; Knox, G. J., Esq.; Roe, H., Esq.; Rowan, Ven. A. B., D. D., ...	6	0	0			
At £3 each:—						
Gilbert, J. T., Esq., ...	3	0	0			
At £5 each:						
Graves, Very Rev. Dean; Todd, Rev. J. H., D. D.	10	0	0			
Total Subscriptions to Catalogue, ...				19	0	0
ANNUAL SUBSCRIPTIONS (2 2*s.* each).						
For 1858:—						
Field, F., Esq., ...	2	2	0			
For 1859:—						
Eiffe, J. F., Esq.; Field, F., Esq.; Lee, Rev. A. T., M. A.; M'Clintock, A. H., M. D.; Neville, P., Esq.; Preston, A., Esq.; Segrave, O'N., Esq.; Smith, C., Esq.; Waller, J. F., LL.D., ...	18	18	0			
For 1860:						
Andrews, W., Esq.; Atkinson, Rt. Hon. R., Lord Mayor; Baker, A. W., Esq.; Beauchamp, H. C., M. D.; Bevan, P., M. D.; Brady, D. F., M. D.; Brereton, D., M. D.; Cane, A. B., Esq.; Chapman, Sir B. J., Bart.; Claridge, J., Esq.; Cooke, A., Esq.; Copland, C., Esq.; Corbet, R., Esq.; Curry, E., Esq.; Davidson, J., Esq.; Davy, E. W., M. D.; De Vesci, Viscount; Downing, S., LL.D.; Egan, Rev. J. C.; Eiffe, J. S., Esq.; Ferrier, A., Esq.; Field, F., Esq.; Fitzgibbon, G., Esq.; Foot, L. E., Esq.; Freke, H., M. D.; Galbraith, Rev. J. A., M. A.; Gibson, Rev. C. B.; Gibson, J., Esq.; Goold, Ven. F., M. A.; Griffin, D., M. D.; Grimshaw, W., Esq.; Hardinge, W. H., Esq.; Haughton, Rev. S., A. M.; Hayden, T., Esq.; Ingram, J. K., LL.D.; James, Sir J. K., Bart.; Jellett, Rev. J. H., M. A.; Kelly, W., M. D.; Kennedy, H., M. D.; Kinahan, J. R., M. D.; Leach, Lieut-Col.; Lee, Rev. A. T., A. M.; Le Fanu, W. R., Esq.; Lentaigne, J., M. D.; Longfield, Rev. G., M. A.; Lyons, R. D., M. D.; M'Clintock, A. H., M. D.; Mac Dougall, W., Esq.; Madden, R. R., M. D; Moore, C., Esq.; Moore, D., Esq.; Moore, W., M. D.; Neville, P., Esq.; Nugent, A. R., Esq.; O'Flanagan, J. R., Esq.; Oldham, T., Esq.; O'Logh-						
Forward,	21	0	0	1181	2	2

	£	s.	d.	£	s.	d.
Brought forward,	21	0	0	1181	2	2
len, Sir C., Bart.; Pakenham, Hon. and Very Rev. H., M. A.; Patten, J., M. D.; Pigot, J. E., Esq.; Preston, A., Esq.; Purser, J., Esq.; Read, A., M. D.; Ringland, J., M. D.; Sanders, G., Esq.; Sawyer, J. H., M. D.; Segrave, O'N., Esq.; Sidney, F. J., LL. D.; Smith, C., Esq.; Smyth, H., Esq.; Stapleton, M. H., M. B.; Starkey, D. P., Esq.; Stewart, H. H., M. D.; Stoney, B. B., Esq.; Sullivan, W. K., Esq.; Talbot de Malahide, Rt. Hon. Lord; Tufnell, T. J., Esq.; Wright, E. P., M. D.; Yeates, G., Esq., ...	165	18	0			
For 1861:						
Alcorn, Rev. J., B. A.; Butler, Very Rev. Dean, M.A.; Churchill, F., M. D.; Dungannon, Viscount; Enniskillen, Rt. Hon. the Earl of; Fleming, C., M. D; Hardinge, W. H., Esq.; L'Estrange, F., Esq.; Maley, A. J., Esq.; O'Donnell, Sir C. R.; Patterson, R., Esq.; Waldron, L., Esq., M. P., ...	25	4	0			
Total Annual Subscriptions, . . .	.	.	.	212	2	0
ENTRANCE FEES (£5 5*s.* EACH).						
Adair, J. G., Esq.; Cameron, C. A., M. D.; Cusack, H., Esq.; Duncan, J. F., M. D.; Frith, R. H., Esq.; Graves, Rev. J., M. A.; MacIlveen, A., Esq.; Mac Namara, R., M. D.; Meyler, G., Esq.; Monck, Lord Viscount; Moore, J., M. D.; Thompson, W., LL. D.; Walker, D., M. D.						
Total Entrance Fees, ...	.	.	.	68	5	0
LIFE COMPOSITIONS:						
Conwell, E. A., Esq., ...	21	0	0			
Cusack, H. Esq., ...	21	0	0			
Frith, R. H., Esq., ...	21	0	0			
Hildige, J. G., Esq., ...	21	0	0			
Moore, J., M. D., ...	15	15	0			
Total Life Compositions, ...	.	.	.	99	15	0
CONTINGENCIES (DR. SIDE):						
Rev. Samuel Haughton, carriage of books, ...	0	1	0			
M. Roberts, Esq., M. A., ...	0	2	0			
Edward Wright, LL. D., ...	0	3	6			
Edward J. Cooper, Esq., ...	0	1	0			
Roman Catholic University, ...	0	10	6			
Geological Society, ...	0	7	6			
Queen's College, Galway, ...	0	2	6			
Queen's College, Cork, ...	0	1	0			
Rev. H. Lloyd, D. D., ...	0	3	0			
Royal Dublin Society, ...	0	2	6			
Total Contingencies (*Dr. side*), ...	.	.	.	1	14	6
TOTAL AMOUNT OF CHARGE, . . .	.	.	.	1562	18	8

THE DISCHARGE.

	£	s.	d.	£	s.	d.	£	s.	d.
ANTIQUITES BOUGHT, MUSEUM, &c. :—									
Campbell, H., ornamented celt, . . .	0	2	6						
Geoghegan, M., bronze pin, ...	0	1	0						
O'Donnell, J., cinerary urn, jet beads, and paddles, ...	3	7	0						
Wakeman, W. F., iron antiquities, . .	1	0	0						
Total Antiquities purchased, . .	.	.	.	4	10	6			
Johnson, E., mending gold lunette, . .	1	0	0						
Cullen, T., repairs of bronze horn, . .	0	5	0						
Total cost of Antiquities repaired,	.	.	.	1	5	0			
Cullen, T., plaster cast, ...	0	5	0						
Wilde, W. R., plaster casts of Antiquities from Mayence, ...	11	12	6						
Total cost of plaster casts of Antiquities, . .				11	17	6			
Kelly, A., drawings of gold Antiquities, ...				0	5	0			
Total Antiquities bought, Museum, &c., . .				.	.	.	17	18	0
BOOKS, PRINTING, AND STATIONERY :—									
D'Arcy, J., books, ...	0	4	6						
O'Neill, H., books, ...	0	3	0						
Hodges, Smith, and Co., periodicals, &c.,	23	0	8						
Whelan, M., Thom's Directory, . . .	0	15	0						
Total Books, Periodicals, &c., bought, . . .				24	3	2			
Ray Society, 1859, 1860, 1861, . . .	3	3	0						
Total Subscriptions paid, . . .	.	.	.	3	3	0			
Barthes and Lowell, charges on books, .	2	14	9						
Brien, T., parcels, ...	0	4	6						
British Steam Packet Company, do., .	0	14	3						
City of Dublin Steam Packet Co., do., .	0	2	0						
Dublin and Drogheda Railway, do. . .	0	0	4						
Dublin and Glasgow, do., ...	0	11	2						
Dublin and Liverpool Screw S. Co., do.,	0	10	0						
Dublin and London Steam S. Co., do., .	0	10	9						
Fishbourne and Co., do., ...	0	3	4						
Graham, G., do., ...	0	0	6						
Great Southern and Western Railway, do,	0	8	1						
Hodges, Smith, and Co., do., . . . ,	0	11	6						
London N. W. Railway Co., do., . .	0	15	2						
London Steamer, do., ...	0	4	4						
Midland Great Western Railway, do., .	0	3	7						
Total Freight, Duty, and Charges on Books, . .				7	9	3			
Total Expenditure on Library for Books, Carriage, and Duty on Books, ...				34	15	5			
MISCELLANEOUS PRINTING :—									
Gill, M. H., miscellaneous printing, from July, 1859, to December 14, 1860, .	34	9	11						
Total Miscellaneous Printing, . .	.	.	.	34	9	11			
Forward, . .				69	5	4	17	18	0

	£	s.	d.	£	s.	d.	£	s.	d.
Brought forward, . .	.	.	.	69	5	4	17	18	0
PROCEEDINGS, PRINTING, BINDING, &c. :—									
Natural History Review, printing, Parts ix. x., and xi., of vol. vii., ...	86	13	11						
Gill, M. H., printing, to Dec. 14, 1860,	40	11	6						
Gray, C. M., woodcuts, &c., ...	2	0	0						
Oldham, W., woodcuts, &c., ...	5	7	6						
Total cost of Proceedings, . . .	.	.	.	134	12	11			
TRANSACTIONS, PRINTING, AND BINDING, &c. :—									
Gill, M. H., printing vol. xxiii., Part i., to December 20, 1860, ...	15	0	6						
Pilkington, F., binding vol. xxiii., Part i.,	5	13	9						
Total cost of Transactions, . . .	.	.	.	20	14	3			
STATIONERY, &c. :—									
Bellew, G., Lithographing, &c., . . .	3	0	0						
Hendrick, R., Leger, ...	1	1	0						
Pilkington, F., council minute book, .	0	10	6						
Tallan, J., paper, envelopes, &c., . . .	9	3	4						
Thom, A., Museum registry book, . .	1	11	0						
Total Stationery, &c., ...	.	.	.	15	5	10			
Total Books, Printing, Stationery, &c., . . .				.	.	.	239	18	4
CATALOGUE OF MUSEUM (PART II.):—									
Curry, E., Irish nomenclature, . . .	2	0	0						
Eager, C. H., registering museum, . .	11	10	0						
Parr, H., transcribing, ...	5	0	0						
Du Noyer, G. V., drawing on wood, .	6	8	3						
Hanlon, G. A., woodcuts, ...	13	12	0						
Oldham, W., do., ...	12	18	0						
" Freeman's Journal," advertising, . .	0	2	6						
" Nation," do., ...	0	2	6						
Gill, M. H., circulars, &c., ...	1	9	6						
Postages on account of Part II. Catalogue, ...	2	2	8						
Gill, M. H., printing, ...	202	13	9						
Pilkington, F., binding, ...	7	11	5						
Total cost of Part II. of Catalogue,	.	.	.	265	10	7			
CATALOGUE OF MUSEUM (PART III.) :—									
Du Noyer, G. V., drawing on wood, . .	11	15	0						
Wakeman, W. F., do., ...	5	0	0						
Hanlon, G. A., woodcuts, ...	10	10	0						
Oldham, W., do., ...	14	13	0						
Total cost of Part III. of Catalogue,	.	.	.	41	18	0			
Total cost of Catalogue of Museum,	.	.	.	.	.	.	307	8	7
Forward, . . .	.	.	.	.	.	.	565	4	11

	£	s.	d.	£	s.	d.
Brought forward,				565	4	11
REPAIRS OF HOUSE:						
Barnwell & Sons, new iron gate lock,	0	12	0			
Boylan, S., cleaning windows,	2	12	9			
Bray, J., cleaning ash-pit, &c.,	1	11	0			
Carroll, J., shaking carpets,	0	14	6			
Dobbyn & Sons, repairs, &c., of clocks,	0	10	6			
M'Kenzie, A., new sewer for library,	4	0	0			
Murphy, J., sweeping chimneys,	1	5	6			
Smyth, B., shaking carpets, &c.,	1	10	0			
Total Repairs of House,				12	16	3
FURNITURE AND REPAIRS:						
O'Brien, M., window-blinds, metal-pillar, and repairs in house and museum,	4	11	9			
Smith, M., sack of sawdust,	0	1	6			
Total Furniture and Repairs,				4	13	3
TAXES AND INSURANCE:						
National Insurance Company,	10	6	0			
Patriotic ditto,	6	3	6			
Parish Cess,	0	9	4			
Total Taxes and Insurance,				16	18	10
COALS, GAS, &c.:						
Alliance Gas Co., 12 months,	22	18	7			
Lambert & Co., tapers, &c.,	0	16	3			
M'Cormick, J., 30 tons coal,	22	10	0			
Smyth, B., coke, &c.,	0	15	0			
Total cost of Coals, Gas, &c.,				46	19	10
CONTINGENCIES (CR. SIDE):						
Bigger, S. L. L., M. D., attendance (medical) on house-porter,	4	0	0			
Clibborn, E., one year's allowance for incidentals used in cleaning house,	10	0	0			
Johnson, T., chloride of lime,	0	4	0			
Derham, M., Sack of sawdust,	0	1	0			
Smyth, B., ditto,	0	2	0			
De Veaux, H., pins for drawings,	0	3	16			
Ferguson & Co., spring for door, gutta percha, &c.,	0	3	0			
Johnson, T., bottle of Cement and brushes,	0	1	1			
Thompson, W., Steel rings, &c.,	0	11	7			
Yeates, G., magnifying glasses,	0	15	0			
Henn, R., delivering summonses,	0	2	6			
M'Cormick, J., ditto,	0	4	0			
Postages paid,	6	18	11			
Total Contingencies (Cr. side),				23	7	5
SALARIES, WAGES, &c.:						
Carson, Rev. J., D. D., Treasurer, 1860–61,	21	0	0			
Drummond, Rev. W. H., D. D., Librarian, do.,	21	0	0			
Graves, Very Rev. Dean, D. D., Sec. of Academy, do.,	21	0	0			
Ingram, J. K., LL. D., Sec. of Council, do.,	21	0	0			
Clibborn, Edward, Clerk, Assistant Librarian, and Curator of Museum, 1860–1,	150	0	0			
Doyle, E. W., Accountant, &c.,	48	0	0			
Kelly, A., house-porter, 52 weeks,	39	0	0			
Forward,	321	0	0	670	0	6

				£	s.	d.	£	s.	d.
			Brought forward,	321	0	0	670	0	6
	Leigh, S., messenger, &c., ditto,			39	0	0			
	Meagher, M., liveries and great-coats for servants,			18	0	0			
	Wright and Oxley, hats for servants,			1	5	0			
	Kelly, J., boots for messenger,			2	0	0			
	Armstrong, J., Cleaning house,		3 10 6						
	Lindsay, A., ditto,		1 13 0						
	Newton, A., ditto,		5 14 6						
				10	18	0			
	Total Salaries, &c.						892	3	0
	GOVERNMENT STOCKS BOUGHT ON ACCOUNT OF CUNNINGHAM TRUST FUND.								
£27 1 2	New 3 per Cents, cost,	£25	3 11						
	11 days' Interest,	0	0 5						
	Brokerage,	0	1 3						
				25	5	7			
27 8 9	New 3 per Cents, cost,	25	0 9						
	13 days' Interest,	0	0 7						
	Brokerage,	0	1 3						
				25	2	7			
54 9 11	*Total Cunningham Fund Stock bought,*						50	8	2
	ON ACADEMY'S STOCK ACCOUNT:								
£22 1 10	Consols,	20	18 8						
	14 days' Interest,	0	5 1						
	Brokerage,	0	1 3						
				21	0	0			
22 7 8	Consols,	20	18 9						
	Brokerage,	0	1 3						
				21	0	0			
62 16 7	Consols,	57	11 4						
	19 days' Interest,	0	1 11						
	Brokerage,	0	1 9						
				57	15	0			
216 10 4	Consols,	199	3 10						
	30 days' interest,	0	10 8						
	Brokerage,	0	5 6						
				200	0	0			
323 16 0	*Total Academy Stock bought,*						299	15	0
	Total Government Stocks bought								350 8 2
	TOTAL DISCHARGE,								1412 6 8
	Balance in Bank of Ireland,						137	2	11
	„ in Treasurer's hands,						13	9	1
	Total Balance in favour of the Public, per this account,								150 12 0
	TOTAL AMOUNT OF CHARGE,							£	1562 18 8

GENERAL ABSTRACT OF THE MONTHLY ACCOUNTS OF THE ROYAL IRISH ACADEMY,

AS FURNISHED TO AUDIT OFFICE, FROM 1st APRIL, 1860, TO 31st MARCH, 1861.

Dr.	£	s.	d.
To Balance on 1st April, 1860,	538	4	2
To Annual Subscriptions,	212	2	0
To Entrance Fees,	68	5	0
To Life Compositions,	99	15	0
To Academy Interest on Stock,	19	13	1
To Catalogues sold, Part I.,	8	5	6
To Catalogues sold, Part II.,	45	11	3
To Catalogue Subscriptions,	19	0	0
To Cunningham Fund Interest,	50	8	2
To Contingencies, Dr. Side,	1	14	6
To Government Grant,	500	0	0
	1562	18	8

Cr.	£	s.	d.
By Repairs of House,	12	16	3
By Taxes and Insurance,	16	18	10
By Furniture and Repairs,	4	13	3
By Coals, Gas, &c.,	46	19	10
By Stationery,	15	5	10
By Salaries, &c.,	392	3	0
By Miscellaneous Printing,	34	9	11
By Proceedings, Printing, &c.,	134	12	11
By Transactions, Printing, &c.,	20	14	3
By Transactions and Proceedings bought,	0	3	0
By Antiquities purchased,	17	18	0
By Books bought,	27	3	2
By Contingencies, Cr. Side,	30	16	8
By Charges against Catalogues sold,	307	8	7
By Academy Stock bought,	299	15	0
By Cunningham Fund Stock bought,	50	8	2
By Balance to next Account,	150	12	0
	1562	18	8

BANK OF IRELAND,
April 30, 1861.

I certify that it appears by the Books of the Bank of Ireland there remained a Balance of £1775 12s. 1d. New Three per Cent. Government Stock, and £974 4s. 3d. Three per Cent. Consols Government Stock, to the credit of the Account of the Royal Irish Academy, on the 31st day of March, 1861. For the Governor and Company of the Bank of Ireland.

J. R. BRISCOE.
Stock Leger Keeper.

ROBERT ROBERTS,
Transfer Office.

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TO VOLUMES I.–VII. OF THE PROCEEDINGS.

END OF VOLUME VII.

THE

CHARTER, STATUTES, BY-LAWS,

AND REGULATIONS

OF

The Royal Irish Academy.

THE

CHARTER, STATUTES, BY-LAWS, AND REGULATIONS

OF

The Royal Irish Academy,

FOR PROMOTING THE STUDY OF

SCIENCE, POLITE LITERATURE, AND ANTIQUITIES.

DUBLIN:

PRINTED BY M. H. GILL,

PRINTER TO THE ACADEMY.

1862.

CONTENTS.

THE CHARTER, STATUTES, BY-LAWS, AND REGULATIONS,

OF

THE ROYAL IRISH ACADEMY.

THE CHARTER.

Preamble.

GEORGE the THIRD, by the Grace of God, of Great Britain, France, and Ireland, King, Defender of the Faith, and so forth: To all unto whom these presents shall come, Greeting, Whereas the institution of societies for the advancement of learning (within our kingdom of Great Britain, and also in countries beyond the seas,) hath been found by experience to have greatly tended to the increase of useful knowledge: And whereas several of our loving subjects of our city of Dublin, and kingdom of Ireland, have lately met together, for their mutual improvement in the studies of science, polite literature, and antiquities: And whereas we are willing to give encouragement to studies of that nature in all parts of our dominions, and more especially in our said kingdom of Ireland, which was in ancient times famous for its schools and seminaries of learning, and hath since produced many persons eminent in every branch of science; and are desirous that useful, curious, and polite literature, should, under our Royal Patronage, and special protection, continue to flourish and increase: Have of our special grace, certain knowledge, and mere motion, by and with the advice and consent of our right trusty and right entirely beloved cousin and counsellor, Charles Duke of Rutland,

our Lieutenant-general and General-governor of our kingdom of Ireland, and according to the tenor and the effect of our letters under our privy signet and sign manual, bearing date at our Court of St. James's the 28th day of September, 1785, and in the 25th year of our reign, and now enrolled in the rolls of our High Court of Chancery, in our said kingdom of Ireland, constituted and appointed, and by these presents for Us, our heirs, and successors, We will, ordain, constitute, declare, and grant, that our well beloved subjects, our right trusty and well beloved cousin and counsellor James Earl of Charlemont, of our said kingdom of Ireland; our right trusty and right entirely beloved counsellor Richard Lord Rokeby, Archbishop of Armagh, and Primate of all Ireland; our right trusty and well beloved cousin and counsellor James Earl of Clanbrassill; our right trusty and well beloved cousin John Earl of Moira; our Right Reverend and well beloved Father in God Thomas Lord Bishop of Killaloe; our Right Reverend and well beloved Father in God John Lord Bishop of Clonfert; our Right Reverend and well beloved Father in God William Lord Bishop of Waterford; our Right Reverend and well beloved Father in God Thomas Lord Bishop of Dromore; our right trusty and well beloved counsellor John Hely Hutchinson, Doctor of Laws, our principal Secretary of State in the kingdom of Ireland; our right trusty and well beloved counsellor Denis Daly, esq.; our right trusty and well beloved counsellor William Conyngham, esq.; our trusty and well beloved Charles Vallancey, esq.; our well beloved in Christ the Reverend Richard Murray, Vice-Provost of Trinity College; our well beloved in Christ the Reverend Hugh Hamilton, Dean of Armagh; our trusty and well beloved Richard Kirwan, esq.; our trusty and well beloved Edmond Malone, esq.; our well beloved in Christ the Reverend Michael Kearney, Doctor in Divinity; our trusty and well beloved Adair Crawford, Doctor in Physic; our well beloved in Christ the Reverend William Hales, Doctor in Divinity; our trusty and well beloved George Cleghorne, Doc-

Date of Letter, 28th September, 1785.

Names of original Members.

tor in Physic; our well beloved in Christ, the Reverend Henry Ussher, Doctor in Divinity; our well beloved in Christ, the Reverend John Kearney, Doctor in Divinity; our well beloved in Christ, the Reverend John Waller, Doctor in Divinity; our trusty and well beloved John Purcell, Doctor in Physic; our trusty and well beloved Robert Perceval, Doctor in Physic; our well beloved in Christ the Reverend Matthew Young, Master of Arts; our well beloved in Christ the Reverend Digby Marsh, Master of Arts; our well beloved in Christ the Reverend George Hall, Master of Arts; our well beloved in Christ the Reverend Richard Stack, Master of Arts; our well beloved in Christ the Reverend William Hamilton; our trusty and well beloved Lawrence Parsons, esq.; our trusty and well beloved William Preston, esq.; our trusty and well beloved William Ball, esq.; our well beloved in Christ the Reverend James Archbold Hamilton, Doctor in Divinity; our trusty and well beloved William Deane, Doctor learned in the law; our trusty and well beloved Richard Lovell Edgeworth, esq.; our trusty and well beloved James Gandon, esq.; and our trusty and well beloved Sir Joseph Banks, Baronet, President of our Royal Society at London; and such others as shall be elected in the manner hereinafter directed, to be one body politick and corporate, in deed and in name, by the name of the Royal Irish Academy, for promoting the study of science, polite literature, and antiquities; of which Academy we do hereby declare ourselves the founder and patron, and by the same name to have perpetual succession, and to purchase, have, take, receive, and enjoy, to them and their successors, lands, tenements, and hereditaments, of whatsoever nature or kind, not exceeding in the whole the clear yearly value of £1000 sterling; and also all manner of goods and chattels of what value soever, and by the same name to sue and be sued, plead and be impleaded, answer and to be answered unto, in all courts and pleas whatsoever, of us, our heirs and successors, in all suits, plaints, and demands whatsoever. And that they and their

Incorporated under the name of *the Royal Irish Academy.*

The King Patron, Empowered to purchase lands, &c.,

not exceeding the yearly value of £1000.

Seal. successors may use and have a common seal, and that it shall and may be lawful for them and their successors, to change, break, alter, or make new the said seal, from time to time, as they shall think fit.

And our will and pleasure is, and we do ordain, and grant, that the said corporation and their successors, for ever, shall President and Council. have one president and a council consisting of 21 members, to be hereafter elected by them, out of which council four Vice-Presidents. Treasurer. Secretary. vice-presidents shall be nominated by the president, by writing under his hand and seal, and one treasurer and one secretary shall be elected.

And for the better execution of this our royal grant, we have nominated, and do hereby nominate, constitute, and appoint our right trusty and well beloved cousin and counsellor Names of first President, James Earl of Charlemont to be the first and modern president of this Academy: And we do further hereby nominate and Council, appoint our right trusty and well beloved cousin John Earl of Moira, our Right Reverend and well beloved Fathers in God William Bishop of Waterford, Thomas Bishop of Killaloe, Thomas Bishop of Dromore, and John Bishop of Clonfert; our right trusty and well beloved counsellors William Conyngham and Denis Daly, esqrs.; our well beloved in Christ the Reverend Henry Ussher, the Reverend William Hales, the Reverend John Kearney, our trusty and well beloved John Purcell, Robert Perceval, and Stephen Dickson, Doctors of Physic; our well beloved in Christ the Reverend Matthew Young, the Reverend George Hall, the Reverend William Hamilton, and the Reverend Richard Stack, Fellows of Trinity College, Dublin; our trusty and well beloved Charles Vallancey, William Preston, and James Gandon, esqrs., to be the first modern 21 of the council of this Academy.

Treasurer, And We do further nominate and appoint our right trusty and well beloved counsellor William Conyngham to be the first and modern treasurer; and our trusty and well beloved Secretary. Robert Perceval, Doctor of Physic, to be the first and modern

secretary to this Academy; the said several persons, and each and every of them, to continue in their and his respective place and offices, from the day of the date of these presents, until the 16th day of March next ensuing, and until others be chosen in their respective places; which said council and their successors shall be aiding and assisting to the president of our said Academy, in all matters for the better regulation and government thereof, and of every member of the same.

To continue till 16th of March next, and others be chosen.

Council to assist President.

And our will and pleasure is, that it shall and may be lawful to and for the said president, council, and officers, and the rest of the members of the said Academy also, as soon as conveniently may be after the date of these presents, to meet together at such time and place as the said president or any one of the said vice-presidents shall appoint by summons, which the said president, or any one of the said vice-presidents, is by these presents empowered and required timely to issue to that purpose to the said members, or such of them as shall be resident within our city, or the liberties of our city of Dublin, in our said kingdom; at which meeting, and at all future meetings of this corporation, 16 at least being present, they are also by these presents empowered to elect, from time to time, such persons as they shall think proper to admit into the said Academy as members of the same, who, after such election, shall be and be called members of the said Academy, in the same manner, to all intents and purposes, as those herein nominated and appointed by these our royal letters patent.

Meetings,

at time and place appointed by President, or a Vice-President, in summons.

To elect new Members 16 at least must be present.

And our further pleasure is, that there shall be two stated general meetings of the said Academy in every year, one on the 30th day of November, and the other on the 16th day of March, being the eve of St. Patrick's Day, and as many other general meetings as the corporation, or the majority of such members as, being duly summoned, shall be present at any preceding general meeting, shall appoint.

Two stated General Meetings every year, on the 30th of November, and 16th March; or,

And in case it shall happen that the 30th day of November, or the 16th day of March, shall, in any year, fall on a

if either fall on Sunday, upon preceding day.

Sunday, then our will and pleasure is, that such general meeting as aforesaid shall, for that time, be held on the day next immediately preceding such 30th day of November or 16th day of March.

On 16th of March, list of 43 to be laid before the Corporation,

out of which a President and Council to be elected for ensuing year.

And our will and pleasure is, that at the general meeting of the corporation on the 16th day of March in every year, or on the day preceding as aforesaid, 16 members at least being present (of whom the president or one of the vice-presidents shall always be one), the president and council shall at every such meeting lay before the corporation a list of 43 names (the names of the then subsisting president and council being included), out of which list the said corporation shall elect a president and council for the next ensuing year, after such form and manner as the president and council, with the approbation of the Academy, shall have ordained or shall hereafter ordain; and at every such annual meeting shall also be elected in the manner aforesaid a treasurer and secretary, which president and council, treasurer and secretary, so elected shall continue in office for the ensuing year, unless they or any of them shall sooner die, resign, or be removed: on which day the new president, if present, shall also appoint, by writing under his hand and seal, four vice-presidents, to continue in office for one year as aforesaid, or in case of his absence, the former vice-presidents shall continue in office until new ones shall be duly appointed in their place.

Treasurer and Secretary to be also elected.

President to appoint 4 Vice-Presidents.

Duration of their office.

In case of death, &c., of Officers, Corporation to meet and choose others,

16 Members (including the President or a Vice-President) being present.

And our further will and pleasure is, that in case of the death, resignation, or amotion of the president, or any one or more of the vice-presidents, the treasurer, secretary, or any member or members of the council, the said corporation shall have full power to meet and choose others in their places respectively, in the manner as aforesaid, 16 members at least being present, of whom the president or one of the vice-presidents shall be always one.

In President's absence, the Senior Vice-

And our further will and pleasure is, that in the absence of the president, at any meeting of the corporation, or the

council, in case that more than one vice-president shall be present, such vice-president as shall be first named in the list of those appointed under the hand and seal of the president, shall preside at such meeting, and have a casting voice in case of an equality of votes on any question, besides his own vote as a member; and if the president and all the vice-presidents shall happen to be absent, then the majority of the members present shall appoint one to preside for such time only.

President present to preside,

and have casting voice.

Failing these, a Member to be appointed *pro hac vice.*

And our further will and pleasure is, that the president and council of the said Academy shall have full power and authority to make and enact such ordinances, rules, and by-laws for the encouragement of the study of science, polite learning, and antiquities, and for the government and management of the said Academy and their estate and revenues, and the manner of the choice and removal of their members and officers, as they shall judge meet and convenient, and the same to vary, alter, and repeal, and others to make in their stead from time to time as they shall see fit.

President and Council empowered to make, alter, and repeal By-Laws.

Provided always, that such ordinances be not repugnant to the laws of our said kingdom of Ireland, or to this our charter of incorporation, and that the same shall afterwards be approved and confirmed by the said corporation at large; otherwise to continue in force until the next general meeting of the Academy, and no longer.

Such ordinance to be confirmed by the Corporation, else to continue only till next General Meeting.

Provided always, that no rule or by-law once duly made and confirmed shall be repealed or altered, except the motion for such repeal or alteration shall have been first approved of, and proposed to the corporation, by the president and council of the said Academy.

The repeal or alteration of a By-Law to originate in the President and Council.

And our further will and pleasure is, that the president, council, and members of the said Irish Academy shall from time to time nominate and appoint such persons as they shall think convenient to be clerks, officers, and servants of the said corporation for carrying on and executing their necessary affairs. And also that it shall and may be lawful for said cor-

Corporation to appoint Clerks, &c.

Corporation may employ a Serjeant-at-mace, &c.

poration to employ one serjeant-at-mace, and such other servants as may be useful to attend on the said president or his deputy on all proper occasions, and to do such other things as may by them from time to time be thought expedient.

Lord Lieutenant, or other Chief Governor, to be Visitor, with power to reconcile differences, &c.

And it is our further will and pleasure, and we do by these presents for us, our heirs and successors, ordain, constitute, and appoint that if any abuses or differences shall at any time hereafter arise and happen concerning the government of affairs of the said Academy, whereby the constitution, progress, improvement, or business thereof may suffer or be hindered, then and so often we do by these presents nominate, assign, and constitute that our lieutenant-general, or other our chief governor or governors of our said kingdom of Ireland for the time being, shall be visitors respectively of the said corporation, with full power to reconcile, compose, and redress any such differences and abuses, and with all other powers to the said office of visitor of right belonging.

Declaration of validity.

And lastly, we do declare and ordain, that these our letters patent, and every clause, sentence, and article therein contained, or the enrolment thereof, made in our High Court of Chancery in our said kingdom of Ireland, shall be in all things firm, valid, sufficient, and effectual in the law unto the said Academy and their successors, according to the purport and tenor hereof, without any further grant, license, or toleration from us, our heirs or successors, to be procured or obtained: Provided always,

Enrolment.

that these our letters patent be enrolled in the Rolls of our High Court of Chancery in our said kingdom of Ireland, within the space of six months next ensuing the date of these presents. In witness whereof we have caused these our letters to be made patent; Witness our aforesaid lieutenant-general and

Date, Jan. 28, 1786.

general governor of our said kingdom of Ireland, at Dublin, the 28th day of January, in the 26th year of our reign.

CONWAY.

STATUTES, BY-LAWS, REGULATIONS

THE Statutes and Ordinances by which the Royal Irish Academy is governed are of three kinds:—

I. STATUTES, properly so called, enacted by Royal authority in the Charter of Foundation, which are therefore incapable of being repealed or altered except by the Crown. These are marked with an asterisk (*) in the following pages.

II. BY-LAWS, which may be enacted, altered, or repealed, by the President and Council, with the consent of the Academy.

III. REGULATIONS in the form of recommendations of the Academy adopted by the President and Council, or of recommendations of the President and Council adopted by the Academy, which are not absolutely binding on the Members, but are adopted as being generally expedient only. These are marked with an obelisk (†) in the following pages.

CHAPTER I.

Of the Constitution of the Royal Irish Academy.

1. * The Academy was incorporated by King George III. for promoting the study of Science, Polite Literature, and Antiquities, and, by Royal Charter dated January 28, 1786, the Corporate Body consists of a President, a Council of twenty-one, and an indefinite number of other Members, elected by the general body, with four Vice-Presidents, nominated by the President out of the Council; and one Treasurer, and one Secretary, elected by the Academy out of the Council.

2. * The King is declared by the Charter to be Founder and Patron of the Academy; which has perpetual succession under the name of THE ROYAL IRISH ACADEMY, with power to purchase, have, take, receive, and enjoy, lands, tenements, hereditaments, of whatsoever nature and kind, not exceeding in the

whole the clear yearly value of £1000 sterling; and also all manner of goods and chattels of what value soever; and by the same name to sue and be sued, &c. And to have a common seal, with power to change, break, alter, or make new the said seal, from time to time, as they shall think fit.

3. The Council is divided into three Committees, each consisting of seven Members, which Committees have for their objects, respectively, the departments of Science, Polite Literature, and Antiquities.

4. * The President and Council have full power and authority to make and enact such Ordinances, Rules, and By-Laws, for the encouragement of the study of Science, Polite Literature, and Antiquities, and for the government and management of the Academy, and their estate and revenues, and the manner of the choice and removal of their Members and Officers, as they shall judge meet and convenient; and the same to vary, alter, and repeal, and others to make in their stead. Provided always, that such Ordinances be not repugnant to the laws of the kingdom, or to the Charter, and that they shall afterwards be approved and confirmed by the Corporation at large; otherwise to continue in force to the next General Meeting of the Academy, and no longer.

5. *And no Rule or By-Law, once duly made and confirmed, shall be repealed or altered, except the motion for such repeal or alteration shall have been first approved of, and proposed to the Corporation, by the President and Council.

6. * The President, Council, and Members are empowered to nominate and appoint, from time to time, such persons as they may think convenient to be clerks, officers, and servants of the Academy; also to employ one Serjeant-at-mace, and such other servants as may be useful to attend on the President or his Deputy on all proper occasions, and to do such other things as may by them, from time to time, be thought expedient.

7. * The Lord Lieutenant-General, or other Chief Governor

or Governors of Ireland, for the time being, are constituted by the Charter Visitors respectively of the Corporation, with full power to reconcile, compose, and redress any differences or abuses that may at any time arise, and with all other powers to the office of Visitor by right belonging.

CHAPTER II.

Of the Election and Admission of Members, Ordinary and Honorary.

1. * Ordinary Members are elected at a general meeting of the Academy.

2. Such election shall be by ballot; and no candidate shall be elected unless it shall appear, on the inspection of the ballot, that three-fourths, at least, of the Members balloting have voted in his favour.

3. * At the meetings of the Academy for the election of Members, there must be present sixteen at least to form a quorum; [but the construction of that passage in the Charter only requires that sixteen persons shall ballot for each candidate for election; and it is not absolutely necessary that so many should be present at the commencement of the ballot.]

4. No balloting for Members shall take place except at the general meetings of the Academy on the second Monday in each month of the session; or on the fourth Monday of the last month of the session.

5. The names of the candidates for election shall be hung up in the public room of the Academy on the day they are proposed, there to remain until the day of balloting; and a certificate, signed by four Members, at least, shall be subjoined to the name of each candidate proposed.

6. Each Member, on his proposing a candidate for election, shall deliver to the Secretary, in writing, the name, profession, and residence of the candidate proposed; and the names of the candidates so proposed and recommended shall lie for

the space of one month on the books of the Academy before the ballot for their election can take place.

7. Except when a Nobleman is proposed to be a Member of the Academy, in which case (a quorum being present), the Academy shall proceed to ballot for him forthwith.

8. The names of the candidates, with the names of the proposers and seconders, shall be read out by one of the Secretaries immediately previous to the ballot.

9. To secure the uniformity of the ballot, the names of the candidates, with the names of the proposers and seconders, shall be printed, and, in using the printed lists, Members are required to mark with an asterisk the name of each candidate whom they desire to elect; to draw a line through the name of any whom they wish to reject; and to leave unmarked the names of those respecting whom they do not wish to vote at all. Such neutral ballots are not counted among the sixteen required by section 3.

10. The Secretary of the Academy shall furnish to each Member, on his election, notice thereof, and shall inform him of the time of payment of the annual subscription, according to such form as the Council shall direct.

11. Every Member, after his election, shall be formally admitted into the Academy at some general meeting thereof, in manner and form following:—The President, taking him by the hand, shall say these words, or words to the same effect:—"I do, by the authority and in the name of the Royal Irish Academy, admit you a Member thereof."

12. And every Member, before his formal admission, shall, in the face of the Academy, subscribe the obligation hereafter set down. See Chap. III.

13. Honorary Members may be elected by the Academy, on the special recommendation of the Council; the grounds of such recommendation to be stated in writing, and hung up in the public room of the Academy for one calendar month before the ballot for their election.

14. Honorary Members are not required to contribute to the funds of the Academy; nor shall they have a vote at the meetings of the Academy; nor be eligible as Officers, or Members of Council.

15. The President of the Royal Society of London, for the time being, is always considered as an Honorary Member of the Academy.

16. The number of Honorary Members shall be limited to sixty. This limit does not include the President and ex-Presidents of the Royal Society.

17. There shall be three Sections of Honorary Members, corresponding to the threefold objects of the Academy, and the numbers in each Section shall be limited as follows:—

Section of Science, 30; of Literature, 15; of Antiquities, 15; total, 60. And the one-half, at least, of Honorary Members in each Section shall be foreigners.

18. The election of Honorary Members shall take place only at the stated meeting in March.

CHAPTER III.

Of the Declaration or Obligation to be signed by the Ordinary Members of the Academy.

The following obligation shall be subscribed by all Members (except Honorary Members) of the Academy:—

"We, whose names are underwritten, having been elected Members of the Royal Irish Academy, for advancing the study of Science, Polite Literature, and Antiquities, do hereby promise, each for himself, that we will endeavour to promote the good of said Academy, and to pursue the ends for which the same was founded; that we will be present at the meetings of said Academy as often as we conveniently can, especially at the annual elections, and upon extraordinary occasions; and that we will observe the Statutes and By-Laws of said Academy. We do also hereby promise and engage, each for himself, his heirs, executors, administrators, and assigns, that we will well and truly pay, or cause to be paid, to the Treasurer of said Aca-

demy, on or before the 16th day of March in every year, the sum of two guineas sterling. Provided always, that we shall not have paid to the said Treasurer, in lieu thereof, the sum of twenty guineas as a life subscription; and provided also, that whenever any of us shall signify to the President, under his hand, that he desireth to withdraw from the Academy, and shall have discharged all arrears due, he shall be free from the aforesaid obligations."

CHAPTER IV.

Of Payments to be made by the Members of the Academy.

1. The Member who proposes any person for admission shall, one week at least previous to the ballot, deposit in the hands of the Treasurer the sum of five guineas, as the admission fee of such person: said sum to be returned in case the candidate should be rejected.

2. Every Member, besides his admission fee, shall pay the sum of two guineas annually, which sum becomes due on the 16th of March next after the admission of such Member; except his election has taken place between the 1st of January and the 16th of March; in which case his first annual subscription shall not become due until the 16th of March in the year following.

3. The names of such Members of the Academy as shall not have paid their subscriptions, due on the 16th of March in any year, before the stated meeting of the Academy in the month of November following, shall be hung up in the meeting-room of the Academy on that night; and such of said Members as shall not have paid their subscriptions on or before the stated meeting in March following shall *ipso facto* be excluded the Academy; and the Secretary shall inform them by letter, a month previous to the said stated meeting in March, that unless their subscriptions be paid on or before said day, their privileges as Members will be suspended. Such defaulters, however, may resume their seats, so forfeited, upon

payment of arrears at any time within a year after such forfeiture incurred. But at the end of the year, if their subscriptions shall continue unpaid, they shall *ipso facto* cease to be Members of the Academy, and shall receive notice to that effect from the Secretary.

4. No Member whose subscription is unpaid on the 30th November in each year shall have the privilege of voting on or after that date, nor be eligible on the Council, until his subscription be paid up.

5. Any Member may compound for future annual payments by paying the sum of twenty guineas at one payment; but any member who has regularly paid his subscription to the Academy for twenty years shall be allowed to become a Member for life on paying six guineas.

6. Persons proposed as Ordinary Members, but not resident in Ireland, shall be admitted as Life Members on paying twenty guineas before the Ballot.

7. In the case of Members residing for any considerable period out of the United Kingdom, the Council shall have the power of remitting or reducing the amount of annual payment as may seem to them just and equitable.

CHAPTER V.

Of the Election of the President, Council, and Officers.

1. * All such elections shall be made at a general meeting of the Academy.

2. In addition to the President, Vice-Presidents, Treasurer, and Secretary, whose offices are constituted by the Charter, there shall be a Secretary of the Council, a Secretary of Foreign Correspondence, and a Librarian, all chosen out of the Council.

3. *On the eve of St. Patrick's day, being the day appointed by the Charter, there shall be an annual general meeting for the election of the President, Council, and Chartered Officers,

unless that day should fall on a Sunday, in which case the meeting shall be held on the day immediately preceding. And at this meeting the President, or one of the Vice-Presidents, and fifteen Members, at least, must be present.

At this meeting the Secretary of Council, Librarian, and Clerk and Sub-Librarian, are also elected.

4. † In order to create a rotation of the President, and Council, it has been recommended by the Academy that it is not expedient that the same person should be elected President more than five times in succession: also, that one Member of each standing Committee shall be removed in each year, in case no vacancy should occur on that Committee by death, resignation, or amotion, and that the senior Member of each Committee shall be the Members so to be removed.

5. † This rule shall not apply to any Member of any Committee who shall hold the office of Treasurer, Secretary of the Academy, Secretary of Council, or Librarian.

6. The form and manner of the election is as follows:—

a. On the first Monday of March in every year, the President and Council shall meet, and shall prepare a list of forty-three names (the names of the then subsisting President and Council being included),* out of which list of 43 names, laid before the meeting on said day, the Corporation shall elect the President and Council for the next ensuing year, after such form and manner as the President and Council, with the approbation of the Academy, shall ordain.

b. This list shall be divided into three sections, each consisting of not less than fourteen names, containing the names of such persons as shall be deemed qualified to serve on the three Committees of which the Council is composed.

c. † In these lists the names of the Members who are to be removed, in accordance with the recommendation of the Academy (§ 4, *supra*), shall be printed in italics, and the names of those whom the Council recommend to fill vacant places shall be printed in capitals,—it being understood that

every Member still retains his right to vote for any name appearing in the Balloting List, whether so printed in italics or not.

d. If any Member whose name is printed in italics in the Balloting lists, be re-elected by the Academy, he shall be considered the Junior Member of the Committee on which his name appears.

e. The names of such Members as shall be found to have attended less than ten meetings of the Council (including *stated* meetings of any one Committee of Council) during the year, before the meeting at which the lists are prepared, and exclusive of that meeting (at which they shall have no seat), shall be omitted in the preparation of the list of forty-three names required by the Charter, and shall not be included in the Council of the preceding year, but shall be treated as if such Members had died or resigned,—provided that if any Member of Council shall have been elected in the middle of the year, he shall not be required to attend ten meetings in order to retain his place in the list, but only such a proportion of the whole number of meetings since his election, as the Council shall judge to be equivalent to ten out of the whole number.

The Committees intended by the foregoing resolution are the Committees of Science, Polite Literature, Antiquities, Publication, Economy, and Library.

f. The list of forty-three names, thus prepared, shall be hung up in the public room of the Academy, and shall there remain until the day of election.

g. A printed copy of the said list shall also be forwarded to each Member of the Academy, with his summons for the stated meeting, at which the election is to take place; and the Members are bound by the Charter to elect a President and Council out of the said list, after such form and manner as the President and Council, with the approbation of the Academy, shall by these By-Laws ordain.

h. Each Member shall deliver to the President the printed list so furnished to him, erasing the name of such Member as he may desire to remove from the existing Council, and underlining the names of those whom he may desire to place upon the Council. And all lists handed to the President not so marked, or so far as they shall be not so marked, or marked in a careless and unintelligible manner, shall be taken as votes for those recommended for the vacant places by the Council.

i. The President for the expiring year, if retiring from the Chair, in accordance with the recommendation of the Academy (§ 4, *supra*) shall be considered as eligible to any one of the Committees of Council.

7. Immediately after the election of the President and Council there shall be a separate ballot for the Treasurer and Secretaries and Librarian, who must be chosen out of the Council.

8. * In case of the death, resignation, or amotion of the President, any one of the Vice-Presidents, Treasurer, Secretary, or any Member or Members of the Council, it is enacted by the Charter, that the Corporation shall have power to meet and choose others in their places respectively, in the manner as aforesaid, sixteen Members at least being present, of whom the President, or one of the Vice-Presidents, shall always be one.

[The words of the Charter, that this election shall be "in the manner as aforesaid," that is to say, in like manner as the general annual election, have been interpreted to mean, that the list of forty-three names shall be prepared as at the annual election, although the Academy be only required to fill up the vacant places, and cannot on such occasions displace the existing President or any Member of Council.]

9. And the same rule shall apply to the Secretary of Council, Librarian, and Secretary of Foreign Correspondence.

CHAPTER VI.

Of the Vice-Presidents, Treasurer, Secretaries, and other Officers.

1. * The President, on the day of his election, if present, shall appoint by writing under his hand and seal four Vice-Presidents, to continue in office for one year. And if the President be not present on the day of his election, the Vice-Presidents of the former year shall continue in office until the new Vice-Presidents shall be duly appointed in their place.

2. * On the absence of the President at any meeting of the Corporation or of the Council, in case that more than one Vice-President shall be present, such Vice-President as shall be first named in the list of those appointed under the hand and seal of the President shall preside at such meeting, and have a casting voice in case of equality of votes on any question, besides his own vote as a Member; and if the President and all the Vice-Presidents be absent at any meeting of the Corporation or Council, the majority of the Members present shall appoint one of their number to preside, for that time only.

3. † The Academy think it expedient, and have made it a request to the President, that he should not reappoint the senior of the existing Vice-Presidents, and should nominate every year a new one in his stead; unless there be a natural vacancy by death, resignation, or any other cause.

4. The Treasurer, the Secretary of the Academy, and the Secretary of the Council, shall attend all meetings of the Academy and Council.

5. The Secretary of Foreign Correspondence shall be purely honorary, without salary; but the Secretary of the Academy and the Secretary of the Council shall have a salary of twenty guineas per annum each.

6. The Secretary of the Academy and the Secretary of the Council shall keep the Minutes of the Proceedings of the

Academy and Council respectively, and shall cause them to be correctly and legibly transcribed.

7. The Treasurer and the Librarian shall also receive a salary of twenty guineas per annum each.

8. The Treasurer's duty shall be to keep an account of the income and expenditure of the Academy; to lodge all moneys received to the account of the Academy; to notice such Members as may be in arrear of their subscriptions, and to receive all subscriptions and other payments due to the Academy.

9. All drafts on the Bank in payment of accounts due shall be signed by the Treasurer, and Secretary of the Academy or Secretary of Council.

10. Immediately after the close of each financial year, the Council shall appoint a Committee to audit the Treasurer's accounts.

11. There shall be also a Resident Clerk and Assistant Librarian, to be elected annually by the Academy (who shall not be a Member of the Academy), and he shall also be the Macebearer of the Academy, as appointed by the Charter. He shall provide the servants, who shall be hired and dismissed by him; he shall be responsible for the sending out of the summonses, and the transcription of the Minutes under the direction of the Secretaries, and shall attend the meetings of the Academy and Council. He shall also attend the Library, and be subject generally to the directions of the Librarian.

CHAPTER VII.

Of the Powers and Functions of the Council.

1. * The duty of the Council is to be aiding and assisting to the President in all matters for the better regulation and government of the Academy and of every Member of the same.

2. * All resolutions that regard the funds of the Academy, as also all resolutions that regard the enacting, altering, or repealing of By-Laws, shall originate in the Council.

3. * Such Ordinances, Rules, and By-Laws, as shall be made by the Council shall continue in force until the next General Meeting of the Academy, and no longer; unless they be then confirmed and approved by the Corporation at large.

4. Provided always, that if any sum or sums of money, not exceeding £20, shall be disposed of by the Council, between any two Meetings of the Academy, the act of Council shall be definitive.

5. No act of Council shall be valid unless signed by the Chairman of the succeeding meeting.

6. All papers or communications whatsoever shall be the property of the Academy. But the author of any paper or communication, before it is published, may, by petition to Council, reclaim such paper or communication; which the Council may restore to him, if they think fit, with or without conditions.

7. All papers, letters, or other communications, addressed to the Council shall be in the charge and custody of the Secretary of Council.

8. All medals or other honorary rewards shall from time to time be awarded by the Council at their discretion.

CHAPTER VIII.

Of the Times and Forms of the Meetings of the Academy and Council.

1. * Two stated meetings of the Academy, as directed by the Charter, shall be held on the 16th of March and on the 30th of November annually [or on the days immediately preceding respectively, if the 16th of March or 30th of November should fall on Sunday].

2. General meetings of the Academy shall also be held on the second Monday of November and December, and on the second and fourth Mondays of January, February, April, May, and June, at 8 P.M. At which meetings the order of business shall be as follows:—

(1.) The Chair being taken, the Minutes of the last Meeting shall be read, and confirmed or amended.

(2.) New Members shall be called upon to sign the Declaration, and be admitted.

(3.) Proposed Members shall be balloted for (if it be a meeting at which, by the Statutes and By-Laws, there can be a ballot).

(4.) The President shall ask the leave of the Meeting to admit such Visiters as are introduced by Members.

(5.) Papers and such other communications as shall have previously obtained the leave of the Council shall be read.

(6.) Donations shall be presented, and commented upon, and thanks returned to the donors.

(7.) Visiters shall be required to withdraw, and private business shall be transacted.

(8.) The names of candidates proposed for election shall be read from the Chair. After which the Meeting shall be closed or adjourned.

3. The Academy may adjourn any of its meetings at pleasure, and extraordinary meetings may be summoned and convened at any time by the Council.

4. At the stated meetings on the 30th of November and 16th of March, no papers shall be read, nor shall any Visiters be admitted, until after the business of the Academy be transacted.

5. Whenever at any general meeting of the Academy By-Laws are to be confirmed, altered, or repealed, notice of such confirmation, alteration, or repeal, shall be printed in full, and forwarded to each Member at least five days before such meeting; and the summons shall contain a statement that the confirmation, alteration, or repeal of the said By-Laws will form a part of the business of such meeting.

6. The stated meetings of the Council shall be held on the first and third Mondays of every month, from November to June inclusive, at such hour as they shall from time to time appoint.

7. At all meetings of the Council, four with the President, or five without the President, shall be a quorum, and they shall have power to adjourn from time to time as they may think convenient.

CHAPTER IX.

Of Papers and other Communications to be read to the Academy, and of their Publication.

1. No paper or any other communication, intended for publication in the Proceedings or Transactions, shall be read to the Academy, without the permission of the Council, or of the President, previously had and obtained.

2. All such papers or communications shall be read in the order in which permission shall have been granted by the Council; but if any paper shall be, from whatsoever cause, delayed or withheld, it shall be read in such order as the Council shall determine.

3. No new paper shall be commenced after ten o'clock, nor shall the time to be occupied in the reading of any one paper exceed half an hour.

4. A Committee of Publication shall be nominated annually by the Council out of its body, and shall consist of seven Members, three from the Committee of Science, and two from each of the other Committees.

5. This Committee shall meet the Tuesday following each meeting of the Academy.

6. It shall be the duty of the Committee—

a. To decide whether Papers read to the Academy shall be published, and, in such case, whether in the Proceedings or in the Transactions.

b. To report to the Council on all Papers recommended for publication in the Transactions.

c. To superintend the final correction of the Press, and to see that the printing and engraving are executed in a manner creditable to the Academy.

d. To arrange all details connected with the printing and publishing of the Transactions and Proceedings.

7. The Committee of Publication shall have liberty to call in any Member of the Council or Academy, to assist them in the reading or judging of any Paper.

8. If it be a question before the Council, whether a paper read before the Academy be or be not published, nine Members of Council, or eight with the President, must be present to form a quorum. And before voting on such question, the President or Chairman, and every Member of Council present, shall solemnly, and with an audible voice, make the following declaration :—

"I (A. B.) do solemnly declare, that in the ballot for deciding whether the paper now proposed for publication be printed, I will proceed without partiality or prejudice, and give my vote in such a manner as will, in my opinion, most redound to the honour of this Academy."

CHAPTER X.

Of the Library and Librarian.

1. The keys of the Library shall be intrusted to no person but the Librarian or Assistant Librarian, one of whom shall be always present during library hours.

2. The Library shall be open every day, Sundays excepted, throughout the year (except during Christmas week, the week before Easter, and the month of August), from 11 A.M. to 4 P.M.

3. The Librarian shall take care to enter in the Catalogue all periodical publications, new books, &c., as they come in, either by purchase or donation; and he shall be accountable to the Academy for all such books, and shall submit the said Library to such examination as the Council, from time to time, may think proper to direct.

4. The Members shall have the privilege of borrowing books from the Library, with certain hereinafter-mentioned exceptions, and the sub-Librarian, before lending any book or

books, shall receive from the Member so borrowing an engagement, signed with his name, to return such book within one month, or sooner if possible; under a penalty of paying for such book, or for the set to which it may belong, if not returned, or if damaged while in his possession; and in case any Member shall refuse to fulfil this engagement, the Librarian must report the facts to the Council.

5. It shall be the duty of the sub-Librarian to examine the state of the books lent, upon their delivery and return, and to report to the Librarian any damage they may have received, in order that the provisions of the foregoing By-Law may be enforced.

6. That, for the greater accommodation of the Members, all new books, reviews, &c., shall be suffered to lie on the table in the Library for at least one month after they come in, or until the new set of reviews, &c., may arrive, when the old ones are permanently placed in the Library. And in the beginning of every year, the Librarian is to see that each set of the periodical publications, &c., be complete for the preceding year, and then have it bound uniformly with the other volumes.

7. No Member who is in arrear shall, on any account, be allowed the use of the Library; and for the better carrying such law into effect, the names of defaulters shall be hung up in the Library.

8. No manuscript shall be lent without the special permission of the Council; and the same Rule shall be extended to rare and expensive works, which shall be marked with an asterisk in the Catalogue, as also to dictionaries and encyclopædias.

9. The following are the regulations in relation to borrowing or transcribing manuscripts, which have been enacted by the Council, in conformity with the foregoing By-Law:—

(1.) That no MS., under any circumstances, be lent out of the Library without such pecuniary guarantee for its safe return as the Council shall require.

(2.) That no copy of the whole, or any part of a MS. or extract therefrom, be permitted to be taken without the express leave of the Council.

(3.) That all applications to the Council for leave to copy or make extracts from Manuscripts be accompanied by a statement in writing of the use intended to be made of such copy or extracts; this statement, and the respectability of the applicant (if he be not a Member of the Academy), to be vouched for by the signature of three Members of the Academy, one of whom shall be a Member of the Council.

(4.) The applicants, to whom leave shall be granted to make copies or extracts, shall be at liberty to make such transcripts themselves, but not to employ any other person, except the scribe be authorized by the Council.

(5.) In cases where a fac-simile or tracing of a MS. is required, the leave of Council must be obtained in the same way as for ordinary transcripts, and the name of the artist or scribe employed to make such tracings must be submitted to and approved of by the Council.

(6.) No MS. shall be used or transcribed by any person whatsoever, except in the presence of the Assistant Librarian or of his Deputy.

(7.) These Regulations shall be printed and hung up in the Library.

(8.) Mr. Curry's Catalogue of the Irish MSS. of the Academy shall be regarded as a MS., and placed under the same regulations as other MSS.