TRANSACTIONS

OF THE

BOTANICAL SOCIETY.

VOLUME VI.

EDINBURGH:
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MDCCCLX.

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The Society as a body is not to be considered responsible for any facts or opinions advanced in the several papers, which must rest entirely on the credit of their respective authors.

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VOL. VI.—PART I.

EDINBURGH:
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TRANSACTIONS

OF THE

BOTANICAL SOCIETY.

12*th November* 1857.—Professor BALFOUR, Vice-President, in the Chair.

A letter was read from Mr N. J. Anderson, dated Stockholm, 3d November 1857, acknowledging the receipt of plants, and promising Swedish specimens in return.

The following donations were announced to the Society's Library, viz.:—

Note sur quelques espèces litigieuses du genre Trifolium, par Dr Puel.—From the Author. Also, Notices of "Collections Botaniques."—From Dr Puel.

Biographical Notice of the late Archibald Gorrie, by Dr George Lawson.—From the Author, who also presented Mr French's pamphlet on the Mechanical Structure of Cotton Fibre.

Proceedings of the Berwickshire Naturalists' Club, Vol. IV., No. 1.—From the Club.

Note sur la famille des Santalacées, par M. Alph. De Candolle.—From the Author.

Flora Melitensis, Auctore Joanne Carolo Grech Delicata, M.D.—From the Author, *per* Mr H. Paul, who also presented Dr Delicata's Memoir "Della Quantita di Acqua che cade annualmente," in Malta.

Twenty-First Annual Report of the Warwickshire Natural History Society.—From the Society.

Professor Balfour stated that the following donations had recently been made to the Museum at the Botanic Garden, viz.:—

From Dr John Lowe—Collection of Wax Flowers, chiefly Orchids.

Dr G. M'Nab—Section of a large trunk of Iron-Wood.

Dr J. Kirk—Mummy Cloth, from Thebes; and Jute, manufactured from *Corchorus capsularis.*

The Most Noble the Marquis of Huntly—Cones of *Pinus insignis*, taken from a tree 50 feet high on the lawn at Orton Hall.

Mr Fortune, China—Stem of Rice-paper Plant, *Aralia papyrifera*, from Formosa; twisted leaves of *Artemisia indica*; and two sticks of Mosquito tobacco.

Mr A. Inglis—Large Grains of Indian Corn.

Dr M'Vitie—Miscellaneous Collection of Australian Seeds and Dried Specimens of Plants.

Mr Scott, Leigh Park—Fruit of Mango, ripened at Leigh Park.

Dr Robert Sim—Section of *Quercus Ilex*, being part of a branch of the tree called "Abraham's Oak," on the plains of Mamre, near Hebron.

Mrs Mackay—Wax Model of Turnip.

Mr Wm. Taylor, Inverury Nursery—Case of Polished Woods, consisting of timber trees and shrubs, indigenous to Britain, 69 in number.

Mr H. G. Dickson junior—Section of Silver Fir, 36 feet in circumference.

Messrs Wm. and G. Law—Specimens of ten varieties of Tea and six of Coffee.

Dr W. H. Todd—Medicinal Powder, prepared from the root of *Podophyllum peltatum*, and a specimen of *Podophylline.*

Messrs Jackson and Son, Kingston—Cone and branch of *Wellingtonia gigantea.*

Professor Balfour—Lima Nests, formed partly of *Phyllophora rubens*, from Lamlash Bay.

Professors Christison and Syme—Specimen of the Stem of one of the Scotch Fir trees of Braemar, exhibiting 26 annual rings. although the tree was only about 1 or 1½ foot high, and about an inch in diameter near the base.

Professor Christison—Peculiar Stem, with corky projections, from the West Indies; likewise, an Australian Fungus, a species of *Clathrus.*

Mr Hoffard—Dried specimen of a young Cauliflower plant, in which the leaves have become converted into conical hollow pitchers.

Mr John Sadler—Specimens of *Sticta crocata*, from Dalmahoy Hill.

Mr T. R. Marshall—Specimens of Lichens from Norway,—viz., *Cetraria islandica*, *C. nivalis*, *Cladonia rangiferina*, and *Alectoria sarmentosa.*

Dr Allen Dalzell—Seeds of *Moringa pterygosperma*, used for the preparation of Ben oil and of oilcake.

Mr David Robertson—Specimens of *Dudresnaia coccinea*, which had been dredged from a gravelly bottom, in about seven fathoms water, in Cumbrae.

Specimens were exhibited from Dr Gilchrist of *Poa Balfourii*, collected by him at Romsdalen, Norway, in August last.

Dr Balfour stated that grapes had ripened this season in the open air in the Botanic Garden; also, that *Exogonium Purga* and *Convolvulus Scammonia* were in full flower in the open border at the end of October.

The following papers were read:—

I. *Short Account of a Botanical Trip in the Island of Arran, with Pupils, in* 1857. By Professor Balfour.

The botanical party consisted of Messrs M'Taggart Cowan, Hugh Cowan, Robert Cowan, Deas, Macfarlan, Linton, A. Stevenson, J. Stevenson, Spittal, and Carpenter, who, along with Dr Balfour, visited various parts of the island. Dr Balfour first made some remarks on the geological features of the island, and noticed the difference between the floras of the Granitic, Trappean, and Red Sandstone districts. He then proceeded to give details of the different excursions. Among the interesting plants near Lamlash, Brodick, and Corrie, were the following:—*Lastræa fœnisecii*, *Hymenophyllum Wilsoni* and *tunbridgense*, *Osmunda regalis*, *Polypodium Phegopteris*, *Œnanthe Lachenalii*, *Hypericum dubium*, *Mentha sylvestris* var. *velutina*, *Inula Helenium*, *Potamogeton plantagineus*, *Asplenium viride*, *Carex lævigata* and *extensa*, *Myrrhis odorata*, *Mertensia maritima*, *Sinapis monensis*, *Pinguicula lusitanica*, *Erythræa linariifolia*, *Hypericum Androsæmum*, *Bidens tripartita*, *Atriplex arenaria*, *Rosa involuta*, *Juncus maritimus*, *Scirpus Savii*, and peculiar filiform varieties of *Fucus vesiculosus*, growing in the saline marshes. Near Whiting Bay, *Cichorium Intybus* was gathered by Mr R. Cowan. Among the waterfalls at the upper part of Glen Cloy there is a profusion of *Hymenophyllum Wilsoni*, also *Asplenium viride*, and *Polystichum aculeatum*; and on the rocks in the vicinity many sub-alpine plants similar to those found on Goatfell. Goatfell does not produce a truly alpine flora, although rising to the height of 2945 feet. The principal plants gathered were *Oxyria reniformis*, *Saxifraga stellaris* and *hypnoides*, *Thalictrum alpinum*, *Juncus triglumis* and *trifidus*, *Sedum Rhodiola*, *Juniperus nana*, *Salix herbacea*, *Carex rigida*, *Lycopodium Selago*, *alpinum*, and *selaginoides*, and *Alchemilla alpina*, with the variety called *conjuncta*. In regard to the latter, it was stated that on the northern side of Glen Sannox specimens were gathered with the leaflets united in various ways, and to various extents, and on the same plant leaves were seen with separated leaflets and others with united leaflets. Mr M'Nab states that *A. alpina*, when cultivated for some time in the garden, becomes *A. conjuncta*. At the southern part of the island the following were some of the plants collected —*Geranium sanguineum* and *pratense*, *Equisetum Telmateia* (some specimens seven or eight feet high), *Inula dysenterica*, *Carlina vulgaris*, *Haloscias scoticum*, *Apium graveolens*, and *Eryngium maritimum*. On the red sandstone rocks near the sea there was abundance of *Callithamnion Rothii*. On the trap rocks at Dippin, *Solanum Dulcamara*, *Verbascum Thapsus*, *Agrimonia Eupatoria*, *Cotyledon Umbilicus*, *Carex vulpina*, and *Ramalina scopulorum;* and on the trap island of Pladda, *Anthemis nobilis*. On the western shores of the island, near Imacher, *Crambe maritima* grows in profusion, along with the oyster-plant (*Mertensia maritima*). On the rocks at King's Cove, *Asplenium marinum* and numerous other ferns abound. The basaltic rocks of Drummidoon are gray with *Ramalina scopulorum*. On the sands near Blackwater foot, *Convolvulus Soldanella*, *Polygonum Raii*, and *Triticum laxum*, were gathered. Near Loch Ranza, *Pyrus fennica* was picked; *Arctium intermedium* (?) and *Lithospermum officinale*. At Waller Paton's "Nameless Rill," near Lamlash, numerous ferns occur, which were pourtrayed in his famous painting exhibited last season in Edinburgh. Some rare species, as *Hymenophyllum tunbridgense* and *Lastræa fœnisecii*, also occur there. On the stones near the rill, where the water is constantly dropping, there is a profusion of *Trentepohlia pulchella*, which is spread over them in the form of a pink covering. In the marshy ground, *Mentha rubra* was found. Numerous sea-weeds were also collected. Among the species were noticed *Stilophora*

Lyngbyi, *Dasya coccinea*, *Asperococcus Turneri*, *Dudresnaia coccinea*. Some Lima nests were dredged up, which were composed almost entirely of *Phyllophora rubens*. Numerous Rubi occur on the island. There are at least sixteen of the so-called species. The fruit of these varies much in appearance and time of ripening, and in flavour. On Holy Island, which rises to the height of 900 feet, there is a great profusion of *Arctostaphylos Uva-ursi;* also, *Osmunda regalis*, *Hypericum Androsæmum*, and *Asplenium marinum*. In the mud, dredged from the bottom of Lamlash Bay, there were found numerous species of *Diatomaceæ*. The mildness of the climate of the island is shown by the following list of plants which stand the winter without protection at Whitehouse, Lamlash, the residence of Mr Paterson, factor for the Duke of Hamilton:—*Fuchsia decussata* of large size (this plant forms hedges in many parts of the island), *Aster argophyllos*, *Aralia japonica* (in fine flower at the end of September and beginning of October), *Medicago arborea*, *Aloysia citriodora*, *Spiræa Lindleyana* (in fine fruit in September), *Catalpa syringæfolia* (not in flower), *Buddlea globosa*, myrtles, and chrysanthemums. Near the Free Church Manse at Kilmorie, fuchsias and hydrangeas grow luxuriantly. All over the island, *Lavatera arborea* is cultivated in gardens, and attains a large size. It may have been introduced from Ailsa Craig.

The following is a statistical summary of the flowering plants and ferns collected:—

DICOTYLEDONES.—Thalamifloræ	. . .	78
Calycifloræ, Polypetalæ	. .	91
Gamopetalæ	. .	66
Corollifloræ	. . . .	71
Monochlamydeæ	. . .	51
MONOCOTYLEDONES.—Petaloideæ	. . .	37
Glumiferæ	. . .	73
ACOTYLEDONES.—Filices	. . . .	24
Equisetaceæ	. . . .	5
Lycopodiaceæ	. . . .	4
Total number of species	. . . .	500

True ferns constitute $\frac{1}{21}$ of the species collected. The mosses, &c., collected by the party were examined by Dr

Nichol, who states that, "besides including some species of universal occurrence, as *Sphagnum cymbifolium*, *Mnium punctatum*, *Jungermannia albicans*, *Tamarisci*, and *epiphylla*, they also comprise some of the rarer species, as follows:— *Dicranum majus*, *Campylopus longipilus*, *Zygodon Mongeotii*, *Orthotrichum Bruchii*, *Bartramia arcuata*, *Pogonatum alpinum*, *Plagiothecium elegans*, *Eurhynchium prælongum*, *E. pumilum*, *Jungermannia compressa*, and *Scapania nemorosa*. *Plagiothecium elegans* is a species of rare occurrence in this country, although widely distributed. It, as well as *Eurhynchium pumilum*, has probably been overlooked. The rest of the species here enumerated are all of a subalpine type."

The following is a list of some of the lichens collected, as drawn up by Mr Sadler:—" *Lepraria alba*, *Lecidea icmadophila*, *L. geographica* var. *sulphurea*, *Parmelia caperata*, *P. perlata*, *P. saxatilis*, *P. physodes*, *P. herbacea*, *P. parietina*, *Sticta pulmonaria*, *Peltidea canina*, *P. horizontalis*, *P. polydactyla*, *Nephroma resupinatum*, *Cetraria glauca*, *Ramalina scopulorum*, *Sphærophoron coralloides*, *Cladonia uncialis*, *C. rangiferina*, *C. furcata*, *Scyphophorus cervicornis*, *S. pyxidatus*, *S. bellidiflorus*, *S. digitatus*."

Specimens of the plants were exhibited to illustrate the paper.

II. *Notice of Abnormality in Flowers of* Lilium. By J. CHRISTIAN, Esq. Communicated by WILLIAM BRAND, Esq.

This communication by Mr Christian was accompanied by several interesting specimens, which were laid before the meeting. They had been examined by Dr George Lawson, who reports as follows:—" In the lily sent by Mr Christian there are ten sepals, eleven stamens, and two ovaries; the petiole is slightly flattened, and appears to be formed of two petioles united. I think the monstrous flower is undoubtedly formed, not by the growth of additional parts, nor by chorisis, or the splitting of organs during their development, but by the fusion of two flowers into one. According to this view the number of parts should be as follows:—*Sepals*, twelve; *stamens*, twelve; *ovaries*, two. In the specimen, two of the sepals seem to be lost by adhesion, as is indicated by two of them presenting a slight cleft towards the apex, showing apparently that they are double. Add this number, two, to the number actually in the flower, ten, and we have the proper number, twelve. Mr Christian states that there were eleven stamens (of which only eight now remain in the flower). I am unable to account for the missing stamen further than to suppose it may be due to adhesion or abortion."

III. *Short Notice of a Peculiar Form of Fungus.* By JAMES YOUNG, M.D.

The fungus which was exhibited had been found by Dr Young while assisting Mr Edwards in the operation of excision of the knee-joint. The patient was, after the operation, laid on a new and clean bed, with a hair mattress, which had been previously covered with gutta percha sheeting, and the limb supported by a M'Intyre splint. The patient lay in considerable comfort for some days. The bed, however, became very soon damp, and it was found necessary to have him changed. On the fourteenth day after the operation, he was removed from the bed to a sofa till the mattress was changed and a new one substituted, when attention was directed to an extraordinary appearance on the under part of the bed, where the fungus was produced in large quantity, growing equally from the spar as from the mattress. The bed was thoroughly cleaned, but in spite of this, at the expiry of nine or ten days, the same appearance was again presented, the fungus being nearly in equal quantity as before.

IV. *Remarks on the Fungus.* By the Rev. M. J. BERKELEY. Communicated by Professor BALFOUR.

"The fungus is an imperfect state of some Coprinus. A similar case is reported in some Italian Transactions, and I recollect one which occurred at St George's Hospital in 1825, and the occurrence was much commented upon at the inquest. The Hospital authorities, on the inquest, chose to deny the fact, but I recollect seeing the case in the Hospital before death, and was requested to say what the species was. I never, however, saw the specimen, as by some accident it had been destroyed. The treatise to which I allude is entitled,—'Sopra alcuni funghi ritrovati nell' apparechio di una frattura. Modena, 4to, 1805.' Targioni—Tozzetti."

V. *Remarks on the Microscopical Structure of Cotton Fibre, with reference to Mr Gilbert J. French's proposed Improvements in Spinning.* By GEORGE LAWSON, Ph.D.

Some improvements in cotton-spinning, recently proposed by Mr French of Bolton, and in connection with which I was called upon to give a Report on the Histological Structure of Cotton Fibre, have excited so much interest among spinners, not only in the north of England, but in the United States and on the continent of Europe, that I have thought a brief statement of his views, accompanied by a few observations of my own on the structure of cotton fibre, would not be without interest to the Botanical Society.

The general structure of cotton fibre is well known to histologists,—consisting as it does of an elongated cylindrical cell, so modified, when mature, as to present the appearance of a flat ribbon, with thickened margins, and twisted in a remarkable manner upon itself. It has thus evident characters that distinguish it from all other animal or vegetable fibres used for the purposes of man; and a knowledge of this fact has not only been of great use in commerce, but (as in the case of the ancient mummy-cloths) has served to shed a ray of light on some dark points in human history. The form of the fibres undergoes no change throughout the various operations of spinning, weaving, bleaching, printing, dyeing, washing, &c.; and even after the stuff has been worn to rags, reduced to pulp, and re-manufactured into paper, the structure remains evident.

Mr French, assuming that the spiral twist is a condition inherent in the fibres of ripe cotton which does not appertain to those gathered unripe, suggests that yarn might be spun from cotton gathered when protected by the covering pod and before exposure to the direct action of the sun's rays had induced the twist.

Mr French thus explains his views:—

"Cotton fibre, whether examined under the microscope or in the flakes sometimes met with in bales with the natural arrangement undisturbed, is found to possess a pearly lustre, which in the finer kinds becomes almost iridescent. This quality appertains also to flax, and in a higher degree to silk, but is not observed in cotton thread or woven fabrics, except when imparted to them by factitious appliances—a practice so common as sufficiently to prove that the retention of the natural lustre is an object of importance. This lustre is probably dependent upon the atomic arrangement of the cotton fibre. If these minute particles occupy uniform positions from the base to the point of the filament, each separate fibre, and any aggregation of fibres arranged in natural parallelism, receive and reflect the light that falls upon them—hence the lustre; but if this arrangement be reversed by placing the parallel fibres in somewhat equal numbers from point and from base, there can be no lustre, as the light is diffused from numberless reversed points instead of being reflected from a smooth surface composed of an aggregate of atoms uniformly arranged. To make this more evident, let me refer to a similar effect produced by the same means upon another material. *Spun* silk is a technical name for threads prepared from waste silk and such cocoons as from accident and malformation cannot be reeled for use in the usual manner. These are treated much in the same way as cotton. The natural parallelism of the fibres is broken up by machinery, and a new arrangement brought about by dint of carding and roving. The threads resulting from this process resemble cotton much more than silk, and have lost in a great measure the brilliant lustre for which that material is principally valued. Forty years ago, linen thread and linen cloth possessed a lustre which is rarely met with in the manufactured flax of the present day. When spun by hand, the natural parallelism of the fibres was retained; but the practice in modern mills is, I am informed, to cut each long lock of flax into four lengths, which, after being heckled, are presented to the spinning machinery without regard to the natural direction of the fibres. Hence, as in the case of cotton and of spun silk, the reflecting surface of the material is broken up, and there is consequently a loss of the desired lustre, though the quality and strength of the thread may in all probability be improved. Arguing from the analogous effects upon silk and flax, I venture to hazard the inference, that a permanent lustre might be given to threads and fabrics of cotton by retaining the parallel position of the fibres which nature has established in the seed-pod. Assuming the hypothesis, that the twists in filaments of cotton are in one direction, to be correct, I suggest that, by continuing this arrangement throughout the process of spinning, the result promises a thread of greater tenuity, with more strength and smoothness, than can be produced by the present practice, which twists one moiety of the fibres composing a thread in the direction of the natural torsion and the other in the reverse direction. I have shown that the spiral convolutions in ripe fibres of cotton *are permanent.* No process of manufacture, or of washing and wearing, succeeds in destroying or even modifying this peculiarity, and, as a necessary consequence, each distorted fibre exerts an unceasing effort to resume its natural position; hence the innumerable *ends* which perpetually show themselves on the most carefully manufactured cotton threads and fabrics. Human ingenuity may be said to have almost exhausted itself in the marvellous contrivances which have been applied to the removal or mitigation of this evil. The daring expedients of passing delicate threads and muslins over bars of red-hot metal, or through curtains of flame, are equalled by the contrivances of the bleacher in smoothing, polishing, and fastening to the surface of the cloth each rebellious point. These expedients serve, however, but for the time, since the friction of wearing and washing, and even changes of temperature alone, induce action in the elastic fibres thus unnaturally convoluted. They persist in an endeavour to escape from their constrained position, and are assisted by every strain upon the thread, as may be seen by the fresh points which at such times perpetually start from its surface. If in spinning cotton the system of parallelism which nature has given to the filaments can be retained throughout the after processes, and the suggestive hint which she offers by that system to form the artificial twist in accordance with the natural torsion of the fibre, were acted upon, yarn would be produced with some amount of elasticity, on which a strain would have the effect of bringing all the component fibres into closer contact; their ends, whether point or base, all clinging inwards to the centre of the thread. The most perfect possible yarn (if I may be permitted to suggest its production as possible) would be that in which the number of artificial twists in a given length coincide with the natural twists in the fibres from which it is made." "It is possible—perhaps not improbable—that the delicate 'webs of woven air,' so fine as to be impalpable to the touch, and woven from threads 'scarce discernible,' for which Eastern India was so famous in former days, may have been made from picked samples of cotton, freed from seeds, carefully manipulated and spun in the undisturbed integrity of its natural arrangement. It is scarcely possible to imagine that such fairy-like fabrics could be produced from the dislocated fibres which the British spinner is compelled to use."

For full information as to the manner in which Mr French proposes to carry out his views in practice, I must refer to his pamphlet, and to a translation thereof, with additions, published in "*Bonplandia,*" copies of which I now lay on the Society's table.*

Without repeating the details of my Report on the specimens of cotton submitted by Mr French for examination, it will be sufficient if I state here some of the more interesting points in regard to the minute structure of the fibre, which his contemplated improvements rendered it necessary for me to ascertain.

1. *Number of Twists or Turns in a Cotton Fibre.*—The natural twist not having before been considered with reference to its possible effect on any process of cotton manufacture, the point does not seem to have been very carefully determined. Mr Bauer, who gave the first correct drawings of cotton fibre, found that "the twists or turns in a fibre of cotton are from 300 to 800 in an inch." In the specimen of Sea Island cotton which I examined for Mr French, the

* Mr French's pamphlet, including my Report, although printed originally for private circulation, has been subsequently published in the Journal of the Society of Arts, London, in "Bonplandia," and in most of the newspapers in the manufacturing towns of the north of England, Scotland, and Ireland. Many of the facts contained in it were detailed in a series of lectures on cotton delivered at Hanover.

number of complete turns or twists was found to be in some cases ten in the $\frac{1}{20}$th part of an inch of fibre (that is, equal to 200 complete turns in an inch); but on the average they were much fewer, for even in the same fibre the degree of twist is variable in its different parts. The specimen here alluded to was certainly more strongly twisted than other specimens which I examined of Indian cottons, contributed to the Herbarium of the Edinburgh University by Dr Cleghorn of Madras.

Crum's calculation (Proc. Phil. Soc. Glasg. vol. i.) of the number of twists differs from my observation to such an extent as to be only explained by supposing that he counted each half-twist as a complete turn of the fibre, and thus gave twice the number of turns that really exist.

2. *Direction of the Twist.*—Cotton has hitherto been invariably spun without reference to the direction of its natural twist. In the Sea Island cotton submitted by Mr French, I found that the fibres were twisted for the most part from left to right (that is, in the direction of the sun's course); a few of the fibres, or at least portions of them, were twisted in the contrary direction (right to left, or against the sun's course); and portions occurred in which there was scarcely any twist at all, the fibre being in the form of a crumpled ribbon.

In my Report it was also stated that the development of the cotton fibre had not been traced by any previous observer with the special view either of ascertaining the prevailing direction of the twist, or of investigating the conditions by which it is regulated, and that it was therefore impossible, from the examination of a single specimen of mature cotton, to predicate what might occur in other kinds of cotton, or even to say with certainty that the prevailing direction of twist in that specimen would also be found in other samples of Sea Island cotton, although such was extremely likely to be the case. Subsequent examination of other samples has led to the conclusion that there is considerable variety in the direction of twist.

This, as well as other peculiarities of twist in the ripe cotton, are only to be rightly understood by tracing the gradual progress of the twist from the straight cylinder of the unripe, to the twisted condition of the ripe pod. Bauer's drawings to Thomson's paper (Phil. Mag. vol. v. 1834) indicate an equal twist both ways, which does not accord with the results arrived at in the examination of Mr French's sample. The drawings of cotton fibres in Dr Royle's book are better. Those accompanying Mr Crum's excellent paper in the "Proceedings of the Philosophical Society of Glasgow," are a repetition of Bauer's.

3. *Cause of the Twist.*—We are still without any explanation, even probable, of the cause of twisting and twining in plants; for Wichura, and others, who have most carefully investigated such phenomena, have not attempted more than an elaborate observation of facts, with an indication of the general effects of the sun, to which, indeed, all the phenomena of plant growth may more or less completely be referred. Mr French observes:—

"Whatever means nature may employ to produce the flattened and twisted arrangement of cotton fibre in the opened pod, it may be fairly assumed that the cause acts uniformly, and is followed by a uniform result. If the twist follows the course of the sun—a supposition powerfully supported by analogy of the known effect of its agency upon many other plants—then the twist in all fibres in the same pod must be in one and the same direction; so also will be the case with each pod of the same plant, each plant of the field, each field of the district, and each district of the hemisphere."

Although Mr French alludes to my observations (supplied to him) as supporting the ingenious view partially expressed in the above paragraph of his pamphlet, that the direction of twist depends upon the sun, and is therefore probably different in the southern from what it is in the northern hemisphere, I must be permitted to say that the allusions in my Report to the course of the sun in explaining the twist of cotton were merely employed as a familiar mode of explanation commonly used by botanists in reference to the twinings of plants (the terms "right to left," and "left to right," having been used by different writers in a totally different sense). I may further state, that my observations have not led me to suppose that there is any necessary relation between the direction of twist and the sun's course.

In conclusion, I would observe, that although many eminent botanists, chemists, and histologists have carefully examined the cotton fibre, and have from time to time pointed out the important bearings which a knowledge of its structure has upon such manufacturing operations as dyeing, spinning, &c., there are still some points of great interest that merit attentive investigation. The effect of climate on cotton fibre has not yet been studied at all in its histological relations, although a few experiments which I have recently made on this subject are not without hopeful indications; and we also want reliable information as to the real variations that occur in the cotton fibres afforded by different species and varieties of Gossypium.

In such branches of inquiry, we may reasonably hope not only for a few new facts of scientific interest, but for some useful additions to the general stock of technological knowledge.

In illustration of his remarks, Dr Lawson exhibited two specimens of the very finest Sea Island cotton of this year, which had been sent to him by Mr A. Oswald Brodie, of the Ceylon Civil Service.

VI. *Notice of the Discovery of a New Station in Britain for* Polygonatum verticillatum. By the Rev. W. Herdman. Communicated by Professor Balfour.

The station is Drimmie Burn Den, near Glen Ericht Cottage, parish of Rattray. Mr Herdman states that it was found at Strone of Cally by Dr Barty some years ago. It has also been long known at Craighall; and the Drimmie station is nearly intermediate in position between these two places, which are about four miles apart. At the same place there is abundance of *Paris quadrifolia.*

VII. *An Account of some of the Habitats of the* Polygonatum verticillatum. By Dr James Rattray.

The author remarks:—" This plant was until lately believed to exist only in the grounds of Craighall and in the

Den Rechip; but so well concealed were the habitats by the natural configuration of the ground, that many botanists have failed to obtain it in both localities; and it has even been affirmed, of the latter place especially, that it had been completely extirpated. It, however, still exists in both places. I observed it in the Craighall grounds in the beginning of August last, and I have been informed of its existence in the Den of Rechip by a gentleman who saw it in the course of last summer. Within the last few years it has been found in the den of Airlie, and in two new* situations near Blairgowrie. *Mercurialis perennis* and *Paris quadrifolia* generally grow in profusion about it, and it seems to thrive best in sheltered situations beneath dense brushwood.

"In one of the new Blairgowrie stations† there are no less than six distinct habitats known; and probably more exist, as the grounds have not been completely explored. From this place the specimen in fruit now exhibited, as well as the four roots, which are in the Edinburgh Botanic Garden, were taken. It grows very luxuriantly, some of the plants being above three feet in height, with almost perfectly whorled leaves. This is by far the most abundant station for it. It was discovered by the Rev. Mr Herdman, parish minister of Rattray.

"The larger of the two barren specimens was taken from Craighall. Here, I believe, the plant was first discovered, but at a different part of the grounds, by Dr Balfour.

"Of the other habitat, near Blairgowrie, and the one at Airlie Castle, I can say nothing, except that they are not abundant, and that they were discovered by the Rev. Dr Barty, parish minister of Bendochy."

VIII. *Notice of the Occurrence of* Asplenium viride *on a wall near Arno's Grove, Southgate, Middlesex.* By V. Edward Walker, Esq. Communicated by Professor Balfour. Specimens were shown.

* These are the grounds of Glen Ericht Cottage, and the Strone of Cally, near Bridge of Cally.

† The Glen Ericht station.

10*th December* 1857.—Dr SELLER, President, in the Chair.

The following resolution was adopted:—

"The Botanical Society feel deeply the loss which they have sustained in the sudden and unexpected death of their president, the Rev. Dr Fleming. He had for many years taken an active part in the Society's proceedings, and had contributed in no small degree to the interest of its meetings. His ample stores of knowledge in all departments of natural science were always available for the instruction of members. His writings had deservedly placed him in the highest rank as a naturalist, and his information in regard to the natural history of Scotland was unrivalled. Botany occupied a large share of his attention, and his love for it seems to have revived since he came to reside in Edinburgh.

"He was a judicious and zealous instructor, and it always afforded him pleasure to encourage young men in the prosecution of science. He was cautious in his inductions; and while he stimulated others to exertion, he strongly impressed upon them the necessity of a careful observation of facts as the basis of science. He often repressed the ardour of the young naturalist disposed to generalize too rapidly, and to build up theories on slight foundations. He was conscientious in his search after truth, and this often caused him boldly to discard generally received opinions, and thus to put himself in opposition to other naturalists. To this love of truth may be traced the occasional severity of his remarks, which were sometimes misinterpreted by those who did not know the character of his mind. He loved science for its own sake, and he saw in it the means of showing forth the glory of the Creator.

"He enjoyed the society of naturalists, and he contributed by his wit and humour to the happiness of many a meeting.

"The Society are sensible that his loss cannot be easily repaired, whether he be regarded as a member of society, a Christian naturalist, or a teacher of youth.

"They desire to express their deep sympathy with his wife and family in their afflictive bereavement."

The Office-bearers for the ensuing year were elected as follows:—

President.

Dr Seller.

Vice-Presidents.

Professor Gregory.
Professor Balfour.
Dr W. H. Lowe.
Andrew Murray, W.S.

Council.

Professor Allman.
Professor Simpson.
William Ivory, W.S.
Thomas G. Stewart.
Henry Paul.
Dr John Kirk.
James M'Nab.
J. Montgomerie Bell.
David Philip Maclagan.
Alexander Grigor.

Honorary Secretary.......... Dr Greville.
Foreign Secretary............ Dr Douglas Maclagan.
Auditor......................... William Brand, W.S.
Treasurer....................... Patrick Neill Fraser.
Artist............................. Neil Stewart.
Curator.......................... A. J. Macfarlan.
Assistant-Secretary.......... Dr George Lawson.

The following Candidates were balloted for and duly elected, viz.:—

As Resident Fellows.

M'Taggart Cowan, Esq., 23 Duke Street.
Frederick de Fabeck, Esq., 2 Windsor Street.

As Non-Resident Fellows.

Dr James Gilchrist, Crichton Royal Institution, Dumfries.
William Marshall, Esq., Lord Mayor's Walk, York.

As a Foreign Member.

William Sharswood, Esq., Philadelphia.

The following donations to the Society's Herbarium were announced:—

From Miss Robertson—European and Indian Plants.

Mr A. Mack, Ardrossan—British Plants.

Dr Gilchrist, Crichton Royal Institution, Dumfries—Norwegian Plants and a large Collection of British Plants.

The Tyneside Naturalists' Field Club, their Transactions, vol. iii., part 3.

The Philosophical Society of Liverpool, their Transactions.

Dr Kirk—Egyptian Plants.

Dr Nichol—British Plants.

Dr Balfour mentioned that the following donation had been made to the Museum at the Botanic Garden:—

From Professor Simpson—Piece of Spruce Fir perforated by *Teredo navalis*, taken from a ship built in New Brunswick, and which was brought to Liverpool for sale, where it lay for two years.

Dr Lawson exhibited a series of beautifully executed plates of British Mosses, nature-printed by Mr Henry Bradbury, which were presented to the Museum at the Botanic Garden. The figures included several species that had recently been added to the British Flora.

An address was then delivered by the President:—

Dr Seller begged to thank the Society for the honour done him by electing him for the second time to the Chair. He had to make a few observations, at the request of the Council, by way of an introductory address. After a brief prelude, he remarked that the number of botanists of the first class must always be too few to do all that is requisite for the steady progress of botanical science; that even the genius of such luminaries as Ray, Jussieu, De Candolle, Brown, and the like, could have gone but a short way towards placing botany on its present footing, but for the abundance of materials supplied by men of very moderate pretensions in botany, who, spread over the world, engaged in multifarious pursuits, had brought the botanical treasures of little known lands within the reach of botanical science; that cultivators of this description had been increased to a host at no very remote period by the genius of Linnæus, who had put into men's hands a system so easy, that they who ran could read, whence chance sojourners in strange countries, when they saw the earth clothed with a herbage new to their eyes, became botanical collectors almost in spite of themselves; that the day when botanical usefulness could be purchased at so easy a price was probably gone by; but that this credit was still to be obtained by a somewhat larger exercise of industry; that the Linnæan system of botanical arrangement, which had unquestionably produced the most beneficial effects, no longer held the place which once belonged to it, and could not be regarded as a fit subject of comparison with the natural system of arrangement by which it was being superseded; that the two systems were not directed to the same one object, and thus were not fit things to be weighed one against the other; that, by consequence, the warfare which had sometimes been carried on by their respective partisans should now be pronounced to be at an end; that the Linnæan system had essentially but the one object, to show whether a plant had or had not been already described, named, and registered by botanists; that, in truth, it possesses nearly every merit which can be conceived to belong to a mere method of determining such questions; that Linnæus himself doubtless saw farther into what should be the principle of botanical arrangement than the botanists of his time in general; but that it does not appear that the actual benefits of a systematic arrangement were then commonly appreciated; that the progress of botany has clearly shown that the determining whether a plant under examination has or has not been already described, named, and registered, is but a subordinate use of a systematic arrangement; that such an arrangement can be rendered so complete that the knowledge of the place which a plant holds in it may suffice to denote at once nearly the entire natural history of that plant; while, as a whole, that such an arrangement may exhibit a condensed view of the highly diversified kinds of form and structure which it has pleased the Author of Nature to impress on the vegetable kingdom; that many frivolous arguments have been used in past times to recommend the natural system to the attention of students of nature; that all these should be thrown aside, and the one advantage just referred to, besides that which it has in common with the Linnæan system, insisted on; in other words, that it is the design of the natural system of botanical arrangement, when matured, to show forth, as far as is permitted to human knowledge, the plan embodied in the word by which God, on the third day, called vegetable nature into being. After some observations on the relation which botany holds to medicine, Dr Seller said, that for those medical men who are destined to practise their profession anywhere in those vast regions of the British Empire, remote from their native shores, there is no study in the whole range of general knowledge to be compared to the study of botany, as less apt to interfere with their proper duties, being at the same time so likely to turn to good account in realising a solid reputation; and as to the supposed difficulties of mastering botany in its present state to a sufficient extent, he would only say, for the benefit of the many young gentlemen whom he saw present, that they had but to enter on the study of the structure of the vegetable kingdom with the same zeal and with the same spirit with which they were wont to prosecute the study of human anatomy, and these difficulties would be at an end. Dr Seller then proceeded to say, that it is now nearly twenty-two years since this Society was established; that the anniversary of its institution is still annually commemorated with enthusiasm; but that there is another duty which too often falls to the lot of the newly-elected President at the commencement of a session, on taking the chair, as he did that evening, the melancholy duty of recording the names of such members as have been gathered to their fathers in the course of the past year; that in two successive years the President for the time had been taken from among them in both cases by an unexpected summons; that little more than eighteen months ago Colonel Madden, the then President, had been suddenly cut off; that less than a month since Professor Fleming, the President of the past year, had gone to the grave with hardly a longer warning; that many here present must remember Professor Balfour's affecting and just tribute to the memory of Colonel Madden at one of the summer meetings in the Botanic Gardens in 1856; that it was now his duty to call upon them to join their regrets with his on the death of Professor Fleming. He said that Dr Fleming had attained a considerable age; but that, nevertheless, his death had come upon them like a thunder-clap,—that they were so accustomed to look upon the instances of bodily and mental vigour which he so frequently exhibited in the discharge of his academical duties, and in the part he took in the various scientific institutions of which he was a member, as so many indications of his being, though advanced in years, young in constitution, that they never felt it to be possible that he should not be left among them till he should have attained nearly the utmost verge of human life; but that if, under the decree of Providence, great length of days was not granted to him, his friends have this satisfaction, that the years which were permitted to him did not lie idle, and that few men have better employed their time than he did, even from early youth, in the discharge of the duties required of him by his position in life, and in the self-imposed task of making the wonders of God's creation familiar to the minds of his fellow-men. Dr Seller, in continuation, said it would be presumption in him to attempt a full delineation of a character so far removed from commonplace as Dr Fleming's, but, nevertheless, a few remarks were required on the present occasion. That Dr Fleming was bold in the cause of truth, and little addicted to own the authority of great names, or to take up views or opinions merely because fashion was on their side—for it cannot be denied that even in the study of nature fashion is not always without its sway for a time; that it does certainly seem at first glance unaccountable that so light an influence as fashion should ever find ground to maintain itself within the sphere of studies resting on the solid foundation of experiment and observation; yet that the fact is incontrovertible, the proofs of it in the history of natural science are flagrant; that this influence would beyond question exercise a greater and therefore a more baneful effect on the natural sciences, but that there arise from time to time among naturalists men fearless of scorn, of dauntless energy, of imperturbable self-reliance, who stem the tide of error or illusion till truth is again able to assert her dominion; that among men of this character Dr Fleming unquestionably ranked; that it is a kind of character which draws forth admiration more than love; that it does not always at once gain the admiration it deserves, inasmuch as its manifestations are sometimes mistaken for the carpings of an envious or jealous temper; that it deserves admiration because of its rarity; that it deserves admiration because, when exercised within the bounds of reason, it confers great benefits on the cause of science; that it deserves admiration because it blends with all that is great and good in human nature; that it deserves admiration because, in its purity, it rests on an uncompromising love of truth, and is as remote as possible from that littleness of mind which, blinded by self-love, sometimes seems to itself to be resisting error when it is merely shutting the eyes to every excellence which did not emanate from self; that this kind of character is not always loved, even by the straightforward, because it must too often take a strong part against the cherished feelings of themselves or of those who are dear to them; that they might, in his conviction, rest assured that Dr Fleming possessed, in a marked degree, this high quality of character, and that in him it was cherished by a determination to permit no weak sensibility to stand between him and the cause of truth. He would ask if any one suspected that Dr Fleming's censures, which were sometimes bitter and unpalatable to those on whom they fell, had their origin merely in a cynical spirit; that the contrary is proved by the fact that no man showed more kindly feelings even to those on whom his censures fell. Again, that no one who knew Dr Fleming will believe that any little jealousy of the fame of others ever dictated his opposition to the views brought forward in his hearing. Dr Seller then detailed some particulars as to Dr Fleming's life and writings, and concluded by saying, that in that Society he had often given proofs of the intimate knowledge he possessed of vegetable nature, and of the profoundness of his views in all matters that related to natural science. That if they had in him a severe critic, they had not the less been satisfied of the kindness of his disposition and of the thorough honesty of his character.

The following papers were read:—

I. *Notice of Egyptian Plants.* By Dr John Kirk.

Dr Kirk gave a short account of a tour in Egypt and Syria during the spring of 1857, and exhibited specimens of the more interesting plants, as the *Ficus Sycomorus*, *Mimosa Lebbek*, and *Acacia nilotica*, one of the gum yielding trees. *Acacia Seyal* was said by the natives in the upper country to yield no gum, but to be used for charcoal. *Cassia ovata* was grown near Assouan; this forms a small part of the Alexandrian Senna. The camel loads which lay on the sand at Assouan for transport to Bonlak were all found to contain nothing but lanceolate leaflets of good quality, and free of *Tephrosia* and *Cynanchum.* The plants observed in cultivation were, the sugar-cane, cotton, rice, wheat, maize, shoura, indigo, lablab, phaseolus, cicer, vetches, lupins, castor oil, and tobacco. Each village had a group of date palms, and often *Zizyphus spina Christi*. The dhom palm was not observed further north than 28 degs. Dr Kirk observed that the weather on the Nile had been very variable and cold last season, yet invalids in general were very much improved during their residence in the upper country. In Syria the spring was late, so that few flowers had appeared except in the rich valleys near Tiberias, which were covered with a profusion of beautiful plants. In the north, that is between Beyrout and Damascus, the mulberry is the great source of wealth; the olive, vine, apricot, and walnut, are also grown; in the south, the cereals, vine, and olive. The oranges are very fine at Jaffa, whence they are taken to Constantinople.

II. *Notice of Plants found in the neighbourhood of Comrie, Perthshire.* By Mr D. P. Maclagan.

Before proceeding to details, Mr Maclagan called attention to the importance of local floras, as a means of extending our knowledge of the geographical distribution of plants. After a few remarks on the situation and climate, he described some of the more important parts of the district. Glen Artney was the first noticed; the more important plants were *Myriophyllum verticillatum*, *Calamintha Clinopodium*, and *Lastrea Oreopteris*,—the prevailing wood being hazel, birch, and oak. In Glen Lednock, a fine pass extending north from Comrie, ferns abound; the flowering plants, among others, embrace *Viola palustris*, *Hieracium diaphanum*, *Listera cordata* and other Orchids, *Pyrola rotundifolia*, and *Vaccinium Vitis-Idæa*. In the hilly part of the Glen, the common subalpine species are plentiful. Loch Erne and its vicinity produce many plants, such as *Carum verticillatum*, *Lobelia*, species of *Potamogeton*, *Carices* and *Fungi*. In the woods on the banks of the loch many grasses are found, *Poa nemoralis* being of the number. In the river Erne, and near its banks, the var. *grandiflorus* of *Ranunculus hederaceus*, *Œnanthe crocata*, and *Sedum Telephium*. Some larches on the road between Comrie and St Fillans are worthy of note. In Glen Ogle many species are found of *Veronica*, *Viola*, *Sempervivum tectorum*, and *Sedum* *anglicum;* others, as *Lychnis Githago*, are introduced in the cultivated ground. At Ochtertyre several interesting plants occur, as *Acer campestre*, *Aspidium angulare*, and a profusion of roses; in the loch the white and the yellow water lily, and other aquatics grow, the margins are fringed with *Typha latifolia.* On the Lawers property, Scotch firs and beeches are planted, which have attained great size and beauty. The Aberuchills do not afford many plants, their tops being bare, though their base is well wooded. Hardy *Junci*, *Scirpi*, and *Carices* occurred, but, curious to say, though high, these hills did not produce any subalpine species, even the common *Saxifraga aizoides*, while they occurred lower down. Whether this is owing to the soil (chlorite slate), or not, is a point that requires to be determined from similar observations in other quarters.

The principal wood grown is oak, large quantities of which are annually felled for tanning purposes; the usual period at which the trees are cut down, being from 22 to 25 years. Larches, fir, and beeches flourish, but the birch is not so common as in most Highland districts. In conclusion, Mr Maclagan said, from what is recorded above it will be seen that there are no rare plants in the district, but this is fully compensated for by the profusion of the common species, which, in most cases, are abundant in quantity, and reach a considerable perfection, as regards their suitability for herbarium specimens. He alluded to the fact that *Lastrea Oreopteris* takes the place of *L. Filix-mas*, which is comparatively rare in the district and ill grown in many cases; also, that while the extremely common *Senecio Jacobea* is not very plentiful, the rarer *S. viscosus* is of constant occurrence; to this a similar cause may be assigned as has been proposed to account for the absence of the subalpine species from the Aberuchills. Mr Maclagan then laid a detailed list of the plants on the table; including varieties, 442 had been noted.

III. *Contributions to Microscopical Analysis. No.* 1, *Tobacco.* By Dr George Lawson.

In this paper Dr Lawson called attention to the imperfect descriptions that existed of the histological characters of tobacco, and the consequent liability to error in microscopical analysis on the part of those who depended upon books for their knowledge. It has been customary to characterize the tobacco as distinguished by its hairs being "glandular," or having an "enlargement" or "roundish swelling" at the tips; but this very imperfectly indicates the peculiar structure of these hairs, which, although extremely variable in size and general form, present certain characters in their lower cells, and in the structure of the glands, which are very constant and of great practical value. These characters were shown by a series of microscopical drawings from various species of *Nicotiana*, as well as from manufactured tobacco. The characteristic hair of the tobacco leaf varies from 1-20th to 1-100th of an inch in length, and is generally thick and gouty at the base, and tapering towards the extremity where the glandular structure is placed; that structure is of an oval or rounded form, and consists of a few closely-packed but well-defined cells, which are very much shorter than the other cells of the hair. The elongated cells of the body of the hair (of which the lower one is most characteristic on account of its very large size), contain fine colourless granular matter and generally nuclei; but the secreting cells are well furnished with colouring matter of a reddish brown, but sometimes of a green colour. A one-inch object glass, recommended by Hassall for the examination of tobacco, is usually insufficient to show the *structure* of the gland; and the mere presence of "glandular hairs" proves nothing, these being common in plants. It is also necessary to keep in view that many small hairs occur on tobacco leaves which are normally without glands. The glandular hairs are most abundant at the tips of the shoots, and especially on the calyx and flower stalks of the tobacco. Dr Lawson, in calling attention to the remarkable prevalence of glandular hairs on the surface of plants in many families, observed that we have here a striking illustration of the view which he endeavoured to explain to the Society last summer, viz., that the secreting structures of plants are invariably formed by *epidermal cells* even where these structures are deeply imbedded in the plant's tissue. To the fact that epidermal hairs are so frequently organs of secretion, Gasparrini has just added the additional one that they are also the organs of absorption.

Dr Douglas Maclagan, in remarking upon Dr Lawson's paper, gave some interesting details of his own researches in regard to the histological and chemical characters of tobacco.

IV. *Notice of Galls found by Mr Beveridge on the leaves of the Beech.* By Mr James Hardy. Communicated by Professor Balfour.

V. *Notice of the occurrence of* Hypnum rugulosum, *Web. et Mohr, on Demyat, Ochils.* By Dr George Lawson.

This moss, although apparently not uncommon in some parts of Yorkshire and elsewhere in England, is decidedly rare in Scotland. It has been observed near the summit of Ben Lawers, Ben Voirlich, and near Kenmore, always barren. In August last I met with it on the southern slope of Demyat, near the summit, where it occupied the earthy crevices of exposed perpendicular rocks. The stems are robust, several inches in length, and sparingly branched in a pinnate manner. The foliage is of a pale greenish-yellow, slightly tinged with brown; the leaves being densely crowded, imbricated, more or less secund, concave, becoming very narrow in the upper part, the midrib extending half way or more. Towards the apex the margins are rather coarsely toothed, and a few scattered scabrous teeth are also seen on the dorsal surface. The stem leaves are broadly ovate-oblong, narrowed into a long slender point; those of the branches narrower, ovate-lanceolate, more shortly acuminate. The leaf is of thin texture, composed of very narrow cells, except at the basal corners, where they are quadrate and of larger size. The fructification has not been observed in Britain.

14*th January* 1858, Dr SELLER, President, in the Chair.

The following Candidates were balloted for and duly elected Fellows:—

FINLAY ANDERSON, Esq., 32 Moray Place.
ANDREW INGLIS, Esq., 33 Albany Street.
STEPHEN JAMES MEINTJES, Esq., 73 George Street.

The CURATOR stated that the following donations had been made to the Society's Library:—

Transactions of the Wisconsin State Agricultural Society, 1851-2-3.—From the Society.

History of Wisconsin, Vols. 1 and 3.

First and Second Annual Reports and Transactions of the State Historical Society of Wisconsin.—From the Society.

Madison Directory for 1855.

Proceedings of the Academy of Natural Sciences of Philadelphia, Parts 3 and 4 of Vol. III.—From the Academy.

Proceedings of Boston Society of Natural History, Parts 21 to 25 inclusive of Vol. V., and 1 and 2 of Vol. VI.—From the Society.

Also the following from the respective authors:—

History of the Growth, Progress, Condition, Wants, and Capabilities of Madison, the capital of Wisconsin. By Lyman C. Draper.

Charter of the City of Madison.

Annual Report of the Geological Survey of the State of Wisconsin. By James G. Percival.

Ninth Annual Report of the Board of Regents of the University of Wisconsin for 1856.

Inaugural Addresses by E. S. Carr., Prof. of Chemistry and Natural History, and by Daniel Read, LL.D., Prof. of Mental Philosophy, Logic, Rhetoric, and Didactics.

Report of the Locating Survey of the St Croix and Lake Superior Railway, by Robert Patten, chief engineer.

Report of the Iron of Dodge and Washington Counties, State of Wisconsin, by James C. Percival, state geologist.

Prairie du Chien, its Present Position and Future Prospects.

City of Watertown, Wisconsin, its Manufacturing and Railroad Advantages and Business Statistics.

Third Annual Catalogue of the Officers and Pupils of the Milwaukee Female College, Milwaukee, Wisconsin, 1854-55.

Map of Madison and the Four Lake Country, Dane County, Wisconsin.

Plans of Madison and Milwaukee.
Colton's Township Map of the State of Wisconsin, &c.

Professor Balfour stated that the following donations had been made to the Museum at the Botanic Garden:—

From Professor George Wilson—Specimen of Flax, showing the Plant after being steeped, from Redford Flax Factory.

William Hunt, Esq.—Specimens of the Tubers of *Oxalis Dieppei*, used as a substitute for the potatoe.

William Nelson, Esq., publisher—A series of chromo-lithographic delineations of the Trees and Shrubs of Scripture.

Dr John Kirk—Photograph of *Quercus Ægilops* or Mossy-cupped Oak, growing in Asia Minor.

James Ivory, Esq., Moreton Bay—Pod of *Castanospermum australe.*

Mr John Reid, Orton Hall, Peterborough—Specimens of Guinea Corn.

Mrs Mackay—Wax Models of Potatoes and Carrots.

The following papers were read:—

I. *On the Occurrence of a new Muscari on Mount Ida.* By Dr John Kirk.

The author remarked—In April 1856, a party was formed among the officers stationed at the British Hospital of Renkioi, on the Dardanelles, for the ascent of Mount Ida, about forty miles distant in a south-easterly direction. Three of us,—viz., Drs Armitage, Playne, and myself, taking an interest in botany, it was agreed that the specimens collected should be divided by lot on our return. At first our route was over a rough country, through the villages of Renkeny and Doumenek, as far as the old Roman aqueduct, crossing a ravine in the metamorphic rocks. This had been constructed to supply Novum Illium with water. Many of the old clay pipes are now used as chimneys to the native hovels. The stream which flows through this ravine is named the Kemar-son, and joins the river Mendere, but in the heat of summer it is lost in the sand about a quarter of a mile from its junction. Thus far the ground had been covered with brushwood of *Pistacia Terebinthus*, *Storax*, *Pinus halepensis*, and dwarf oaks of several species. A few clumps of handsome Valonia oaks, *Quercus Ægilops* and

Cerris, were seen towards the plain of Troy. In the valleys the Oriental plane, the poplar, and prickly Paliurus bush grew luxuriantly, festooned with *Clematis cirrhosa* and *Vitalba*, *Periploca græca*, *Cynanchum*, and wild vine. The ground was covered with several species of *Anemone*, *Iris*, and *Crocus*. After having crossed the Kemav, we soon entered a pine forest covering the high grounds as far as the plain of Beyramitsh; in this we lost our way, but followed the direction in which we believed Beyramitsh to be. We caught sight at last of the minaret of a Turkish village, which we reached as the Muezzim called to evening prayer. We had wandered many miles off our route, and had a narrow escape of camping out, which, but for the ague, is often preferable to the insect torments of a house. Next morning we followed the Mendere through a rich well-watered valley. By the road-sides the hop and lint grew wild. *Anemone appenina* and *Scilla bifolia* were picked; they had been transported from a higher region by the waters. Passing through the town of Beyramitsh, we paid our respects to Ahmed Bey, the feudal lord of the district, who sent two of his rawashes as guides and escort. These men were a source of much annoyance afterwards. Between this and the foot of Ida the country was rough and barren, intersected by ravines, through which the Seammander found its way to the plains. At the village of Avjylar we had some difficulty in obtaining lodging. This arose from our rawashes; but, being independent of interpreters, we soon made friends over pipes and coffee, with the natives. Early the following morning we began to ascend on foot. Proceeding in an oblique direction for some time we came to one of the sources of the Seammander, where it gushes by many powerful springs from the schist rocks. In this neighbourhood we found Saxifrages, Geraniums, *Dentaria bulbifera*, *Ruscus Hypoglossum*, and *Pæonia decora* among the fine timber of *Pinus Pinaster* which covered this region. There, too, the *Muscari* was picked in considerable abundance, which seems to be a new species, and which we have named, from its remarkably broad leaves, *M. latifolium*. It now appeared that our guides had deceived us, and taken us off the proper road, and from this point it seemed almost impossible to ascend. But, being determined to reach the top, we set off, leaving them to follow if they chose. Near the summit the forest opened out, and left nothing but bare rock; we picked the *Crocus garganicus*, *Corydalis tuberosa* and *digitata*, *Viola gracilis*, *Scilla bifolia*, *Ornithogalum nanum* and *fimbriatum*. The scanty soil had been turned up by the wild pigs in search of bulbous roots. The ascent had occupied from seven in the morning till three P.M. On our return we followed a much easier path, and here we found the *Saxifraga sancta* growing in wet boggy spots. This species had been previously discovered by Griesbach on Mount Athos. The sun had set by the time we reached the village of Avjylar, and, having enjoyed a night's rest, we set off on our return to the hospital, where we arrived on the fifth day from our departure.

Dr Kirk briefly indicated, in the following terms, the characters of the new *Muscari*:—

MUSCARI LATIFOLIUM; scape erect, about 12 inches in height, rising from a globose bulb, and bearing near its base a large sheathing, broadly lanceolate, rather obtuse solitary leaf; flowers numerous, forming a raceme about two inches in length, the lower ones shortly pedicellate, the upper ones barren, sessile; perianth tubular (blue), in the fertile flowers inflated below. *Muscari latifolium*, ARMITAGE, KIRK & PLAYNE, in Herb.

II. *Note on* Cryphaea (Daltonia) Lamyana, *Montagne.* By Dr GEORGE LAWSON.

Dr Lawson stated that, in 1846, M. Montagne had described and figured, in apparently a very careful manner, a new moss found near Vienna, under the name of *Daltonia Lamyana* ("Ann. des. Sc. Nat., Botanique," 2 serie., tom. 6, pp. 327-329, tab. 18, fig. 2). Subsequent writers had referred it to *D. heteromalla*. Specimens shewn to the meeting, which had been collected in the river Taw by the Rev. C. A. Johns, were considered by Mr Wilson and others to be identical with M. Montagne's moss; but they differed so widely from his elaborate description, that Dr L. thought the whole subject was still deserving of inquiry. The points which remain to be determined are these:—1. Is *D. Lamyana*, Montagne, a good species? 2. Is the English plant identical with it?

III.—*On the correspondence between the Serial Internodes of Plants and Serial Crystalline Forms.* By Mr WILLIAM MITCHELL. Communicated by Professor BALFOUR.

Having, on a previous occasion, very briefly pointed out an apparent analogy between the serial arrangement of the leaves of plants and crystals, I would here endeavour to present the subject in a clearer light, and attempt to show that we may, without fanciful effort, observe a very striking correspondence of the kind indicated at the head of this paper.

By the serial internode of a plant, is here meant, that portion of the axis comprehended between a node and the one immediately above it, on the same vertical line; and which is usually expressed by a fraction, the numerator of which denotes the number of turns in a spiral passing through all the nodes in this part of the axis, and the denominator the number of nodes included in these turns.

Thus, for different plants, we have the series,

$$\frac{1}{2}, \frac{1}{3}, \frac{2}{5}, \frac{3}{8}, \frac{5}{13}, \frac{8}{2}, \text{\&c.}, \quad . \quad . \quad . \quad . \quad (1.)$$

where each turn represents a serial internode. In the arrangement of this series, however, the terms are alternately greater and less; but if we take the alternate terms, two regularly increasing series are obtained, viz.:—

$$\frac{1}{2}, \frac{2}{5}, \frac{5}{13}, \frac{13}{34}, \text{\&c.}, \quad . \quad . \quad . \quad . \quad . \quad (2.)$$

$$\frac{1}{3}, \frac{3}{8}, \frac{8}{21}, \frac{21}{55}, \text{\&c.}, \quad . \quad . \quad . \quad . \quad . \quad (3.)$$

Again, by a serial crystalline form is here understood the plane or face of a crystal, which cuts off a portion of any one of the principal axes, and may therefore be represented by a fraction. A series of these fractions, arranged in the form of a regularly increasing series, gives serial crystalline forms, belonging either to different crystals, or to any one compound crystal. The following series is arranged from a treatise on crystallography, by Professor Tennant and the Rev. Walter Mitchell, and comprehends the most of the crystalline forms which have hitherto been found in nature.

The terms within parentheses, however, are supplied for reasons about to be explained.

$$\tfrac{1}{8}, \tfrac{1}{7}, \tfrac{1}{6}, \tfrac{1}{5}, \tfrac{2}{9}, \tfrac{1}{4}, \left(\tfrac{3}{11}\right), \tfrac{2}{7}, \tfrac{1}{3}, \tfrac{3}{8}, \tfrac{2}{5}, \left(\tfrac{3}{7}\right), \tfrac{4}{9}, \tfrac{1}{2}, \tfrac{3}{5}, \tfrac{8}{13}, \tfrac{5}{8}, \tfrac{2}{3}, \tfrac{7}{10}, \left(\tfrac{5}{7}\right),$$
$$\left(\tfrac{3}{4}\right), \tfrac{7}{9}, \tfrac{4}{5}, \left(\tfrac{5}{6}\right), \tfrac{6}{7}, \tfrac{7}{8}, \tfrac{8}{9}, \tfrac{1}{1}, \tfrac{13}{12}, \tfrac{12}{11}, \left(\tfrac{11}{10}\right), \tfrac{10}{9}, \tfrac{9}{8}, \tfrac{8}{7}, \tfrac{7}{6}, \tfrac{6}{5}, \tfrac{5}{4}, \tfrac{9}{7}, \tfrac{4}{3},$$
$$\tfrac{15}{11}, \tfrac{11}{8}, \tfrac{7}{5}, \tfrac{10}{7}, \tfrac{3}{2}, \tfrac{14}{9}, \tfrac{11}{7}, \tfrac{8}{5}, \tfrac{5}{3}, \tfrac{12}{7}, \tfrac{7}{4}, \tfrac{9}{5}, \tfrac{11}{6}, \tfrac{24}{13}, \tfrac{13}{7}, \tfrac{15}{8}, \tfrac{2}{1}, \tfrac{15}{7},$$
$$\left(\tfrac{13}{6}\right), \tfrac{11}{5}, \tfrac{9}{4}, \tfrac{16}{7}, \tfrac{7}{3}, \tfrac{12}{5}, \tfrac{5}{2}, \tfrac{8}{3} \left(\tfrac{11}{4}\right), \tfrac{14}{5}, \tfrac{3}{1}, \tfrac{10}{3}, \tfrac{7}{2}, \tfrac{11}{3}, \tfrac{4}{1}, \tfrac{9}{2} \left(\tfrac{32}{7}\right),$$
$$\tfrac{23}{5}, \left(\tfrac{14}{3}\right), \tfrac{5}{1}, \tfrac{16}{3}, \tfrac{11}{7}, \left(\tfrac{17}{3}\right), \tfrac{23}{4}, \tfrac{6}{1}, \tfrac{7}{1}, \tfrac{8}{1}, \tfrac{9}{1}, \tfrac{10}{1}, \tfrac{11}{2}, \tfrac{12}{1}, \tfrac{13}{1}. \quad . \quad (4)$$

In the series (1.), for plants, the relation of any three terms taken in their order is easily seen to be

$$\frac{a+c}{b+d}=\frac{e}{f}, \quad . \quad . \quad . \quad . \quad . \quad (5.)$$

if $\frac{a}{b}, \frac{c}{d}, \frac{e}{f}$, represent three consecutive terms. Or the same series may be regarded as the convergents to $\frac{2}{\sqrt{5}+3}$ converted into a continued fraction. Thus—

$$\frac{\sqrt{5}+3}{2}=2+\frac{1}{1}+\frac{1}{1}+\frac{1}{1}\ \&c.\,;$$

and hence the convergents to $\frac{2}{\sqrt{5}+3}$ are

$$\tfrac{1}{2}, \tfrac{1}{3}, \tfrac{2}{5}, \tfrac{3}{8}, \tfrac{5}{13}, \ \&c.$$

But in each of the series (2.), (3.), the relation of any three consecutive terms is

$$\frac{a+e}{b+f}=\frac{c}{d}, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6.)$$

and the continued fraction is no longer periodical.

Now, the analogy between the serial arrangement of the leaves of plants and crystals, already referred to as having been pointed out, will be found by comparing the two series (2.), (3.), with the series (4.) for crystals, when it will be evident that the relation given in equation (6.) is the same for each.

Thus, in the first three terms of (2.) we have $\frac{1+5}{2+13}=\frac{6}{15}=\frac{2}{5}$; and in (3.) $\frac{1+8}{3+21}=\frac{9}{24}=\frac{3}{8}$ &c. And in the series for crystals, taking the first three terms $\frac{1+1}{8+6}=\frac{2}{14}=\frac{1}{7}$; and for the fourth three terms $\frac{1+2}{3+5}=\frac{3}{8}$, &c.

The terms within parentheses are interpolated according to the formula (6), and since so few of these are required in a series including nearly the whole range of crystalline forms, the relation in question may be regarded as the law of the series.

It must be specially observed, however, that neither the series given for plants nor that for crystals is here intended to mean anything more than an arbitrary but similar arrangement of terms. In crystals, the same relation will be found to hold in many cases, when applied to consecutive forms occurring in compound crystals presented by nature; but at present we confine our remarks to the comparison of the given series for plants and crystals.

It has been stated that the fraction expressing any term in the series for plants gives the number of turns of a spiral in the serial internode, and the number of nodes included in the same. Hence the numerator may be considered as a curvilinear measure of a portion of the axis expressing *length*, and the denominator as a number expressing *position*, since the angular divergence of the leaves or nodes is indicated by the given fraction.

Taking this view, it is remarkable how closely any term representing a crystalline form comes up to the above definition. In order to make the correspondence clear, let $Ax+By+Cz=D$ be the general equation to the plane of a crystal. Then, by the nature of the plane, the quantities A, B, C are proportional to the cosines of the angles which the plane makes with the co-ordinate axis respectively, and D is proportional to the length of a perpendicular on the plane from the origin of measurement.

Now, the intercepts, or parts of the axis cut off by the plane, are found by putting two of the variables in the equation to the plane alternately equal to zero. In this way, we find $\frac{D}{A}$, $\frac{D}{B}$, $\frac{D}{C}$, for the three intercepts, any one of which may be a term in the series for crystals; while the numerator of any one will express *length*, and the denominator *position*.

In the series (4), the terms are arranged according to their magnitude, and selected from all the systems of crystals; and each term represents one intercept, or refers to one axis, which may be that of x, or y, or z. Thus, let $\frac{D}{A}, \frac{D}{B}, \frac{D}{C}$ be the intercepts 1, 3, $\frac{1}{2}$ of the plane of a crystal; then in series (4) each of these is separated in order to occupy its place in the order of magnitude, and though 1, or 3, or $\frac{1}{2}$ may frequently occur in different planes, it is set down in the series only once.

In this manner, a fraction representing a term referred to one axis of a crystal may be compared with that referred to one axis of a plant; and hence, taking any term, say $\frac{2}{5}$, from series (2) in plants, we may write, according to the foregoing definitions—

$$\frac{2 \text{ expresses length}}{5 \text{ expresses position}}.$$

Also, taking any term, say $\frac{2}{9}$, from series (4) in crystals, we may similarly write—

$$\frac{2 \text{ expresses length}}{9 \text{ expresses position}},$$

which seems to indicate a correspondence very distinctly; and when combined with the relation $\frac{a+e}{b+f}=\frac{c}{d}$, given in equation (6), makes it difficult for me to avoid the inference, that there is a correspondence between the serial internodes of plants and serial crystalline forms.

There are other analogies which I have recently observed, including chemical combinations as well as crystalline, in the relation for series (2) and (3) in plants; pointing, I presume, to some grand unity of action in all these departments of nature.

In Mr John Scoffern's "Chemistry," p. 36, we find it stated as the law of chemical combination, that for one series of compounds A unites with 1, 2, 3, 4, 5, &c., of B; and for another, that A unites with 1, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3, $3\frac{1}{2}$, &c., of P. Now, if, according to my arrangement of such series, we express each term as a fraction, we have

$$\frac{1}{1}, \frac{2}{1}, \frac{3}{1}, \frac{4}{1}, \frac{5}{1}, \text{\&c.}, \quad . \quad . \quad . \quad (7)$$

and

$$\frac{1}{1}, \frac{3}{2}, \frac{2}{1}, \frac{5}{2}, \frac{3}{1}, \frac{7}{2}, \text{\&c.}, \quad . \quad . \quad (8)$$

for the two series, each of which agrees with formula (6).

Thus in (7), $\frac{1+3}{1+1}=\frac{4}{2}=\frac{2}{1}$; and in (8), $\frac{1+3}{1+1}=\frac{3}{2}$, &c.

In a small treatise on Crystallography by Professor Regnault, p. 24, it is stated, in reference to the different octahedrons of the second system of crystals, that "we never find in the same substance a greater number of octahedrons than are expressed by the formulæ—

$$(a : a : 2c), \quad \text{or} \quad (a : a : \tfrac{1}{2}c),$$
$$(a : a : 3c), \quad (a : a : \tfrac{1}{3}c),$$
$$(a : a : 4c), \quad (a : a : \tfrac{1}{4}c);$$

that is to say, octahedrons in which, the secondary axes being equal, the principal axis is 2, 3, 4 times greater, or 2, 3, 5 times less, than the principal axis *c* of the primitive octahedron." Similarly for other systems of crystals, as in pp. 29, 37, and 42.

From these, then, we have two series of combining crystals, as $\frac{1}{1}$, $\frac{2}{1}$, $\frac{3}{1}$, $\frac{4}{1}$, and $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{2}$, $\frac{1}{1}$, also in the relation of equation (6).

Once more, since the nodes of a plant, at the termination of each serial internode, may form a series of parallel lines by supposing transverse sections passing through them, we may notice another analogy in one and the same plant to one and the same compound crystal. Thus, the intersections of planes combining in a crystal frequently run in parallel directions, or present a series of parallel lines, such that a line crossing them at right angles is called by crystallographers a zone-line, while a plane may exist at the intersection of any two of these zone-lines.

May we not be allowed to infer that these geometrical conceptions are realized in the actual crossing of lines of force, every combination producing a new and similar form. The subject requires deeper investigation; and it may be that yet we shall succeed in penetrating farther into those depths of the Divine workmanship of which we can now get but glimpses, to stimulate inquiry, and elevate our conceptions of the adorable Author of all.

IV. *On* Macadamia, *a new genus of Proteaceæ.* By Dr George Lawson.

The past history of the natural order Proteaceæ affords a remarkable illustration of the rapid progress that has been made in descriptive botany during the present century. In Linnæus's "Species Plantarum," 3d edition, 1764, we find 18 species described. In Persoon's "Synopsis Plantarum," published in 1805, the number is increased to 108; and Dryander gives, in the following year, a list of 49 species inhabiting New Holland and Van Dieman's Land. Brown's "Prodromus Floræ Novæ Hollandiæ," published about 1815, brought the number of New Holland species up to 204. Subsequent discoveries enabled Dr Lindley, in 1845, to estimate the total number of species of Proteaceæ at 650; and now we have Meisner's Monograph in De Candolle's Prodromus (1856), in which 1026 species are described, and the possible existence of many others indicated by long lists of expurgated names. We thus find that this remarkable group of plants, which was represented in the time of Linnæus by a convenient dozen and a-half of species, now consists of upwards of a thousand; and it will be seen that, in forming an estimate of the botanical arrangements of those days, we ought to keep before us the fact, that *we* look upon many natural groups from a point of view very different from what was then possible, when every botanist's great aim was to have a complete herbarium of all the plants. While the number of species of Proteaceæ have gone on increasing from year to year by successive discoveries, a corresponding increase in the number of genera has not taken place, new forms having been found to be readily referable to known genera. Thus, in 1845, Lindley's estimated number of species, 650, were grouped into 44 genera, and since then—viz., in twelve years—the number of genera, according to Meisner's arrangement in the Prodromus, has only increased by one genus, his number being 45. This is remarkable, when we consider the increased tendency to subdivide genera to a useless extent which has of late years manifested itself in many orders of plants. Considerable interest is therefore attachable to the discovery of a new genus of Proteaceæ, whose characters are such as to indicate its claims to the title to be genuine, and such, I believe, are those of the plant now before the Society. The genus *Macadamia* is founded on a beautiful tree of oriental subtropical Australia, of which specimens were obtained by Hill and Müller, in forests on the Pine River of Moreton Bay. The genus is described by Dr Ferdinand Müller from these specimens, and he has dedicated it to Dr John Macadam, lately of Glasgow, now lecturer on Natural Science in the Scotch College, Melbourne.* I am indebted to that gentleman's brother, Dr Stevenson Macadam of Edinburgh, for placing into my hands the following information, which is entirely derived from Dr Müller's description and drawings.

The tree is furnished with flat and net-veined leaves which are arranged in whorls of three, or, rarely, opposite; in form they vary from lanceolate to oblong, the margins being serrated by prominent pointed teeth. The stomata are confined to the lower surface of the leaf, not being distributed equally on both sides, as frequently occurs in this order. The inflorescence is in the form of rather dense terminal pedunculate racemes of numerous flowers, which are arranged in twos, with a solitary bract, and are hermaphrodite and symmetrical. The sepals are four in number, spathulate-linear, recurved at the apex, deciduous; the stamens, also four in number, are inserted near the middle of the sepals; the filaments are longer than the anthers, and the connective projects slightly beyond the linear anther-cells. The hypogynous annulus is denticulate, the ovary sessile, the style deciduous, filiform, ending in a vertical continuous blunt stigma, which is slightly thickened upwards. The capsule is ovate or elliptical, almost woody, dehiscing on one side. This beautiful genus is allied to *Adenostephanus*, *Orites*, and *Xylomelum*.

A drawing of the plant, by Mr Neil Stewart, and nature-prints of the leaves, were exhibited to the meeting.

* Transactions of the Philosophical Institute of Victoria.

V. *List of Herbaceous Plants and Shrubs in flower, in the open air, at the Royal Botanic Garden, Edinburgh,* 14*th January*, 1858. By Mr JAMES M'NAB.

Veronica Buxbaumii, Veronica Andersoni, Symphytum caucasicum, Ruta graveolens, Bellis perennis, Chrysanthemum sinense, Sisyrinchium grandiflorum, Hepatica triloba (var.), *Phlox verna, Primula Auricula, Primula vulgaris, Primula veris, Gentiana acaulis, Viola odorata, Scrophularia annua, Leontodon Taraxacum, Iberis sempervirens, Tussilago fragrans, Tussilago alba, Vinca major, Vinca minor, Aponogeton distachyon, Anchusa sempervirens, Galanthus nivalis, Helleborus niger, Helleborus graveolens, Helleborus laxus, Helleborus olympicus, Helleborus atrorubens, Potentilla alba, Potentilla fragarioides, Alchemilla conjuncta, Alchemilla montana, Cheiranthus Cheiri, Mathiola incana, Erysimum Perowskianum, Cydonia japonica, Rhododendron atrovirens, Rhododendron Nobleanum, Jasminum nudiflorum, Garrya elliptica, Erica herbacea, Erica stricta, Viburnum Tinus, Arbutus Andrachne, Arbutus serratifolia, Arbutus Unedo, Corylus Avellana, Cornus mascula, Camellia japonica, Daphne Mezereum, Arabis præmorsa, Arabis iberica, Alyssum gemonense.*

In reference to Mr M'Nab's list, Dr Balfour called attention to the remarks of Dr Lindley, who states that, in accounting for the vegetation of 1857, attention ought to be directed in a special manner to the heat of the soil. Little has been done, as yet, in the way of obtaining accurate observations of the temperature of the earth at the depths of one and two feet during the period of vegetation. In April 1857, the ground heat was nearly 3 deg. higher than usual. In May it was 1 deg. 23 min. warmer than usual. The earth heat continued to advance very much in June, moderately in July; it was also augmented in September, October, and November. In the latter month, at the depth of two feet, it was warmer than usual by nearly 7 deg. During eight important months, the earth at one foot below the surface had absorbed 29 deg. 26 min. more than usual, and even at two feet 12 deg. 26 min. Add to this the remarkable fact, that in November the heat, at one foot below the surface, was within 2 deg. equal to that in May, and we may explain the ripening of many exotic fruits this season. The geo-thermometer accounts satisfactorily for the phenomena of last season.

Professor Balfour also noticed the sudden death of Dr Royle, one of the Society's members, and secretary of the Horticultural Society of London, who had done much to develope the natural resources of India, and to advance our knowledge of botany. Dr Balfour referred to the leading events of Dr Royle's useful life, and to the important works which he had published, and concluded by paying a just tribute to his memory.

11*th February* 1858.—Dr SELLER, President, in the Chair.

The following candidate was balloted for and duly elected:—

As Ordinary Resident Fellow.

ROBERT H. RAMSAY, Esq., Viewville.

Dr Balfour stated that the following donations had been made to the Museum at the Botanic Garden, viz.:—

From Dr Wise, H.E.I.C.S.—Soil from Catibar, in the north-east of Bengal, in which the indigenous tea plant grows.

Messrs Potts, Cairnie, and Rae—Fibre prepared from the leaves of *Chamærops humilis*, in Algeria, and imported for stuffing chairs, &c.

Mr Baxter, Riccarton—Large cone of *Abies Douglasii.*

T. Y. Smith, Esq., Barnsley, Yorkshire—Specimen of coniferous resin, and of bitumen from coal.

Mr C. Hope exhibited some curious varieties of *Asplenium Adiantum-nigrum* and *A. Ruta-muraria.*

Dr Balfour read a notice of Mr Mason's contemplated visit to the Cape Verde Islands, for the purpose of investigating their natural history.

Dr G. Lawson exhibited a photograph of a Banyan tree at Dumdum, near Calcutta, taken by Mr L. A. Stapley. Dr Lawson also read a note from Dr John Lowe, King's Lynn, in which he observes:—"We have now in the Museum a specimen of *Testudinaria Elephantipes*, which Dr Baines brought from Africa. After remaining hung up for several years, it put out, last year, a shoot about three feet long, and has one now upwards of eight feet, having been planted and taken root."

The following papers were read:—

I. *Notes of a Botanical Trip, with Pupils, to Coldstream and Norham, in July* 1857. By Professor BALFOUR.

Professor Balfour stated that, along with twenty-six pupils, he proceeded, on the afternoon of Friday the 17th of July 1857, to Kelso and Cornhill, whence the party walked to Coldstream. On the 18th they proceeded, by the banks of the Tweed, to Tweedmill, and, amongst others, collected the following plants:—*Dipsacus sylvestris* (in profusion, and very large, near Coldstream), *Nasturtium sylvestre*, *Malva moschata*, *Melilotus officinalis*, *Lythrum Salicaria* (a plant more common on the west coast of Scotland), *Epilobium angustifolium*, *Scabiosa Columbaria*, *Lactuca virosa* (in great quantity, specimens having been seen from eight to ten feet high), *Echium vulgare*, *Linaria vulgaris*, *Verbascum Thapsus* (in considerable abundance), *Origanum vulgare*, *Potamogeton lucens*, *natans*, *perfoliatus*, *heterophyllus*, *prælongus*, and *pectinatus*, and *Carex vulpina*, picked by Mr John Inglis near Coldstream. The party then went across the Tweed, and walked by the banks of the Till as far as Twizel Castle, crossing the river by the old bridge along which the English army passed to Flodden. Among the plants collected were noticed *Sambucus Ebulus*, *Saponaria officinalis*, *Ballota fœtida*, *Agrimonia Eupatoria*, *Humulus Lupulus*, *Anchusa sempervirens*, *Conium maculatum*, and *Œnanthe crocata*. The party, after visiting Twizel Castle, proceeded to the banks of the Tweed, opposite Milnegraden. A little below this, on the Scotch side of the river, Mr Ainslie pointed out *Asplenium marinum* growing on a sandstone rock close to the river, fully eight miles from the sea. Abundance of *Ligustrum vulgare* was also gathered. Proceeding by the English side of the river, the party afterwards walked to Norham, visiting the Church and Castle. Among the plants gathered may be recorded *Lepidium latifolium*, *Viola odorata*, and *Lysimachia Nummularia*. The party next proceeded by train to Berwick, and collected on the walls and ramparts *Sisymbrium Irio*, *Diplotaxis tenuifolia*, *Sagina maritima*, and *Hyoscyamus niger*.

II. *Remarks on the Distribution of Plants in the Northern States, Canada, and the Hudson's Bay Company's Territories, &c.* By Dr George Lawson. Part I.

After some preliminary observations on the subject of geographical botany, Dr Lawson alluded to the favourable conditions afforded by the physical characters of the North American continent for tracing the horizontal range of vegetation. Having recently received extensive collections of North American plants from Mr A. Oswald Brodie, of the Ceylon Civil Service, Mr M'Tavish, of the Hudson's Bay Company, Mr M'Leod, Providence, and other botanists, he proposed to bring before the Society some of the more interesting facts respecting plant distribution which they served to illustrate. The arctic forms were first noticed, and a collection of plants, made by Dr Rae during his last boat voyage in search of Sir John Franklin, was exhibited, embracing many species of considerable interest. The collection contained only one Fern, the rare *Lastrea fragrans* (*Polypodium fragrans*, Linn.), from Repulse Bay, where the party wintered. In reference to this fern, Mr Moore observes, in a letter to Dr Lawson:—"I was very glad to get the fronds, as I had not previously been able to procure this species. It is very fine, about twice the size of the fronds sent, in the Kew Herbarium, collected by Dr Seemann, and of similar size, from some of the Russian arctic dominions, in a collection from the Imperial Academy of St Petersburg,—type specimens, which Dr Regel was good enough to send me for inspection. From the same source I learned that the North American *Allosorus gracilis* is the old *Pteris Stelleri* of Amman, *Allosorus Stelleri* of Ruprecht, which name takes precedence; so that it spreads from North America, through Siberia, to India, whence Dr Hooker has it." The reference in Linn., Sp. Pl., 3 ed., 1850, "Habitat in Siberia, Anglia," is erroneous as regards England; so also is the quotation of Huds. Fl. Ang., the plant being very different from any British species. *Lastrea Oreopteris* and *Thelypteris* seem to have passed under this name among the earlier English botanists.

III. *Notice of the Produce of the Olive Crop in the Island of Corfu during the past season,* in a Letter from Mr Mackenzie, Corfu, to Dr George Lawson, dated January 11, 1858.

Whatever may have been the disturbing cause, it is evident the unusual state of the weather and temperature in this island since April last has arisen from some uncommon electrical deviation, or at least that this was the chief agent. On the 17th of October we were visited by a severe hail-storm, followed by a beautiful water-spout having the appearance of a huge inverted funnel; a gentleman crossing the Channel at the time, in an open boat, compared the hailstones to pieces of brick. It is remarkable that this extraordinary season seems to be peculiarly favourable to the olive crop, which is exuberant, and exceeds that of any year since 1833. The olive is at all times a precarious crop, requiring different degrees of temperature at different stages. In the green state, heat is requisite; in September, when their colour becomes red, moisture is indispensable; and in the last stage, to preserve them from a destructive insect produced by foggy and sultry weather, a cool and clear atmosphere is absolutely necessary. This mischievous insect eats its way round the kernel, and the berries gradually decay and drop. The sirocco wind is the chief agent in this process, a few days' continuance of its sultry breath being sufficient to destroy an abundant crop.

For further particulars, I send an extract from my journal for the month of October:—This is the most pleasant month in the year, the mean temperature corresponding with that of the month of May. Beans and early pease are sown in the latter end of the month; but the valuation of the olive crop, which begins on the 30th, is of far greater importance to the population in general. The quantity of oil is estimated while the fruit is on the tree, and computed in jars, each containing four English gallons. The villano (tenant) receives one-third, and whatever accident may occur from storms or heavy rains after this period, he is by law bound to give the proprietor two-thirds of the original valuation. Oil being the staple produce of the island, it is lamentable to see the little attention paid to the cultivation of the olive.

The law regulating the sale of oil is as simple as it is primitive—payment on delivery. But there is a kind of gambling transaction, which is rather singular, and perhaps original. Two men will, while walking on the street, nominally buy and sell oil to a considerable amount. Thus A will purchase 500 barrels from B, at 48s., to be settled on a given day, say the last day of the month. On that day, the price of oil is 50s. per barrel, consequently B forfeits 2s. per barrel, and A gains £50. Thousands of barrels of oil are thus nominally bought and sold in this island. The estimated value of this year's crop is as yet unknown, but it will in all probability exceed 1,000,000 dollars. The export duty, which is heavy (19½ per cent.), will greatly assist our impoverished exchequer. To Liverpool merchants, and others connected with the Ionian oil trade, the above may be of some use.

IV. *Remarks on a species of* Loranthus; *and Measurements of Tree Ferns in Australia.* By Mr THOMAS CANNAN. Communicated by Professor BALFOUR.

Dr Balfour stated that Mr Cannan had sent seeds of a parasitic species of *Loranthus*. The seeds are attached to branches, and are in different states. Some of them are beginning to germinate. The plant is said to produce showy flowers, and to grow on almost any tree with a smooth bark. It grows well on some of the trees introduced into Melbourne gardens, such as the English oak and elm, and the common laburnum. It attaches itself to the native *Eucalypti*, and is propagated by means of birds, which scatter the seeds.

Mr Cannan also sends the following measurements of Tree Ferns met with during his Australian rambles:—

No. 1—From the ground to the top of some upright fronds, 18 feet; from the ground to the crown, clean stem, 13 feet; girth at the bottom of the stem, 8 feet; girth 5½ feet from the ground, 4¼ feet; length of fronds, 10 to 12 feet. About half-way from the ground this plant is divided into two stems, each stem supporting a beautiful head.

No. 2—Length of clean stem, 18 feet; girth at the bottom, 7 feet; girth 5 feet from the ground, 5½ feet; length of fronds, 5 feet.

No. 3—Clean stem, from the ground to the crown, 20 feet; divides into two stems, one measuring 11, and the other 8 feet; girth where the stem divides, 5 feet; length of fronds, 6 feet.

No. 4—Length of stem, 20 feet; girth at bottom, 6 feet; girth 6 feet from the ground, 4 feet; length of frond, 5 to 6 feet.

Mr Cannan describes the Botanic Garden of Melbourne as extending to 60 acres, including 18 acres of lagoon. The garden is partly bounded by the River Yarra.

V. *Notice of Plants collected in the Isle of Skye.* By Dr JOHN ALEXANDER SMITH and Dr GILCHRIST. Communicated by Dr GEORGE LAWSON.

Dr Smith, while residing at Armadale Castle, Skye, in October and November last, observed a few interesting plants in the neighbourhood: *Sticta pulmonaria* was in great abundance, and in fine fruit, on the trees; and other lichens and ferns were collected. *Himanthalia lorea* formed large patches on the rocks along the shore; and Dr Smith presented to the Herbarium specimens showing the various stages of growth.

Dr Gilchrist visited the Cuchullin Hills, Skye, in company with Dr Lindsay in 1855, and collected many interesting mosses of the genera *Andræa*, *Bryum*, *Splachnum*, &c., specimens of which were shown. Specimens of *Andræa nivalis* from Ben Nevis were also exhibited.

11*th March* 1858.—Professor BALFOUR, V.P., in the Chair.

The following candidate was balloted for and duly elected:—

As Ordinary Resident Fellow.

J. G. BOOTH jun., Esq., 4 Hermitage Place, Leith.

A copy of Mr Howie's "Musci Fifenses" (containing excellent specimens of the Mosses of Fife), having been presented to the Library by the author, the Society, on the motion of Mr Brand, cordially agreed to a special vote of thanks to Mr Howie for his valuable donation.

Dr Balfour exhibited the following donations to the Museum at the Botanic Garden:—

From Mr James D. Wright—A Russian canoe, made from the bark of the birch.

Miss Smith—Seed-vessels of *Abelmoschus esculentus* (Ochro).

Ralph Carr, Esq.—Four planks of the Douglas Pine (*Abies Douglasii*), cut from the same tree, grown at Hedgeley, Northumberland.

Dr Balfour exhibited an extensive series of nature-prints of sea-weeds, which had been sent by Mr Johnston and Mr Croall as examples of the illustrations of their forthcoming work on the Marine Algæ. Dr Balfour also exhibited Professor Henslow's series of drawings illustrating the natural orders of plants. These drawings have been published by the department of Science and Art.

Dr Lawson exhibited specimens of *Mollugo Cerviana*, Ser. (*Pharnaceum Cerviana*, Linn.), collected at Aden by A. Oswald Brodie, Esq., Ceylon Civil Service.

The following papers were read:—

I. *A few Remarks on the Application of Photography to Botanical Purposes.* By CHARLES J. BURNETT, Esq.

II. *Remarks on the Genus* Orthotrichum. By BENJAMIN CARRINGTON, M.D., Yeadon, by Leeds. Communicated by Dr GEORGE LAWSON.*

Until the publication of the "Bryologia Britannica," little had been done to determine the British species of *Orthotrichi*. Even now it will, I think, be granted that the mosses of this group are less generally understood than of almost any other.

Our indigenous species have been determined with care

* The original paper was illustrated by specimens, microscopic drawings of the reticulation of the leaves, structure of the peristome, spores, &c., and enlarged diagrams of the species described. I have thought it better to omit those portions of the paper relating to generic characters, classification, and the causes and range of variation in species, retaining only those parts likely to be of practical value to the bryologist.

only in a few districts; but the results of this partial examination are most encouraging, eight (ten according to Wilson) new species having been added to the genus since the publication of Hooker's "English Flora."

I feel convinced new forms will yet reward the diligent observer, and that, when better known, those now considered rare will be found more widely distributed than is supposed. It has been my endeavour to arrange the diagnostic characters of allied species in such order that they may be readily compared with each other.

The descriptions apply to the plants when in a mature state, unless the contrary is specified. It is difficult, if not rash, to attempt the determination of species from immature specimens, or those past maturity.

Analysis of Species.

A.—Pedicel generally shorter than the perichætial leaves; leaves gradually tapering from the base, not contorted when dry; ochrea distinct. Monoicous, except 7 and 13, which are dioicous. (*Orthotrichum*, B. and S.)

* *Peristome single, erect when dry.*

1. *O. anomalum*, Hedw.—Whole plant rufous; capsule quite exserted, oblong, with 8 ribs; teeth 8, bifid. Limestone rocks and walls. Spring.

2. *O. cupulatum*, Hoff.—Capsule immersed, pale, ob-ovate, with 16 ribs; teeth 16, equidistant; calyp. campanulate, hairy. Limestone walls, &c. Spring.—*β. nudum*. Capsule exserted; calyp. naked. Borders of streams.

** *Peristome double, outer of* 8 *teeth reflexed when dry.*

I. Pumilæ.—Capsule of thick texture; ribs 8, *prominent, as broad* as the intermediate portion; lid with a short beak; spores small, brown. Forming minute, erect tufts, from ¼ to ½ inch high (except 9). On hedges or exposed trees.

† *Leaves acute.*

3. *O. tenellum*, Brach.—Leaves lanceolate, erect when dry; capsule exserted, sub-cylindrical, full brown; cilia 8; calyp. conical, slightly hairy, yellow. June.

4. *O. stramineum*, Hornsh.—Leaves acute, lax when dry; caps. exserted, ob-ovate, orange-brown; cilia 8 or 16, rough; calyp. campanulate, with purple apex; vaginata hairy. June, July.

5. *O. pumilum*, Schwaegr.—Minute; leaves ovate-lanceolate, imbricated when dry, not papillose; caps. elliptic, sessile, rounded below; cilia 8; calyp. campanulate, naked, light brown. April, May.

†† *Leaves more or less obtuse.*

6. *O. pallens*, Bruch.—Leaves light green, somewhat obtuse, ligulate-lanceolate, imbricated when dry; caps. pale, immersed; cilia usually 16; calyp. naked, campanulate, the apex orange. June.

7. *O. obtusifolium*, Schrad.—Dioicous; leaves imbricated, ovate-obtuse, concave, with plane margins; gemmiparous.

8. *O. Sprucei*, Mont.—Lurid-green; leaves erect when dry, elliptic-spathulate, apiculate; nerve weak, areolæ large; calyp. campanulate, naked, dull green. Trees by streams. May, June.

9. *O. rivulare*, Turner.—Stems tall, prostrate; leaves flaccid, spreading, ovate-ligulate, obtuse; nerve strong; areolæ very minute; cilia 16, slender; calyp. campanulate, lurid-green, naked. Stones in streams, &c. June.

II. Affinæ.—Capsule of thin texture (leptodermous); ribs *about half as broad* as the intermediate portion; lid with a long beak; spores large, green; stems 1 to 2 in. high.

10. *O. affine*, Schrad.—Leaves of *coarse texture, loosely imbricated* when dry, oblong-lanceolate, rather obtuse, or apiculate; capsule narrow, tapering into the seta, pale; cilia 8; calyp. conic-campanulate, pale green, hairy. Trees and walls. June, July.—β *fastigiatum* (*O. fastigiatum*, Bruch.) Leaves more acuminate, erect when dry; caps. broader, with stronger walls; calyp. large, ferruginous. June.

11. *O. speciosum*, Nees ab Es.—Leaves lanceolate; caps. quite exserted, cylindrical, faintly ribbed above; calyp. large, yellow, very hairy. Trees, alpine glens. July.

*** *Outer peristome of* 16 *teeth, capsule thin, with weak ribs (as in II.)*

12. *O. rupestre*, Schleich.—Leaves brown, rigid, acute; caps. pyriform, urceolate when dry, faintly ribbed in the upper half; teeth 16, erect when dry; cilia 8; calyp. brown, very hairy. Alpine rocks. July, August.

13. *O. Lyellii*, Hook.—Dioicous, 2·3 in. high; leaves very long, squarrose, coarsely papillose, gemmiparous; teeth white, reflexed; cilia 16, red, of two rows of articulate cells. Woods. July.

14. *O. diaphanum*, Schrad.—Stems short; leaves ovate-acuminate, with rough diaphanous points; calyp. campanulate, scariose. Trees and walls. May.

III.—Capsule without ribs.

15. *O. leiocarpon*, B. and S.—Leaves appressed when dry, lanceolate; outer teeth 16; cilia 16, erose-articulate. Trees. Spring.

B.—Pedicel much exserted, two or three times as long as the capsule.

I.—*Calyptra campanulate, smooth.*

16. *O. pulchellum*, Smith.—Leaves lanceolate, pale green, somewhat crisped when dry; capsule small, with a short lid; teeth 16, red; cilia 16. Trees. May, June.

II.—*Calyptra very hairy, ochrea indistinct.* (Ulotrichum, B. and S.)

a. Leaves lanceolate, not crisped when dry.

17. *O. Hutchinsiæ*, Smith.—Tufts close, dark green; leaves rigid, appressed when dry; capsule sub-clavate, furrowed; teeth 8, bifid; cilia 8. Alpine rocks. July.

b. Leaves lanceolate, from an ovate-dilated base, slightly crisped when dry; stems creeping.

18. *O. Ludwigii*, Schwaegr.—Stems slender; capsule thin, pyriform, faintly striate, contracted and plicate at the mouth when dry; teeth 16, small, erect. Trees, alpine glens. August, September.

19. *O. Drummondii*, Hook. and Grev.—Leaves narrow, erect when dry; caps. oblong-pyriform, with distant ribs, and small mouth; teeth 16, in pairs, long, patent when dry. Trees, alpine glens. August.

c. Stems erect, leaves remarkably contorted when dry.

20. *O. crispum*, Hodw.—Leaves crowded, all spreading, and crisped when dry; capsule pale, oblong-clavate, tapering into the strong seta, contracted below the mouth when dry; ribs broad, close; cilia 8, broad, of two rows of cells; spores small; calyp. yellow. Woods. Aug.—*β. crispulum* (*O. crispulum*, Hornsh.) Smaller in all its parts; capsule oval; its pedicel slender. Trees. Aug. (?)

21. *O. Bruchii*, Brid.—Upper leaves larger, erect when dry; caps. ovate-pyriform, olive-brown; the mouth small; ribs distant, less tapering into the twisted pedicel; cilia 8, of one row of cells; spores large; calyp. very dark and hairy. Woods. September, October.

22. *O. phyllanthum*, B. and S.—Leaves lanceolate, not dilated at the base; nerve excurrent, bearing near the apex a tuft of brown, stellate gemmæ. Trees near the sea, &c. Always barren.

Remarks on Species.

It will be convenient to distribute the remarks on individual species under the following heads:—

I. *Species with very obtuse leaves.*
II. *Species likely to be overlooked as varieties of* O. affine.
III. *Species allied to* O. crispum

I. *Species with very obtuse leaves.*

Orthotrichum obtusifolium, Bruch. Forming small tufts, ½ to 1 inch high; dioicous.

Barren stems shorter, sparingly branched, light green. Leaves closely imbricated when dry, patent when moist; lower leaves smaller, ovate-oblong-obtuse; upper larger, ovate-obtuse, very convex, with plane margins, nerves ending about a fourth from the apex; areola large, quadrate, strongly papillose, the apex appearing sub-serrulate; surface studded with oblong articulate gemmæ. Fertile stems more slender, and branched; perichætial leaves very broad and obtuse; areola somewhat smaller than in the barren plant; capsule half immersed, oblong, tapering into the pedicel, with 8 strong ribs; outer peristome of 8 bigeminate teeth; cilia 8, yellow; calyptra campanulate, scariose, orange-brown, the apex scabrous. Discovered by Mr Wilson on ash near York, Sep. 1855; Cheltenham, trees and walls; Middleton, Gloucester. Fertile plant not yet found in Britain.

The short, obtuse, concave leaves, with plane margins, bearing oblong gemmæ, and closely imbricated when dry, giving the stems a neat rounded appearance, not unlike those of *Hypnum murale*, and the dioicous inflorescence, at once distinguish this moss.

O. gymnostomum, Bry. Eur., resembles it most nearly in the form of the leaves, but is destitute of peristome. It has been confounded with *O. Rogeri*, which is monoicous, with the leaves more spreading, loosely imbricated, and incurved when dry, much narrower, oblong or ligulate-lanceolate, obtuse, carinate (not convex), margin slightly reflexed.

In a letter, Mr Wilson observes,—"There is much confusion about *O. Rogeri*, Brid. (*O. inflexum*, C. Müller), who says it is dioicous, but which, according to Bruch and Schimper, is monoicous), and C. Müller refers it to *O. obtusifolium* (Drummond's 'Musc. Amer.,' No. 157), which moss seems to me truly *O. obtusifolium*, Bry. Eur.

"I have seen in Herb. Arnott an original specimen of *O. Rogeri*, Brid., from Bridel himself, and should never regard it as identical with *O. obtusifolium.*" "It is as well to say that Mr Spruce told me he thought he had once found *O. Rogeri* near York, and possibly it was the moss I found last year there as *O. obtusifolium.*"

O. Rogeri has not yet been found in this country, and appears to be rare, and little understood even on the Continent. The leaves are most like those of *O. pallens* in shape, but they are yellowish, less carinate, the nerve ending at some distance from the summit, more crowded, and loosely imbricated when dry, the margin of the lower leaves nearly plane

O. Sprucei, Montague, not uncommon on trees by streams, Yorkshire, Bristol, Scotland. It is most likely to be overlooked as a small state of *O. rivulare*, which it resembles in the lurid green, soft foliage, and form of the calyptra and capsule; but the stems are much shorter, with few leaves, erect and imbricated when dry, ob-ovate-spathulate obtuse, with a small apiculus, broader in the upper half; margins slightly reflexed; nerve weak; without papillæ; areolæ two or three times larger than in *O. rivulare.* The stems of *O. rivulare* are tall, fasciculate, and prostrate; the leaves longer, spreading when wet, loosely imbricated when dry, ovate-ligulate obtuse; apex sub-serrulate; broader in the lower half, carinate, with a strong nerve; margins revolute; and areolæ smaller and more closely placed than in any other species; the surface studded with minute papillæ.

O. Sprucei was at first mistaken for *O. Rogeri*, Brid., which is more slender, with narrow, ligulate, crisp leaves.

II. Pumilæ.—Species with the habit of small states of *O. affine*, but forming minute tufts; capsules with thick walls, ribs as broad as the intermediate portion; lid* small, with a short beak; spores small, brown.

O. pallens, Bruch. Tufts minute, of a light green colour; stems ⅛ inch high, simple or bifid; leaves patent when moist, closely imbricated when dry; lower leaves shorter, lanceolate-oblong, somewhat obtuse; perichætial leaves lon-

* These species have a small convex lid, with a *broad* reddish-brown border, gradually passing into the pale colour of the short beak; whereas in *O. affine* the margin is *narrow*, of a *bright scarlet* colour, the remaining part of the lid, and long beak, yellow.

ger, narrowly ligulate, carinate, with a strong nerve reaching to the apex; margin recurved; texture thin, minutely papillose; areolæ larger than in *O. affine*. Capsule immersed, pale yellow, elliptic-oblong, the apophysis rounded; seta short; ribs broad, orange, formed of four rows of large quadrate cells; intermediate cells four rows, narrower, oblong; capsule contracted below the mouth when dry; outer peristome of 8 yellow teeth; inner cilia slender, incurved, usually 16, the intermediate ones shorter. Calyptra straw colour, the apex slightly red, campanulate, naked, covering half the capsule. Lid convex, orange, with a short beak.

O. pallens is a rare species, first found near York by Mr Spruce; near Mickley, Mr Baker; between Bolton and Ilkley, W. Yorkshire, not uncommon on hedges. Fr., June.

The Wharfdale specimens differ as follows from the ordinary form:—Upper leaves longer, more obtuse, appressed; capsule immersed, rounded and nearly sessile below, darker brown, resembling that of *O. pumilum*. I have never found more than 8 cilia; but it is proper to state, the specimens were collected either before or after maturity. Still, some of the capsules were perfect, and unless the intermediate cilia are very fugitive, traces of them should have remained. They are sometimes absent even in Bruch's specimens, and, as in the instance of *O. stramineum*, are probably only to be depended upon as affording supplementary characters.*

O. pumilum, Dickson. I have never seen native examples of this moss in good condition; it appears to be of rare occurrence.

Examples from Schimper differ from *O. pallens* in the shorter, stouter stems; leaves ovate-lanceolate, more acute, appressed when dry, not papillose; areolæ considerably larger; capsule elliptic-ovate, reddish-brown, inflated below, almost sessile; the mouth small; teeth 8, small; cilia 8; not contracted below the mouth when dry, except when very old; calyptra short, naked, light brown, covering two-thirds of the capsule; lid very small, brown. With care, it is not likely to be mistaken for *O. tenellum*, which has lanceolate, papillose

* *June* 1858.—I have examined many specimens this season, but all agree in wanting the intermediate cilia, and in the shorter, nearly sessile capsule. If, as Schimper asserts, *O. pumilum* varies with other leaves, it becomes a question, whether the two are really distinct, or how they are to be distinguished? It is necessary that bryologists should be aware of the existence of such intermediate forms.

leaves, with smaller cellules; capsule narrow, oblong, on a longer pedicel; calyptra long, conical, yellow, slightly hairy.

O. pumilum, Swartz, is made a new species, the *O. fallax*, Bry. Eur., said to differ in its more acuminate leaves, loosely imbricated when dry; pale exserted capsule, tapering into the longer pedicel; ribs yellow; lid with a longer beak; and narrower calyptra. It has not been found in this country.

O. tenellum, Bruch. Stems solitary or bifid, ⅓ inch high, slender; leaves lanceolate, keeled, margins revolute, erect, but not appressed when dry; areolæ intermediate in size between those of *O. pumilum* and *O. affine*; capsules numerous, exserted on a longer pedicel, with thick walls, golden-brown; ribs darker, very broad, and prominent; cells at the mouth smaller and more compact. Capsule sub-cylindrical, not contracted below the mouth when dry; outer teeth 8, yellow, rather small; cilia 8, translucent, consisting below of two rows of narrow cells; vaginula smooth, with a distinct ochrea; lid convex, with a broad brown margin; beak short, yellow; spores small, brown; calyptra narrow, conical, yellow and glossy, the apex slightly hairy, covering two-thirds of the capsule. Hedges and exposed trees. More generally distributed than *O. pallens*, but less common than *O. stramineum*. Sussex; Cleveland and Thirsk, Wharfdale, &c., Yorkshire; Devon.

A very neat species, distinguished from small states of *O. affine*, and its var. *fastigiatum*, by its slender stems, erect, pale green leaves, narrow exserted capsule, with very broad ribs, and conical calyptra.

The stems of *O. affine* are usually taller; leaves darker, of coarser texture; capsule pale, leptodermous, with ribs about half as broad; lid with a long beak and narrow crimson border; spores green, twice as large; calyptra conical, campanulate, more hairy.

When young, it is best recognised by the narrow greenish-yellow calyptra exserted on a seta about as long as the upper leaves, and short, slender stems.

The calyptra of *O. anomalum* is brownish, campanulate; whole plant with a rufous tinge; capsule with faint, distant ribs; peristome single; and it grows on walls, not trees.

O. stramineum, Hornsh. Readily known from the allied species by the acute, loosely-imbricated leaves of a full green; areolæ as in *O. affine;* capsules short, ob-ovate pyriform, with broad orange-brown ribs, exserted on a pedicel nearly as long as the perichætial leaves; vaginula clothed with hair-like processes; short lid; and broad, campanulate, straw-coloured calyptra, with a purple apex; peristome buff-coloured; cilia 16, rough, with obscure trabeculæ, the intermediate ones shorter, often wanting. Trees, hedges, &c.; common in West and North Yorkshire. It may be found wherever *O. affine* abounds.*

When old, the capsules are narrow and contracted, dark brown, and bear great resemblance to those of *O. tenellum;* indeed, it is nearly impossible to distinguish them, except by the hairy vaginula of *O. stramineum.* The base of the seta of *O. tenellum* is surrounded by an ochrea, often torn when old: care must be taken not to mistake this for the hairs of *O. stramineum.* When the calyptra is present they are not likely to be confounded, nor are the ripe capsules.

O. Braunii, Bry. Eur., is said to differ in the shorter stems, brown, rigid leaves, and smaller, pale, pyriform capsule, solid and urceolate when dry; calyptra brown. The vaginula is hairy; and it seems closely allied to *O. stramineum*, a variety of which is sometimes found with the leaves and calyptra yellowish-brown.

O. affine, Schrad. The varieties of this moss are very numerous, and sometimes equally perplexing; they may all, however, be arranged under three forms:—

a. vulgare. Growing near the roots of trees, or in shady places, where the direct rays of the sun seldom penetrate. Stems tall, branched; leaves dull green, spreading, of coarse texture, broad and abruptly pointed, loosely imbricated, and somewhat undulated when dry; capsule narrow and pallid, passing gradually into the seta, with narrow ribs, about half as broad as the intermediate portion; calyptra conic-campanulate, pale green, somewhat hairy; spores large, green, double the size of any of the *Pumilæ.*

* The stems of *O. affine* soon become branched, giving off each season innovations from the floral axis; so that the capsule, although really terminal, has the appearance of being lateral, the fruit of several seasons remaining on the older stems. In the four last species the stem is always short, sparingly branched, and crowned by the more conspicuous capsules. Those of more than two seasons are scarcely ever observed together.

b. fastigiatum (*O. fastigiatum*, Bry. Eur.) On hedges and trees exposed to the sun, especially in dry limestone and sub-alpine countries, we find another form, with stems more closely tufted, leaves broadly lanceolate-acuminate, rigid and erect when dry, the cellular tissue less developed; capsule stronger, darker, with more prominent ribs; and calyptra larger, yellowish-brown.

c. rivale. There is a third well-marked variety, found rarely on trees by streams, which, from its resemblance to *O. rivulare*, Mr Wilson suggests should be named *rivale.* The leaves are lurid green, of succulent texture, very obtuse and lax when dry; calyptra narrow, lurid green; capsule exserted, oblong, less tapering into the pedicel, and not so contracted when dry.

The extreme form of *O. fastigiatum* seems at first distinct from *O. affine*—the stems are more compact (in habit approaching *O. leiocarpon*), leaves yellowish, more acuminate and rigid, not abruptly pointed as in the common form; the capsule is stronger and better developed, and calyptra brown; but on looking over an extensive series of specimens, I find many intermediate states connecting the two together.

Schimper states that *O. fastigiatum* ripens its capsules some weeks earlier than *O. affine.* In British examples we perceive little diversity in this respect. Perhaps the dryness of locality, and greater exposure, may sometimes produce a slight difference, but certainly not enough to warrant the formation of a new species. In shape and colour, the capsules of *O. affine* are subject to much variation; but the ribs in all are much narrower than the interstices, and the walls thin, and slightly contracted below the mouth when empty. The colour of the calyptra is also inconstant, although usually green; in many specimens it is tinged with some shade of yellow or brown.

The authors of Bry. Eur. state that the species "present few variations, and that their specific characters are constant, and *bien tranchées;*" but the history of *O. affine* would lead us to a very different conclusion. Whether from our more humid climate, or other causes, it is certainly not uncommon in this country to meet with varieties differing from the typical form; and sometimes perplexing intermediate states are found which it is impossible to determine satisfactorily. To account for these, I have been led to the conclusion, that occasionally hybrids occur. This suggestion is put forth with diffidence, because it is almost impossible to prove the fact experimentally. But judging from what is known to take place with higher orders of plants, it is not improbable that species so closely allied in habit and structure may sometimes produce fertile hybrids. To this class I am inclined to refer *O. affine*, var. *rivale*, which appears to hold an intermediate place between *O. affine* and *O. rivulare*, having many of the characters of both species. It is of very local occurrence: first observed by the stream at Congleton Cloud, Cheshire, by Mr Wilson; Laskill, N. Yorkshire, Mr Baker, with *O. rivulare*. The leaves are shorter than in *O. rivulare*, with larger reticulation; capsule thin and pale, with distant striæ; cilia 8; and calyptra narrower.

A lurid form of *O. cupulatum* is not uncommon on stones in streams in limestone countries, which is sometimes mistaken for *O. rivulare*. The leaves, however, are more rigid, broadly lanceolate-acuminate; capsule exserted, with 16 striæ; and the peristome simple, with 16 teeth, converging when dry.

O. patens, Bruch., is a very puzzling species, intermediate between *O. stramineum* and *O. affine*. The capsule bears much resemblance to that of *O. affine*, var. *rivale*, broader and more rounded below than the common form, thin and pale, with distant ribs; but the vaginula is hairy, and the leaves very narrow and acuminate. It is probably a hybrid.

III. Species allied to *O. crispum*.

Orthotrichum Bruchii appears to be of much commoner occurence than *O. crispum*. The following comparative statement of characters may assist their diagnosis:—

O. Bruchii, Brid. Leaves yellowish-brown, linear-lanceolate, with a dilated ovate base, margin reflexed in the lower half, contorted when dry; perichætial leaves larger, lanceolate, erect, and scarcely altered when dry; texture thin, with large, distant areolæ (double the size of those of *O. crispum*), very narrow near the base of the leaf, obscurely papillose; capsule ovate-pyriform, the apophysis rounded, and less tapering into the long, twisted pedicel, olive-brown, with 8 strong distant ribs, about half as broad as the intermediate portion. When old, the capsule is buff-coloured, contracted at, never below the mouth, and fusiform. Outer teeth 8, bifid, coloured; cilia 8, filiform, of one row of narrow cells; spores larger, olive or buff; calyptra dark, very hairy. Trees in woods; common. Fr., Sept. Oct.

From Teesdale and Forge Valley, Scarborough, I have seen a variety of *O. Bruchii* about half the usual size, with a short oval capsule, which seems to bear a like relation to the ordinary form that *O. crispulum* bears to *O. crispum.*

O. crispum, Hedw. Leaves bright green, narrow, linear-lanceolate, with a dilated base and stronger nerve, all spreading when moist, and remarkably crisped and undulated when dry, of more opaque texture; areolæ smaller and closely placed; distinctly papillose. Capsule elliptic-clavate; the apophysis long, and gradually tapering into the strong, scarcely-twisted pedicel, straw-coloured or pale brown; ribs as broad as the intermediate portion; capsule narrow, and contracted below the mouth when dry. Outer teeth 8, large, white; cilia 8, shorter and broader, formed of two rows of elongated cellules; spores about half as large as in *O. Bruchii ;* lid with a shorter beak; calyptra campanulate, pale, very hairy. Woods and trees; not uncommon. Fr., July, August.

O. crispum varies in the size of the capsule; it is usually long and narrow, but occasionally (as in *O. Bruchii*) a variety occurs with very short capsules. This has been described as a new species in Bry. Eur., and is said to differ in the following manner:—

β. crispulum (*O. crispulum*, Bry. Eur.); *O. crispum, β. minus*, Schwaegr. Smaller in all its parts; leaves elongate-lanceolate from a broad base, pale green or yellow, all crisped when dry; capsule short, oval-pyriform, of thin texture, with more distant striæ; apophysis shorter; the pedicel slender and weak. Fr., July, August (?). Subalpine glens, &c.; rare. Ambleside; Yorkshire; Scotland.

This is a remarkable variety; but, after the comparison of British and foreign specimens, I have been forced to the conclusion that it is only a variety of *O. crispum.* The leaves are yellowish-green, with prominent papillæ, and rather larger and more distant cellules than in the ordinary form; but in light-coloured varieties of *O. crispum* the areolation is more laxly disposed, and the cells larger. The capsule is short, oval-pyriform, and is said not to be contracted below the mouth when dry. This may arise from the shortness of the walls; but in specimens from Schimper himself the older capsules are contracted below the mouth. Others, collected in Scotland by Mr Wilson, are worthy of notice, because, while some tufts agree in every respect with foreign examples of *O. crispùlum*, others present short capsules intermixed with those of the ordinary state, showing a transition between the two. These specimens are further interesting, because they were in good condition (many with the lid on) so late as September 1855; whereas *O. crispulum* is said in Bry. Eur. to ripen so early as May or June. *O. crispum* does arrive at maturity six or eight weeks earlier than *O. Bruchii*; and the two may frequently be distinguished, when growing in company, by this means. The peristome is composed of double cells, and, as well as the spores, resembles the same parts of *O. crispum*. The colour of the spores is variable, and changes with the age from green or olive to brown.

O. phyllanthum, Bry. Eur. This is distinguished from its allies by the peculiar exserted and thickened nerve, those of the inner leaves having near the apex a tuft of brown septate gemmæ, arranged in a stellate manner. The leaves are less acuminate, not dilated at the base; the areolæ very small,—those at the lower portion of the leaf are not enlarged and pellucid as in other species. This moss not uncommon: specimens from inland localities are stunted and pale; those from near the sea taller, more branched, and of a darker colour. The fruit is unknown.

One or two foreign species of *Cyathophorum* bear on the leaves similar gemmiparous appendages. In *C. pennatum* they are much longer than in *O. phyllanthum;* slender, and more densely disposed. Their use is unknown. In structure they resemble the confervoid radicles at the base of the stem; but it is curious that in Britain we only find gemmæ on the dioicous species, and they may serve as buds to propagate species, in the absence of true fructification.

Before concluding, I would beg those who have access to suitable districts, such as the Trossachs in Scotland, and the

English lakes, to pay especial attention to the disputed species (*O. fastigiatum* and *O. crispulum*), comparing their mode of growth and time of maturity with the commoner species with which I have associated them. I shall be most thankful for any facts bearing on either side of the question. Much has yet to be done before the history of many species can be considered satisfactory. When a new name is given, we look for something essentially distinct. Few botanists know anything of *O. fastigiatum*; but many will be able to recognise a pale, rigid var. of *O. affine*, with more acute leaves, broader capsule, and ferruginous calyptra.

The other new species will, I think, be found in most districts where *Orthotrichi* abound, if looked for on exposed trees, especially the transverse trunks in hedges, early in the summer, before the leaves are fully expanded.

III. *Recent Botanical Intelligence.* By Professor BALFOUR.

1. *Gutta Percha of Surinam.*—Professor Bleckrod of the Delft Academy has recently given a notice of the gutta percha of Surinam. Although gutta percha has been known in Europe for a dozen years, and has now come into general use, yet much still remains to be done regarding it, both as respects its uses and its sources. The Professor states that Dutch Guiana can supply gutta percha. This is of importance, when we consider the value of the article, and the probable exhaustion of it in the countries from which it is now supplied. The Dutch government took measures to transplant the *Isonandra Gutta*, and cultivate it in Guiana; but they have lately discovered in that country a species of Sapota, to which Blume gives the name of *Sapota Mülleri*, which yields a juice in every way equal to that of the *Isonandra*. It is probable that other trees of the same natural order may be found to yield a similar product. *Achras Sapota*, the fruit of which is known in the West Indies as neesberry, also yields a milky juice like gutta percha. The *Sapota Mülleri* of Blume is probably the tree called "Bullet-tree" by the English, and its wood is known as "horse-flesh." It is a tall tree, yielding in summer a large quantity of milky juice. It appears that under the name of common Boerowe or Bullet-tree, there have been confounded—1. the *Lucuma mammosa* of Gærtner (Marmalade-tree)—

the *Mimusops* of Schomburgk; 2. The white Boerowe, which is the *Dipholis salicifolia* of Alph. DC., and is known in Jamaica as Galimata; 3. The Bastard Boerowe, or Lowranero, which is the *Bumelia nigra* of Swartz; and, 4. The Neesberry Bullet-tree, or *Achras Sideroxylon* of botanists, which yields one of the best of the Jamaica woods. *Sapota Mülleri* grows abundantly on slightly-elevated situations. In collecting the milk, the trunk is surrounded with a ring of clay, with elevated edges, and then an incision is made in the bark as far as the liber. The milky juice flows out immediately, and is collected in the clay reservoir. The juice resembles in some respects the milk of the cow; it forms a pellicle on its surface, which is renewed after removal. By the evaporation of the juice 13 to 14 parts in 100 of pure gutta percha are obtained. Six volumes of absolute alcohol, added to ten of the juice, separates at once all the gutta percha which it contains. Sulphuric ether acts more rapidly than alcohol. The juice is not coagulated by acetic acid. This Surinam gutta percha is said to be sold at Amsterdam at the same price as the best gutta percha of commerce.

2. *Vegetation around the Volcanic Craters of the Island of Java.* By M. H. ZOLLINGER.—Decandolle, in his "Geographie Botanique," has omitted to notice among vegetable stations that around volcanic craters. In Java there are more than sixty of these craters, all isolated and surrounded by vast virgin forests. When the craters are active, and send forth lava (which is not the case with the Java volcanoes), or cinders, or sand and fragments of rock, or when they exhale continually vapours and gases, then there is no vegetation except some Oscillarias, which are found in hot-water springs. It is only when the direct volcanic action is diminished by the effect of time or the distance of the crater that a special vegetation appears. The craters of the Indian Archipelago are characterised by the absence of all parasitic or epiphytic plants, as well as of climbing and twining plants. Woody plants only appear at a considerable distance from the craters. We can easily distinguish three different regions—1. An interior zone, nearest to the centre of volcanic action; 2. A middle zone, surrounding the first; 3. An exterior zone.

(1.) *Interior Zone.*—This exhibits mostly small species, scattered here and there, belonging to the lower orders of plants, and to those having no corolla. Among these are:—*Oscillaria labyrinthiformis*, Ag. (?), in warm springs; *Cladonia macilenta*, Hoff.; and *C. baccilaris* or *obtusa* of Schær.; some fungi belonging to the genus *Polyporus;* a *Marchantia;* two or three species of mosses; some ferns, such as *Selliguea Feei*, Bory., *Polypodium triquetrum*, Bl., *Asplenium macrophyllum*, Bl., *Asplenium mucronifolium*, Bl., and *Gleichenia vulcanica*, Bl.; among the Cyperaceæ, *Phacellanthus multiflorus*, Steud. *Polygonum corymbosum*, Bl., is the only Dicotyledon.

(2.) *Middle Region.*—Many social ferns occur here; some Dicotyledons, for the most part small shrubby plants. Among the ferns are:—*Polypodium Horsfieldi*, R. Br., 3000 to 8000 feet; *Pteris aurita*, Bl.; *Blechnum pyrophyllum*, Bl.; *Gleichenia ferruginea*, Bl.; *Mertensia longissima*, Kze.; *Lycopodium spectabile*, Bl.; *L. trichiatum*, Bory. We also meet still with *Phacellanthus multiflorus*, *Carex*, *Polygonum corymbosum*, and *Imperata arundinacea.* Species of *Antennaria* and *Anaphalis*, among Compositæ, and certain Ericaceæ, appear; also *Leontopodium*, *Elsholtzia elata*, *Wahlenbergia lavandulæfolia*, DC., *Ophelia Javanica*, *O. cœrulescens*, Zoll., *Melastoma setigerum*, Bl. (the cells of which are said by M. Zollinger to contain crystals of pure sulphur), *Medinilla javensis*, Bl., *Rubus lineatus*, Reinw.; besides other genera and species.

(3.) *Exterior Region.*—This region gradually loses itself in the ordinary forest vegetation. Some rare mosses, ferns, and orchids appear at the outer portion of the region. Among other plants may be noticed,—*Synœcia* (*Ficus*) *diversifolia*, Miq., *Rhododendron javanicum*, Reinw., *Agapetes elliptica*, Don, &c. Amongst the common arborescent plants may be mentioned,—*Agapetes varingiæfolia*, Don, *A. myrtoides*, fem., *Myrsine avenis*, Bl. The beautiful *Albizzia montana*, Bth. (a social plant), *Casuarina montana*, Lesch, and *C. junghuhniana*, Miq., are on the outer part of the region. We find also here an arborescent *Bœhmeria* and a dwarf *Epilobium.* Some twining plants form transition species, such as *Nepenthes gymnamphora*, Bl., and some varieties of *Polygonum corymbosum.* The order Ericaceæ is the predominant one: we find, besides the species already mentioned, *Rhododendrum albùm*, Bl., *Agapetes floribunda*, Don, and other species of the genera, *Gaylussacia lanceolata*, Bl., *Pernettia repens*, Zoll., *Gaultheria punctata*, Bl. (an odoriferous plant of great beauty), *G. leucocarpa*, Bl., and species of *Clethra*. The genus *Rubus* is well represented; *Dodonœa viscosa*, Andr., is common towards the eastern part. The orchid that approaches nearest the craters is *Thelymitra javanica*, Bl. These are the more common and more characteristic plants of the three crateric regions of Java, according to M. Zollinger.

3. *The Lotus or Sacred Bean of India.*—Dr Buist gives some notes on the lotus or sacred bean of India (*Nelumbium speciosum*) in the Transactions of the Bombay Geographical Society. He says:—"The lotus itself is one of the most elegant of Eastern flowers, and seems, from time immemorial, to have been, in native estimation, the type of the beautiful. It is held sacred throughout the East, and the deities of the various sects in that quarter of the world are almost invariably represented as either decorated with its flowers, seated or standing on a lotus throne or pedestal, or holding a sceptre formed from its flowers, sometimes expanded and at others closed. It is fabled that the flowers obtained their red colour by being dyed with the blood of Siva when Kamadeva wounded him with the love-shaft arrow. Lakshmi is called the lotus-born, from having ascended from the ocean on its flowers. The lotus is often referred to by the Hindoo poets. The lotus floating on the water is the emblem of the world. It is also the type of the mountain Meru, the residence of the gods, and the emblem of female beauty. The lotus flower is repeated *ad infinitum* in the earliest Eastern sculptures as that on which Bhuddah sat, and from which Bramah sprung. In the cave-temples of Salsette, dating back several centuries before the Christian era, it is represented everywhere as at once an emblem and an ornament. Dr Buist thinks that Dr Lindley is mistaken in saying that the wicks used on sacred occasions by the Hindoos are made of the spiral vessels of the leaves of the lotus. They are formed, according to Dr Buist, of the dried flower or leaf-stalk. He does not believe that all the spirals of all the lotuses in India, from the Himalayas to the Line, would make a lump of wick a yard long the thickness of the finger. Individually, the

spirals are finer than gossamer; the leaf is 14 to 16 inches in diameter; the stalks about 6 to 8 feet long, and seldom rise higher than 2 or 2½ feet above the surface of the water. The leaf is buoyant enough to support a crow, and is frequently made use of by that bird as a fishing station, from which flies, snails, or water-lizards are preyed upon. The flower has something of the smell of the Tonquin bean, or the blossom of the bean. The upper surface of the leaf is a deep green; it repels the water when pressed under it. This is referred to in some of the native writings, a translation of one of which is given by Dr Buist:—

> "He is not enslaved by any lust whatever;
> By the stain of passion he is not soiled,—
> As in the water, yet unwet by the water,
> Is the lotus leaf."

When the leaf is held obliquely, the light is reflected as if from a mirror. The same thing occurs with drops of water thrown upon it; and this peculiarity can only be overcome by rubbing the leaf so as to destroy the fine texture, by which the result is brought about. This seems to consist of minute capitate papillæ, by which a fine film of air is kept entangled, the water in reality never coming in contact with the actual surface of the leaf at all; a fact established and illustrated by its reflecting light from its own under surface. The same phenomenon of repulsion of water is seen in the leaves of the *Pistia Stratiotes*, a floating plant abounding in shallow tanks in India. When pressed under water, the leaves look like frosted silver. It is the same organization that enables rose, clover, and young cabbage leaves, young shoots of grain and grass, and the numberless other plants that exhibit dew in its beautiful pearly form, to repel water from their surface. It is the same that produces the like results usually ascribed to oil and grease on the feathers of birds, especially of water-fowl, and most of all of divers, which, when they plunge under the surface, seem to carry with them a perfect flash of light. A piece of glass, a varnished or greased surface, or polished stone, throws the water off as perfectly as the various matters enumerated, but in none of these latter cases is there any appearance of reflection. Dr Buist, on examining a lotus leaf in a little pool of water, noticed thin films of air arising leisurely, and adhering to the leaf. The water flowing over them, by the reflecting light from its under surface, showed the area over which the air was emanating. The air gradually collected into bubbles, and then rose to the surface. The quantity of air which rises is very great, especially from the spiral vessels when wounded in any way. A single stem of one-third of an inch in diameter, containing tubes of sectional area of not more than one-fourth of this, or say two-tenths of an inch square, even where the leaf is cut off, has been ascertained by experiment to discharge 33 cubic inches of air hourly; the velocity with which the column advances must be at the rate of 20 feet an hour.

4. *Structure of the Ovary of Boraginaceæ.*—M. Germain de Saint Pierre has examined recently the structure of the ovary of Boraginaceæ.

He remarks, in the first place, that the ovary of Labiatæ is composed of two carpels, with an introverted and curved dorsal suture, which gives rise to a false dissepiment, and that there are four in place of two loculaments, each containing an ovule. M. Germain confirmed this by an observation made on a monstrous *Stachys*, the ovary of which had become leafy, and appeared in the form of two valves united, with the dorsal sutures slightly introverted at their upper part, and completely to the axis at the lower part. Many have conceived the ovary of Boraginaceæ as composed of four carpels. This M. Germain says is not the case, as shown by a teratological example in the case of *Myosotis cæspitosa.*

Some plants of the *Myosotis*, cultivated in the garden of M. Schoenfeld, presented the appearance of a leafy ovary, exactly like that already mentioned as occurring in *Stachys.* It appeared to be composed of two carpels united. In some specimens he found the calyx composed of large free sepals, like caulinary leaves; the corolla tubular, five-lobed,—the lobes of large size, and green; the stamens not much altered; the ovary represented by two leaves projecting more or less above the corolla, entirely free to their base, not prolonged into a style, and not presenting any traces of ovules; no appearance of a gynobase disc. The axis of the flower was prolonged generally as a leafy branch, and often floriferous.

He concludes that the ovary of Boraginaceæ, like that of Labiatæ, is in reality composed of two carpels, and that the division into four is caused by the inversion of the dorsal suture.

8th April 1858.—Dr Seller, President, in the Chair.

The following gentlemen were admitted Fellows :—

John R. Turnbull, Esq., 7 Hill Place.
John W. Johnston, Esq., 78 Pleasance.

The Curator stated that Dr Von Martius had presented to the Library his work on the names of plants.

Professor Balfour stated that the following donations had been made to the Museum at the Botanic Garden, viz. :—

From Alex. Dickson, Esq.—Specimens of Rose with Bedeguar, and species of *Polyporus* from Germany; also fascicled stem of *Malva rotundifolia,* from the vicinity of London.

Mrs Gillespie Smith, Exmouth—Seeds of *Mangifera indica* (mango).

Mrs Mackay—Specimens of wax flowers and fruits, the latter including mango and custard apples.

The following papers were read :—

I. *Description of* Narthex Assafœtida, *Falconer, at present in flower in the Royal Botanic Garden.* By Professor Balfour.

Dr Balfour stated, that since the time of Kæmpfer, who visited Persia in 1687, Assafœtida had been known to be the produce of an umbelliferous plant. Several species of plants have been supposed to yield this article of Materia Medica. Dr Christison states that it is probable that Assafœtida is obtained from at least two distinct species,—1. *Ferula Assafœtida* of Linnæus, or *Narthex Assafœtida* of Falconer; and, 2. *Ferula persica* of Willdenow. Both these plants have been cultivated in this country for some time. A root of the latter plant was sent to Edinburgh by Pallas as the true Assafœtida plant, from the mountains of the province of Ghilan, in the west of Persia. It was cultivated in the Edinburgh Botanic Garden by Dr John Hope in 1786. The plant has flowered and fruited frequently in Britain. The former has never done so until the present year, when two specimens have pushed forth flowering stems in the Botanic Garden. The plant was found by Kæmpfer growing in the province of Laristan, towards the Persian Gulf, not far from Gambroon; and he also states that the plant grows on the eastern confines of Persia, and the province of Khorasan near Herat. Since Kæmpfer's day it has been found in various parts of Persia by European travellers.

The following statement is given by Dr Christison as to the seeds sent to this country:—"In 1839 seeds of the Herat plant were received in this country from Sir John M'Neill, who visited the district, and saw the plant growing. In 1838, Dr Falconer saw the same plant growing in the valley of Astore, to the north of Cashmere, and afterwards cultivated it in the Saharunpore Botanic Gardens. In 1840, another locality was found by the expedition of Lieutenant Wood to the sources of the Oxus. This is situated in Syghan, near the western termination, and on the northern slope of the Hindoo Coosh range of mountains, about twenty miles north of Bameean.

"Seeds were sent to the Edinburgh Botanic Garden both by Sir John M'Neill and Dr Falconer, and were carefully reared by Mr William M'Nab the superintendent. In 1842 these seeds germinated, but the shoots merely appeared above ground, and then seemed to die. Mr M'Nab, however, did not give them up for lost. He would not allow the earth under the frame to be dug up, and determined to give them another year's trial. Accordingly, next summer new shoots appeared, and from them the present stock of plants in the garden has been derived. Ever since that time the plants have sent up a vigorous crown of leaves in early spring, but these have withered by midsummer, without any symptoms of flowering. The crown of the roots continued, however, to increase annually, and in some of the specimens attained a diameter of four inches."

We have looked yearly for the production of flowers in vain, until the present spring, when two plants, which had been transplanted in the spring of 1857, showed evidence of pushing up a flowering axis. At first the shoots consisted entirely of an axis covered by large yellowish-green membranous sheaths. In this form it reached the height of 1 to 2 feet. Then flowering branches began to show themselves in the axils of these sheaths, which are the enlarged petioles or pericladia embracing the stems and covering the flowering buds. In the lower part of the axis these sheaths are terminated by leaves of a much smaller size than the ordinary leaves of the plant, but having the same pæony-leaf-like form. As we proceed upwards on the axis the size of the laminæ diminish, and ultimately at the upper part the sheaths alone are developed. These also become smaller as we reach the terminal umbels. In one of the plants there are no such leaves, in the other there are a few, thus resembling the figure given in Kæmpfer's work. In that figure the sheaths do not present the conspicuous appearance which they do in the plants now in flower in the garden. Professor Balfour then proceeded to detail the generic and specific characters, filling up the description which had been given by Dr Falconer in "Royle's Materia Medica," and making one or two alterations. He stated that the colour of the flower is yellow, that the sheaths are not all aphyllous or leafless, and that the petals have an ovate form, without an acuminated point. Barren flowers, bearing stamens only, occur in peculiar rounded umbels below the fertile umbels. In these flowers the petals have a peculiar oblique and unequal form. The characters taken from the fruit could not be perfectly given in the present state of the plant. Perhaps the peculiar summer of 1857 may have had some effect in maturing the plant.

Mr M'Nab gives the following notice of the plants now in flower:—

"The large plant of *Narthex Assafœtida*, now in flower in the Botanic Garden, was lifted from a glazed pit where it had been growing vigorously for the last five years. An alteration in the pits rendered it necessary to remove the plant to its present site. This was done on the 10th of March 1857. At the time of removal the leaves were beginning to unfold, and continued to do so freely throughout the spring months. The plant has always been protected with glass during winter. On the 15th of February of the present year it showed symptoms of flowering, appearing at first like a large round ball of a greenish-yellow colour, having a few short leaves rising from it. On the 19th of March the plant had assumed a peculiar club-shaped appearance, 21 inches high and 15 inches in circumference at top. About the 22d of March the sheaths began to unfold themselves and expose the dense clusters of flowers, and at this stage the daily growths became most conspicuous.

"From 8 A.M. of the	22d	March	to 8 A.M. of the	23d,	growth	4	inches.
Do.	23d	do.	do.	24th	"	4½	"
Do.	24th	do.	do.	25th	"	4½	"
Do.	25th	do.	do.	26th	"	3½	"
Do.	26th	do.	do.	27th	"	2½	"
Do.	27th	do.	do.	28th	"	1½	"
Do.	28th	do.	do.	29th	"	5½	"
Do.	29th	do.	do.	30th	"	6½	"
Do.	30th	do.	do.	31st	"	2½	"

"At the present time the upright growth has nearly ceased, while the lateral branches (29 in number) are daily increasing in length. This day, 7th April 1858, the plant is 5 feet 7 inches high, and the branches 36 inches in diameter of spread."

The Assafœtida plants grow in a very dry climate. Besides the gum-resin, Falconer states that the fruit of the *Narthex Assafœtida* is imported into India from Persia and Affghanistan, under the name of Anjoodan, being extensively employed by the native physicians in India. Anjoodan is the term applied to the seed of Heengsch or Hingisch, or Hulleet, by Avicenna, also quoted by Kæmpfer, and used by the Indo-Persian and Arabic writers generally in describing the Assafœtida plant.

Falconer thinks that the fruits sent by Sir John M'Neill from Persia were not those of Narthex.

Assafœtida is got by incision into, or slices taken from, the top of the root. The whole plant has a strong garlic odour.

The communication was illustrated by a flowering branch of the plant, with its leaves and sheathing petals, as well as by stereoscopic photographs taken by William Walker, Esq., F.R.C.S.E.

II. *Recent Botanical Intelligence.* By Professor Balfour.

1. Braun *on Parthenogenesis.*

Dr Balfour gave a rapid sketch of the progress of vegetable embryogeny, from the times of Grew, Ray, Camerarius, Linnæus, and Morland, up to the present day. He then gave an abstract of Dr Braun's statements in regard to Parthenogenesis, or the production of perfect seed without the agency of pollen.

The doctrine of reproduction in plants and in animals by the agency of two sexes has been so generally received, that it has become a physiological character in the organized kingdom of nature. Of late years, however, facts have been produced, which seem to prove that reproduction may take place in certain instances without fecundation. To this Siebold has given the name of Parthenogenesis, or virgin-birth. This has been demonstrated in a very interesting manner by Siebold, in the case of bees, and of some butterflies (Wahre Parthenogenesis bei Schmetterlingen und Bienen, von Th. von Siebold, 1856). Various experiments have also been made on diclinous, especially monœcious plants, which seem to show a similar mode of production in the vegetable world. The earliest observations appeared to be so completely at variance with the received doctrine of science, that they were discarded, and the facts, as narrated, were referred to some error or fallacy in the experiment. The difficulty of isolating the flowers of plants, and preventing the contact of a single grain of pollen, was so great, that botanists were cautious in giving assent to the facts which seemed to be proved by the experiments. These remarks apply to the observations of R. J. Camerarius in 1694, of Spallanzani from 1767 to 1779, of Henschel in 1817–18, of Girou de Buzareingues in 1827 to 1833, of Ramisch in 1833-38, and of Bernhardi in 1834–39. Within the last few years, however, the experiments of Tenore, Gasparrini, Naudin, and Smith of Kew, seem to place the doctrine of vegetable parthenogenesis beyond doubt.

The following are the plants on which the most direct and positive observations have been made :—

A. *Diœcious Plants.*

1. *Cannabis sativa*, common hemp.
2. *Spinacia oleracea*, common spinach.
3. *Lychnis dioica*, common campion.
4. *Mercurialis annua.*
5. *Bryonia dioica*, bryony.
6. *Datisca cannabina.*
7. *Pistacia narbonensis*, and other species of the genus.

B. *Monœcious Plants.*

8. *Cucurbita Melopepo*, and other species of the genus.
9. *Cucurbita Citrullus*, water melon.
10. *Urtica pilulifera*, Roman nettle.
11 *Ficus Carica*, fig.

All the observations, however, made on these plants have not been rigorously demonstrative, inasmuch as due precautions have not in all instances been taken to prevent the access of pollen from some extraneous source, nor to determine whether or not some male flowers may not have appeared among the female ones. At the same time, it must be admitted, that when such careful and able observers as Spallanzani, Bernhardi, Naudin, and Thuret, deduce the same results from experiments made without any preconceived ideas, their opinion bears strongly in favour of the existence of parthenogenesis.

In order to put the matter beyond doubt, Braun remarks, it was necessary that we should have an exotic diœcious plant of which there was only female and no male specimens in our gardens, and in which it could be shown that there was no tendency to produce male flowers among the female ones. These conditions seem to be fulfilled by the plant called *Cœlebogyne ilicifolia.*

In 1829, Allan Cunningham sent to the garden at Kew three specimens of a small shrub, with holly-like leaves, which he had found growing abundantly in the forests of the Brisbane River at Moreton Bay. The plant produced female flowers, and was found to be Euphorbiaceous. It first received the name of *Sapium ilicifolium* and subsequently of *Cœlebogyne ilicifolia.* The plant was found to have produced perfect seeds, in circumstances where pollen could not have come into contact with the pistil. The plants produced by the seeds were in every respect similar to the parent.

Since Mr John Smith's first observations at Kew opportunities have been afforded of experimenting carefully on the plant; and after twenty-seven years' observations, the fact, as stated by Mr Smith, appears to be confirmed.

In the Berlin garden similar observations have been made, and the results are confirmatory of those at Kew. In all cases female plants have been produced similar to the parent, and seeds have been perfected without the contact of pollen. Some of the seeds have been found by M. Braun to contain no albumen nor embryo, while others were perfect in every respect.

The question then comes to be, How are these seeds perfected?

1. Is there any fecundation in the plant by means of the glandular bodies, or otherwise?

2. How is the embryo formed, and what phenomena precede and follow its development, as compared with what takes place where pollen intervenes?

3. Is the Cœlebogyne really a plant of a single sex, as it appears to be in our gardens; or, if there are two sexes in its native country, what are the numerical relations of the individuals of each sex in the case of fertility without previous fecundation, and in the case in which the embryo is the necessary consequence of fecundation?

As regards the first question, it may be remarked, that effective fecundation without anthers or pollen is contrary to all probability among Phanerogams. M. Braun has examined the glands which occur on the external surface of the bracts, and has not been able to detect anything different from the glands of other Euphorbiaceæ.

As to the second question, M. Braun gives observations by M. Th. Deecke on the production of the embryo, in which he shows that the embryo follows the usual course of development in angiospermous Phanerogams, with the exception of the absence of the pollen tube. Radlkofer confirms these statements from observations made on more than twenty ovaries of the plant at Kew. The germinal vesicles which appear are either two or three, one of which comes to perfection. Thus, says M. Braun, these observers plainly point out this as a case of true vegetable parthenogenesis. The stigma of the plant remains for a long time fresh, and even increases during the enlargement of the ovary. This is contrary to the ordinary phenomenon, when, after contact with the pollen, the stigma withers and dries up. This fact has also been confirmed by Messrs Naudin, Thuret, and Decaisne, in their observations on the production of seeds without fecundation, in the hemp, and *Mercurialis annua.*

As to the third question, whether *Cœlebogyne* has only one sex, it is stated that Sir William Hooker has in his herbarium male specimens collected by Allan Cunningham. These have been examined by Braun, and Decaisne, and have been found to possess normal stamens filled with perfect pollen.

It therefore appears that Cœlebogyne is a diœcious plant, which produces seeds by parthenogenesis, as well as by the agency of sexes. But we cannot at present conjecture what relation these two modes of reproduction bear to each other, and what is the bearing of parthenogenesis on the vital economy of the plant. If it is shown that without fecundation the plant only produces female individuals, which is the case in gardens at present, we may ask if this mode of multiplication is indefinite, or if it ceases after a determinate series of generations; or, finally, if, after a series of female generations, it will produce male individuals.

The other plants in regard to which parthenogenesis has been proved do not furnish any facts which can aid us in replying to these questions, seeing that their unfecundated seeds produce up to the fourth and fifth generations both male and female plants.

M. Braun thinks that parthenogenesis also can be shown to occur in some diœcious species of Chara, as in *Chara crinita.*

In Characeæ there exist reproductive organs of both sexes. In them sporangia and antheridia have been detected. Most of the Characeæ are monœcious, and some are diœcious. Among these diœcious species may be noticed *Chara aspera* and *crinita, Nitella syncarpa, capitata,* and *opaca.*

Chara crinita was first described and figured by Wallroth in 1815. This species is distinguished from all its congeners by the fact that the number of the series of cortical cellules of the stem is equal to that of the leaves which form a verticil, and the number of the same cellules in the leaves is equal to that of the secondary verticillate leaflets, which are usually called bracteæ; whilst in the other Charas the number is double or triple that of the parts which compose each verticil.

The geographical distribution of this species is less extensive than that of most of the others. It is found only in Europe, in Middle Asia, and in Northern Africa. It delights in saline or brackish water, and is found chiefly near the sea or in countries possessing salt springs, or ground impregnated with salt.

Although *Chara crinita* is said to be diœcious, yet we seldom can detect antheridia. M. Braun has in vain attempted to find these organs; and he arrives at the conclusion, that the *Chara crinita*, so far as he can ascertain, is usually represented only by female individuals, and that, nevertheless, it produces in abundance sporangia and fertile spores. M. Requien has very recently detected male plants at Courtheson, near Orange, and these, when examined, were found to bear antheridia. It would appear, then, that in certain localities the *Chara crinita* is represented by two sexes, whilst in general it is only represented by one.

The spores in the species of Chara follow the same development as in monœcious species, having both antheridia and sporangia.

Braun concludes that, on the supposition that the antheridia in Characeæ are true male organs, and that the antherozoids in them serve for fecundation, and that the spore formed in the sporangia is the true female organ, which is fertilized by contact with the antherozoids, he is justified in attributing to *Chara crinita* the power of producing, at least in certain localities, even without the action of male organs, perfectly-formed spores fit for germination, and that consequently this is a true case of parthenogenesis.

2. M. Auguste Trécul *on the Circulation of Plants.*

M. Trécul endeavours to show that the absorption by the roots, and the movements of fluids in plants, cannot be accounted for by capillarity and endosmose. Physiologists allow that these forces cannot carry the fluid to the summit of our trees without the aid of the evaporation from the leaves, which, as it were, draws the fluids to these organs. If evaporation makes the fluids ascend, Trécul thinks that it should prevent them from descending.

If we allow that endosmose causes the fluids to ascend by the wood and descend by the bark, then it follows that the density of the sap must go on augmenting in proportion as we ascend; it must increase in passing through the leaves from the woody part to the bark, and in descending from cell to cell in the interior of the cortical tissue. Mere gravity cannot account for the descent of the sap, when we reflect that the descent takes place in pendulous branches.

Botanists who admit the endosmotic theory have not considered that there must be two currents of fluids of different densities by the side of each other; that the ascending sap being less dense than the descending, must be attracted by the latter, since the membranes are permeable; that there must be throughout the whole length of the trunk a horizontal centrifugal current, until an equilibrium of density has been produced; and that then the double current of ascending and descending sap can no longer exist. The descending current, at least, would cease. Another force, therefore, seems to regulate the absorption of fluids from the soil, similar to that which regulates the absorption of gases from the atmosphere. Moreover, there are in plants other movements besides that of the ascending and descending sap. The sap communicates to the cells, during its progress, the substances required for their nutrition. The cells assimilate the matters which are suitable for them, and reject others. The rejected elements are taken up, according to Trécul, by the laticiferous vessels, or are collected into special reservoirs, as essential oils, &c. In these reservoirs there is not a denser fluid for which these oils have an affinity. Hence, then, endosmose seems to have no share in the movements.

The cellules on the surface of roots take up fluids by a vital force which we cannot explain, says Trécul. These fluids are carried to the woody parts of the root, and then of the stem; they reach the leaves, and then descend towards the roots, describing thus a kind of circle. This circulation may be called the *grand circulation;* while the *venous* circulation is that which, by means of the laticiferous vessels, carry back to the vessels, properly so called, the substances which the cells have not assimilated. There is, besides, an intra-cellular movement in many plants, to which the name of *rotation* has been given, as the fluid seems to perform a revolution with more or less regularity in the interior of each cell.

During vegetable life, all the fluids are in motion in each of the cells which compose the plant. Some cells take up the materials necessary for their growth or the formation of amylaceous, saccharine, and albuminous principles; other cells remove substances which have become useless and require to be eliminated, or matters which must be carried to other parts of the plant for cell-growth. This general movement constitutes the circulation. This name, however, is generally given to the more evident determinate currents which traverse the plant throughout its whole length.

The grand circulation consists, then, of an ascending and a descending current of sap. The ascent of sap takes place in the vessels which receive the liquids taken up by the roots from the soil. When the ascent commences, all the cells are in action. The nutritive substances which they contain are ready for assimilation. Starch, transformed into sugar by the action of diastase, is carried to those parts where it is required for cell-multiplication; the starch at the base of the buds goes to nourish them; that of the bark is conveyed into the interior of the cells of this organ. Under the influence of these nutritive matters increase in diameter commences by multiplication of cells. This cell-development at first takes place without the aid of the sap elaborated by the leaves, for we often find the cambium layers acquiring a considerable thickness before the leaves appear. The sap in ascending undergoes elaboration, and it contains certain matters fit for assimilation which may aid in the nutrition of the leaves and buds (in which the spiral vessels appear from below upwards).

The sap, after taking part in the nutrition of the first organs developed, reaches the leaves, where it is submitted to a new elaboration in their green parenchyma, as well as in the cellules of chlorophyll of the stems of fleshy plants without leaves. The carbonic acid of the air is absorbed, then decomposed during the day; its carbon is retained by the sap, and the greater part of its oxygen is evolved. The sap, modified under the influence of respiration, traverses the cortical cells, to which it imparts nourishment; it then contributes to the multiplication of cells of the generating layer, which increase in a horizontal direction. One part of the cells is multiplied horizontally, and forms a new layer of bark, ligneous fibres, and medullary rays; the others are transformed into vessels. The mode of formation of these vessels is as follows:—The excess of descending sap which is not used in the nourishment of the newly-formed cells, or in the thickening of those first formed, descends through certain of the newly-produced cells; it dilates them, perforates them, and makes them take all the characters of vessels.

This vascular formation takes place from above downwards, at the expense of the cells, which are multiplied in a horizontal series. This downward vascular formation has given rise to the idea that these fibres are the true roots of the buds or the leaves.

All the sap absorbed by the old and new cells, whether for their increase in length or thickness, or for the production of starch, albumen, and other matters required for after increase, is not used by the cells. A part only of its elements is assimilated, and the rest is thrown off. The latter, in the form of resin, essential oils, &c., is collected in particular reservoirs, whence it is poured out externally; or the non-assimilated matters are taken up by the laticiferous vessels, and are carried by them to the vessels properly so called (this is the venous circulation). There those substances which usually want oxygen are elaborated, oxidated under the influence of oxygen drawn from the air, and which reaches the vessels by the intercellular canals. Thus these matters become again fit for assimilation. From their oxidation results the carbonic acid given off during night, as well as that produced during the day, and decomposed in the leaves under the influence of light. The vessels formed by the descending sap serve during succeeding years for the ascent of the juices. They are filled with them so long as vegetation is very active, but are usually emptied by degrees as the fluids in the soil become less abundant.

M. Trécul has shown the course of the descending sap by means of ligatures round the stem, decortications, and other means. By such experiments sinuous vessels are produced; some parts of the vessels being vertical, others horizontal or oblique, according to the nature of the obstacles. These vessels are formed of cells elongated in a vertical direction—*i.e.*, parallel to the axis of the stem. The sinuosities of these vessels exhibit currents of sap moving through the cells of the generating layer, turning themselves in all directions in order to get an exit, perforating the cells from above downwards or horizontally, according as the current is vertical, oblique, or horizontal.

III. *Notice of a few Plants collected in the vicinity of Stirling, in August* 1857. By Dr George Lawson.

Among the rarer species may be noticed *Lysimachia Nummularia, Solidago Virgaurea, Epipactis latifolia, Circæa Lutetiana, Campanula latifolia, Lychnis Viscaria, Lamium album, Viola odorata, Veronica Anagallis, Calystegia Sepium, Œnanthe crocata, Astragalus glycyphyllus, Sedum anglicum, Hymenophyllum Wilsoni, Cystopteris fragilis, Asplenium*

Ruta-muraria, *Andræa petrophila*, *Hypnum rugulosum*, *Cinclidotus fontinaloides* (with antheridia, and fruit), *Grimmia leucophæa*, numerous *Diatomaceæ*, &c.

Dr Balfour read a note from Mr Babington, in which he calls attention to the *Fumaria capreolata* of Britain, which he thinks will probably turn out not to be the species so named by Linnæus. He is also disposed to think that in place of this species there are in this country several of the plants mentioned in modern French floras. Mr Babington is anxious to get fresh specimens of the *Fumaria capreolata* from various localities.

Thursday, 13*th May* 1858.—Dr SELLER, President, in the Chair.

On the President taking the Chair, the following resolution was adopted by the Society:—

"The Botanical Society, with the deepest sentiments of regret, have to record in their minutes the premature death of their distinguished member and councillor the late Professor WILLIAM GREGORY. In doing so, they feel called upon to express their sense of his merits and eminence as a chemist, and as a teacher and investigator of science. While he prosecuted chemistry with zeal and success, he devoted his attention, in no small degree, to microscopic investigations, and has contributed valuable papers on the difficult order of Diatomaceæ, abstracts of some of which have appeared in the Proceedings of the Botanical Society. He was not less celebrated for his proficiency in languages, and for his kind, obliging, and amiable demeanour. He was a man of high accomplishments, and was universally esteemed and beloved. His death has occasioned a blank which cannot be easily repaired. The Society beg most deeply to sympathize with his family in this afflictive bereavement."

The following donations were announced to the Society's Library and Herbarium, viz.:—

Mr Sadler's Narrative of a Ramble among the Wild Flowers on the Moffat Hills, in August 1857—From the Author.

From Dr Greville—Fungi and plants from Madagascar.

From William Brown, Esq., R.N.—Specimens of *Lastrea recurva*, *Asplenium marinum* and *A. lanceolatum*, collected in Devonshire and Cornwall.

The following donations to the Museum at the Botanic Garden were exhibited by Professor Balfour, viz. :—

From Mr Cunningham, Duke Street—Fasciated stem of *Arctostaphylos Uva-Ursi*.

Colonel Ryley—Plank of Deodar Cedar Wood; fibres of the "Murooah," a creeping plant found in the jungles, near Mussorn, on the Dehra Doon, in the Himalaya.

Mr Izett Anderson—Specimen of *Polistes*, a kind of wasp from Jamaica, with a *Sphæria* growing on it.

Dr Balfour exhibited a drawing of a branching coco-nut palm, growing at Dunnoch, St Ann's, Jamaica, the property of Dr Dakin.

Dr Balfour also exhibited from Dr Coldstream a Chinese work on Surgery, compiled by Dr Hobson, Shanghai, containing woodcuts of some medicinal plants.

Dr Balfour called attention to the elasticity of the stamens of *Thelygonum Cynocrambe*. Flowering shoots of the plant when dipped in water, and then allowed to dry, show in a remarkable manner the sudden protrusion of the filaments and the scattering of the pollen.

Dr Douglas Maclagan exhibited small seeds, apparently of a leguminous plant (probably a *Phasæolus*), used as beads, which, when swallowed by a child, had produced symptoms of poisoning.

Mr M'Nab exhibited several interesting Rhododendrons from the garden of Isaac Anderson, Esq., Maryfield.

The following communications were read :—

I. *Short Biographical Sketch of Professor Gregory.* By Professor Balfour.

The University of Edinburgh has lost a distinguished member by the death of Dr William Gregory, Professor of Chemistry. He was the scion of a Scottish family which for many generations has been distinguished for great literary and scientific ability, and which has supplied eminent Professors to several of our Universities. In a direct line of descent, for nearly 200 years, the Gregories have been conspicuous in the scientific world. James Gregory, the well-known inventor of the reflecting telescope which bears his name, after distinguishing himself as a mathematician and physicist, was elected Professor of Mathematics in St Andrews in 1668, and afterwards was promoted to the corresponding chair in the University of Edinburgh. His son, the second James Gregory, was Professor of Medicine in King's College, Aberdeen, and was the least distinguished of the race. The succeeding generation revived the family honours—John Gregory, the son of the King's College Professor, having been one of the most distinguished British teachers of medicine in the middle of the eighteenth century. He filled the chairs of medicine in Aberdeen and Edinburgh, and was appointed first physician to His Majesty in Scotland in 1766. The next descendant of the family, James, the father of the subject of this notice, is better known to the present generation as having from 1790 to 1821 discharged with brilliant success the duties of the important chair of Practice of Physic in the University of Edinburgh; previous to which, however, he had for fourteen years been Professor of the Theory of Medicine. As a practitioner, a lecturer, and a scholar, Dr James Gregory was surpassed by none of his own time, and by few of any period in the history of medicine. Many are yet alive who have benefited by his professional skill; most of the surviving seniors of the medical profession delight to speak of the time when they sat on the benches of his lecture-room; and his *Conspectus Medicinæ Theoreticæ*—at once distinguished by the correctness of its views of the theoretical medicine of the day, and the purity of its style—is yet the admiration of those who can, and the terror of candidates for degrees and diplomas who cannot appreciate a most admirable specimen of elegant Latinity. Besides their scientific ancestry, the Gregories had a genealogy which must not be forgotten. They were a branch of the Clan Macgregor, and their name is a saxonification of the more emphatic Celtic patronymic. It is, we believe, a fact that Rob Roy formally acknowledged the alliance by paying a visit to his scientific clansman, at that time Professor in Aberdeen.

William Gregory was Professor James Gregory's fourth son. An elder brother, James Crawford Gregory, who died, was also educated for the medical profession. He embraced the practical department, but was cut off in the prime of manhood by typhus, contracted in the discharge of his duties as physician to the Royal Infirmary. William duly completed his medical studies, and graduated at Edinburgh in 1828; but for him practical medicine had no attractions. He very early showed a strong predilection for the study of chemistry, and, relinquishing all views of practice, he devoted himself to a science to which he has made some valuable additions. When but a young man, as the result of much and laborious experiments, he introduced a process for making the muriate of morphia, which, we believe, is still followed, and he thereby facilitated the introduction into practice of a very valuable remedy. Soon after completing his curriculum here, he went to the Continent for the purpose of prosecuting the study of chemistry, to which he had resolved to devote himself. After spending some time in the Continental schools, he returned to Edinburgh, where he established himself as an extra-academical lecturer on chemistry. He did not, however, continue long here. He was soon after appointed Lecturer on Chemistry in the Andersonian

University of Glasgow, where he succeeded Mr Graham, the present Master of the Mint, who had been moved to University College, London, as successor to Dr Edward Turner. A favourable opening in Dublin having thereafter presented itself, he removed to the Irish capital, and lectured in one of the medical schools there. In 1839 he was appointed to the Professorship of Medicine and Chemistry in King's College, Aberdeen, and thus became the occupant of a chair which had been filled by more than one of his distinguished ancestors. In 1844 he was elected by the Town Council to the Chair of Chemistry in the University of Edinburgh, on the death of Dr Hope. His chief opponent was Dr Fyfe, the present distinguished Professor of Chemistry in King's College, Aberdeen.

At the time of Dr Gregory's graduation in 1828, but when he had already made up his mind to aim at distinction only as a chemist and teacher of chemistry, the greater part of what we now regard as the first principles of this science had been brought to light within the recollection of the passing generation. This may be said of the system of Lavoisier, of Priestley, and Cavendish, founded on the experiments which determined the constitution of air and of water, and the nature of combustion; of the researches of Black and of Watt on the nature of carbonic acid and the properties of steam; of the laws of crystallography, ascertained by Haüy; of the atomic theory, originating with Dalton; of the analysis of the alkalies, and discovery of the nature of chlorine, by Davy; and of all the applications of chemistry to illustrate the processes of assimilation, nutrition, respiration, and excretion, both in vegetables and animals; and likewise of the application of these processes to illustrate the results of examination of the memorials of the former inhabitants of the globe made known to us by geology. In order to bring within a reasonable compass the instruction to be given on subjects of such extent and interest, Dr Gregory early saw the necessity of a greater subdivision of the science than had previously been adopted; and in the preface to his "Outlines of Chemistry," published in 1845, he assigned his reasons for the division of the *ponderables* from the imponderables, and the exclusion of the former elementary subjects,—*i.e.*, of heat, light, electricity, and magnetism, from the study of the *ponderables*, or proper chemical elements, whether solid, fluid, or gaseous, and their compounds; and if his health had enabled him to execute what at one time he had in view, a separate and complete course of lectures on each of these, the whole of the instruction delivered from that chair would probably have been more complete than from any other scientific chair in Europe. But when the subject of chemistry is nearly confined to the ponderable elements, the study of the imponderables must be held as preliminary to that subject, and as being usually made part of natural philosophy and part also of natural history. On the other hand, several of the applications of chemical science to the arts are of late years provided for in our University by the professorships of agriculture and of technology.

The departments of chemical science which Dr Gregory regarded as chiefly demanding attention from him, both on account of their novelty and their importance in all departments of medicine, were those which concern the *organic* as distinguished from *inorganic* substances. To the former subject, as appears by his volume of Outlines, not less than two-thirds of his course of lectures were appropriated; and as he was early convinced that the chief progress in this truly scientific treatment of these subjects is at present on the continent of Europe, he soon attached himself particularly to the celebrated Professor Liebig of Giessen, whom he assisted in several of his courses of experiments, and several of whose publications, at the request of their author, he translated and edited in this country. The last and best known of these are "Familiar Letters on Chemistry, and its application," of which the third edition was published in 1851; and in regard to his execution of that task, it is sufficient to quote the words of the illustrious author:—"From his intimate familiarity with chemical science, and especially with the physiological subjects here treated, I am confident that the task could not have been entrusted to better hands than those of my friend Dr Gregory." It is satisfactory to add, that the friendly intercourse of these men of science continued unabated to the last, and that the last scientific labour executed by Dr Gregory was a short paper stating his belief in the truth and importance of certain views of which he had received an account a few weeks only before his death from his friends. With Baron Liebig he was also joint editor of posthumous editions of Dr Edward Turner's "Elements of Chemistry."

When suffering of late years from repeated attacks of painful disease, he found it absolutely necessary to relax somewhat from the harassing labours of his lectures and practical instructions. He sought relief at times by change of scene, and at times only by a change of the subjects of study, particularly by the use of the microscope.

Dr Gregory retained throughout life the same simplicity and earnestness of character which had distinguished him as a zealous and devoted student of natural science. Incapable of deceit himself, he was unwilling to ascribe any such intention to those from whom he received what they held out as scientific facts; and hence, in the opinion of many of his friends, he was too credulous as to the evidence of certain alleged principles of science. His knowledge of the modern languages was such as to enable him to enjoy the society of several scientific friends both in Germany and France, and he often enjoyed better health in those countries than in this; but his naturally candid and benevolent disposition attached him strongly to his native city and his friends in Scotland. Under much and varied suffering from disease, he was uniformly and remarkably patient and cheerful.

As a scientific man, Dr William Gregory worked more for utility as a teacher than for fame as a discoverer. His principal memoirs were on Pyroxanthine, a solid volatile product of the destructive distillation of wood; on a Compound of Sulphur and Nitrogen; and on the Decomposition Products of Uric Acid; whilst to practical chemistry he contributed improved processes for the preparation of hydrocholoric acid, oxide of silver, and muriate of morphia. He is better known, however, for his writings than for his laboratory work. He had a thorough knowledge of all that had been done, and that is not a little, in chemistry up to the present time; and none was better able than he to give information to any inquiring student as to the actual state of our knowledge on any chemical subject, especially in the interesting and pre-eminently important department of organic chemistry. This knowledge he embodied in an elementary work, which, in a succinct form, presents the best *résume* of chemistry, especially in the organic department, which exists in the English language.

On this subject he made several valuable communications to the Society, illustrated by magnified drawings, beautifully executed, by Dr Greville, who aided him in these researches. The last volume of the Transactions of the Royal Society of Edinburgh contains an elaborate and beautifully-illustrated memoir by him on this subject. He has left behind him some farther researches on this curious subject, which it is hoped will be published under the superintendence of Dr Greville. M. de Brebisson, in alluding to Dr Gregory's papers on Diatomaceæ, says,—"ses travaux sont de plus grand prix pour la science." The late M. Bailey of New York also says,—"I have read Dr Gregory's papers, as they appeared in the "Microscopical Journal," with great interest: and I believe that he is working in the right direction. I am a complete sceptic as to the value of any of the characters now relied on for the specific or even generic characters of the *Diatoms*. Form, number, size, colour, &c., all fail."

From an examination of Dr Gregory's manuscripts, there is abundant evidence to prove that his minute and patient observation was wonderful:—"Whether he was right or not in some of his views of specific difference, they were not arrived at by hasty examination. Some people who find, perhaps, only one or two examples of one of his species in a slide, would be ready to jump to the conclusion that he was content to decide upon too scanty materials. But in such cases he persevered through hundreds of slides,—often mounted only to be subsequently destroyed,—until he had completed his investigation. He kept a record of everything of interest in every slide he examined; and the amount of labour is perfectly astonishing."

Notwithstanding his occupation with these inquiries in another field, he continued to be a diligent student of his own science, and kept himself faithfully *au courant du jour* as to what was going on in the chemical world. As a teacher and writer he has been highly useful in his day and generation; and for this, as well as for his amiable disposition, his memory will be cherished and respected.

Dr Gregory died in his fifty-fourth year. He leaves behind him a widow and only son (named after his friend Liebig) to mourn his premature decease.—(*From notices in Edinburgh Newspapers and other sources.*)

II. *Notes on the Action of the Soil on Vegetation.* By the late Professor GREGORY. Communicated by Professor BALFOUR.

1. Way, and after him Liebig, have shown that every soil absorbs ammonia, and also potash, from solutions containing them or their salts, generally leaving the acid, which takes up lime, &c., from the soil, in solution. The ammonia and potash, which are absorbed in very large pro-

portion by arable soils, are rendered thereby quite *insoluble.* 2. Arable soils absorb also silicic acid in very considerable proportion, and it also becomes insoluble. 3. Arable soils also absorb the phosphoric acid of phosphate of lime, or of ammoniaco-magnesian phosphate, apparently selecting the acid, which also becomes insoluble. 4. Hence the soluble ingredients of manures *cannot* be conveyed to the plants in the form of a solution percolating the soil (such as liquid manure, or a solution formed by rain-water, with the aid of carbonic acid), since such a solution is deprived of its dissolved ingredients by filtering through a very moderate amount of soil. 5. Hence, also, as the food of plants must thus be fixed in the soil in an insoluble form, it is plain that it can only enter the plant in virtue of some power or agency in the roots, which decomposes the insoluble compounds in the soil, and thus renders soluble the necessary matter. 6. The absorbent power of soils is partly chemical and partly mechanical, as is the case with charcoal. 7. The quantity of alkalies, of phosphates, of ammonia, &c., capable of being supplied to plants by rain-water, after it has percolated through the soil, even supposing the whole to be assimilated, does not amount to more than *a mere fraction* of what the plants contain. 8. The theory of the transference of ammonia, potash, silica, phosphates, &c., from the soil to the plant is not yet understood; but the old theory, that the rain conveys food to the plant directly, is certainly not the true one.

IV. *Reports of Recent Botanical Expeditions.* 1. *Letter from Dr Hector, North America, to Dr Balfour.* 2. *Letter from Dr W. Balfour Baikie, West Africa, to Dr Christison.*

Letter from Dr HECTOR *to* Professor BALFOUR.

FORT EDMONTON,
SASKATCHEWAN, 5*th January* 1858.

DEAR DR BALFOUR,—I had hoped to have been able to have given you a long account of our movements since I last wrote to you, but I must defer it until I have an opportunity in spring, as the gentleman in charge here is obliged suddenly to send off the winter express this afternoon instead of the 12th, as he intended to do. I have just arrived here alone as regards the rest of our party, who are at Fort Carlton, about 400 miles from this, and where our winter quarters are. Captain Palliser had to return to the civilized world on business during the winter, and he left me in charge, with the work of engaging men, and making other preparations for our trip next year. To do this I have had to make a winter journey with dogs and snow-shoes to this place, to see the principal factor for the Saskatchewan district, and I shall have to continue on to the mountains before I return. I enjoy the winter travelling very much, although at first I found it rather hard work. I am in excellent health, and can stand the running behind the dogs famously. M. Bourgeau has made a very large collection of plants and seeds.

A gathering of the gentlemen in charge of the various trading ports for the New-Year's Day settling of accounts, gave me an opportunity of making further inquiries about Mr Jeffrey the botanist that you wished to hear about, and who has gone amissing. I have seen a gentleman who travelled up to the head water of the Little Fork of Frazer's River on the west side of the mountain, and there he left him. Mr Frazer, who was in charge of Jaspar's House at the time, says he came up in December 1851 along with the winter express, and that he remained at this fort (Edmonton) till February, when he left to cross the mountains on snow-shoes. He remained some time with Mr Frazer at Jaspar's House, and then started to descend the Columbia along with Mr Clouston. I shall try and hear from the latter gentleman what became of him; but he is at present on the west side of the mountains. I shall not give up the inquiry until I hear something positive about his disappearance. All who saw him say he proved a most expert and hardy traveller.

The country here is wooded with poplar and a few pines (*Abies alba*). It is no long time since it was all prairie, but, as seems to be the case everywhere hereabouts, the woods are rapidly encroaching on the bare plain; so that places which were buffalo plains only thirty years ago, are covered with a thick growth of poplar (*P. tremuloides*). The country is divided into two districts by the woods, so well marked, that it gives the character of a variety, not only to all the animals, but even to the Indians. The traders talk of wood Crees and plain Crees; and they are quite distinct in their habits. Then there are wood and plain wolves, buffalo, deer, moose, reindeer, and many other animals, all distinguished generally by the kind which inhabit the woods being the larger, and of solitary habits. The margin of the wood country to the south seems to agree with lat. 54° in this long., but in long. 106° it begins to sweep to the S.E., and reaches lat. 50° at Red River, and even 48°, in Lake Superior, S. of this line. Except close to the base of the mountain there are no woods, save on the N. and N.E. sides of hills, and in the river valleys, on their banks that face the N. This is true, with but few exceptions.

At Carlton we have a rude observatory for magnetical and meteorological purposes, under Lieutenant Blakiston's care, and we all take part in making hourly observations day and night; so that the winter does not hang heavily on our hands.

The weather as yet has been as unusually mild as last winter was severe. The deepest snow does not exceed one foot in this quarter; and in some places there is hardly enough to run the dog-sleigh on. The greatest cold as yet has been $-17°$. The general standing of the thermometer is 15° during the day, and 5° at night. I never feel it so cold as I did at home, although sleeping on the snow in the open air every night. Deferring the rest of my news, of which I have a large stock, until I return to Carlton, and wishing you a very happy new year, I remain, ever yours very sincerely,

JAMES HECTOR.

Letter from Dr W. BALFOUR BAIKIE *to* Dr CHRISTISON.

ENCAMPMENT NEAR JÉBA.
RIVER KWÓRA, 1*st January* 1858.

Here we have had our mishaps. We lost our ship (The Dayspring) by striking on a sunken rock on the 7th October last, and ever since we have been living in tents and open mat huts. I look upon our living here so long, without losing a man, as a kind of triumph in its way over those who call the African climate so deadly, as we could not have landed under more unfavourable circumstances. Totally unprepared, having to leave the ship at a few minutes' notice; working all the first day on a sandbank or in the water; tired, fasting, depressed at night after the excitement; sleeping on damp ground, having our temporary tent blown in the first night by a violent tornado and ourselves drenched; living for two days in the middle of a marsh; working hard ten or twelve days in a hot sun, in carrying our effects up to a small height; erecting tents and huts; removing things from the wreck, &c.; and having every day or two heavy tornadoes with tremendous rain, and this, too, just as the marshes were beginning to dry up and the river to fall, the most unhealthy period of the year. According to rule, half of us at least should have died. Every one of us had fever; some, as myself, severely, with repeated ague seizures; but here we are alive and well, and hard at work, though without European food, neither wine nor spirits, and living almost entirely on native food. Our drink, until we got a little tea and coffee from Lagos a few days ago, was an infusion of roasted and bruised Indian corn. For sugar we have a very inferior honey, and our night light is from Shea butter, burnt in a rude native lamp. The nicest country dish is a stew of yam and fish, or fowl cooked with fine palm oil, which is most palatable, indeed unusually so. Palm oil is easily digestible, and slightly laxative. A nice evening drink is made by mixing roughly-ground rice with water and sweetening with a little honey. Our vegetables are yam, sweet potato, ochro, and, for those who like them, onions. Our bread is of native ground corn, either maize or zéro. We drink, when good, native beer and palm wine; and our fruits are papaw (*Carica Papaya*), banana (*Musa sapientum*), plantain (*Musa paradisiaca*), and ground-nut (*Arachis hypogea*).

Around this spot we have collected nearly 700 species of plants, and by living ashore and watching them, have got them in different stages. We have discovered several new palms and a real African bamboo. I have several new grains and a numerous collection of fruits, pods, and seeds. By living here so long I have learned much of native products and manufactures, and I am working hard at the Fúlo or Fuláta language, while Mr Crowther has taken up the Núpe, that of the country we are in.

I have had my parties out also, and have had the route from this to Lagos surveyed and opened, and the river as far as Búsa. Our encampment is about twelve miles beyond Rábba. What I gave you as palm kernel oil is not so, but the oil of commerce purified and refined by being twice boiled with water and skimmed off. The kernel oil is of a dark coffee colour, occasionally of a pale brown, and is here chiefly used for burning in lamps, the red refined oil being used for food. The shea butter-tree is abundant here. It is at present in flower, and shows panicles with beautiful white blossoms. We have found two varieties, one being more umbellate in its inflorescence. We have several gums, and have already traced some to their sources; also several native dyes. I am getting sections of many of the palm stems, especially the oil-palm, the Raphia or wine-palm, and the Borassus or fan-palm. Each of these, as well as the coco-palm and date, has a peculiar figure and outline, and can, after a little practice, be easily distinguished. I have also traced all the mats of the natives to their sources, and found out the dyes used for them. We got also an excellent fibre, making a capital rope, from a species of Hibiscus, easily cultivated, and which would form a good commercial article. If I am duly supported, I am so much in the good graces of both chiefs and people along the river, that I could with but little trouble firmly establish British influence, and lay the foundation of a very extensive trade in shea-butter, ivory, palm-oil, cotton, indigo, gum, wax, &c., &c. My zoological collection suffered much by the wreck, and several boxes of good skins and skeletons were ruined; but I am doing what I can to replace them; and, especially in birds, fishes, and insects, I am rapidly advancing. I have already, particularly in the case of fishes, many novelties. I have also some good specimens of reptiles.

We have learned to eat and relish hippopotamus flesh, and some large river tortoises yield excellent turtle soup. So you see we are also attending to the cuisine.

Such, then, is a rapid outline of our proceedings of late. Scarcely a day passes without some novelty or addition to our store, our last one being a pretty purplish-blue Nymphæa. I am now anxiously expecting a steamer to carry us off and enable us to make a fresh start. Our present daily range of temperature (this being the dry season) is from 34° to 38°. Yesterday it was 41°, viz., from 60° to 101° F., and this in a large well-ventilated mat-house. At this moment, with a cool breeze blowing at 12·30 P.M., the thermometer close to me stands at 95°.

WM. BALFOUR BAIKIE.

V. *On the Compound Nature of the Cormophyte.* By ALEXANDER DICKSON, Esq.

The investigation of the nature of the plant is one of the highest importance. It will be only when the phytologist is able to raise himself from his present position of doubt, and show satisfactorily what a vegetable is, that any hope of attaining to great general views in the field of biological science can be entertained. I do not here refer to the abstract definition of the *vegetable* as distinguished from the *animal*, believing that by the advance of science this is becoming daily more difficult, but allude to the more important question as to whether any given and acknowledged vegetable is a simple or compound organism; if compound, of what its members consist, or if there be such a thing as a vegetable individual at all.

The zoologist has done his part, and that well; but is it not rather to the discredit of botanical science, that, when its sister sciences are day by day acquiring increased definiteness, its students should be halting among theories whose name is legion, and hanging their heads when asked the apparently simple question, What is a vegetable?

Vegetable physiology has done much to bridge over the gulf which had so long appeared to separate the animal from the vegetable, and has led to the fond hope that they are capable of strict morphological comparison. Plants have been compared with plants, and their homologies have (at least in the higher forms) been successfully traced; but we have indeed made but little progress until we can attach a meaning to the different structures that we are comparing, and which can be done satisfactorily only by discovering what relation they bear to those of the animal organism.

The non-scientific observer is very much in the habit of looking upon plants as things with which he stands in no relations of fellowship. He may sometimes have the resemblance to himself of many animals forced upon his notice, and go the length of calling himself an animal, but the idea of classing himself along with plants appears preposterous; these he views as something entirely distinct,—almost as much so as rocks or minerals. Even the botanist can scarcely realize that those beautiful structures, which he plucks and mutilates without remorse, consist of living, breathing beings, living as he does upon this earth to enjoy it, and subject to the same mysterious and irresistible law of death which is inherent in his own constitution.

The subject which I at present attempt to treat has very important bearings upon phytological classification; the determination of the vegetable individual being the only means by which we can recognise the true values of the different structures composing the vegetable organism.

I cannot pretend to have given in the following remarks a complete solution of this very difficult problem; I shall have attained my object however, if I have afforded any suggestions which may lead others to the farther prosecution of this investigation.

When we examine one of those plants (the Cormophyte) which form the subject of this paper, we find that it can be broken up into a greater or less number of pieces, each of which possesses an inherent vitality, inasmuch as it may form another plant similar to that of which it was originally a member. If we suppose that the vegetable organism is possessed of a psychical or immaterial essence, it follows that there is in the plant, not one, but several psychical elements, one of which, at least, may be supposed to reside in each portion capable of continued independent growth. This I think must be at once apparent, since it cannot be imagined that a psychical element—or, in other words, an individual being or entity—is divisible, or that the mere act of division can call into life beings which had previously no existence. We have examples in many plants of natural dismemberment, as in the detachment of axillary buds in *Dentaria bulbifera, Lilium bulbiferum*, &c. These buds cannot be held by the philosophic botanist as essentially different from those which produce persistent branches; and yet, without doubt, new and independent organisms originate in this manner.

On the other hand, if we imagined the plant to be destitute of an immaterial element, as distinguished from a force or forces provisionally termed vital, but supposed to be essentially physical, we might view the various extensions of the plant, not as individuals, but merely as propagations of such arrangements of elementary particles, and of such forces as might be supposed to produce the phenomena of plant life.

There are certain physiologists who would thus separate *organisation* from a *necessary coexistence of an immaterial element*, and who, although admitting the existence of an immaterial element in the higher organisms, yet deny that it has any necessary connection with the development of the material structure. Such physiologists can with perfect consistency imagine that an organism in which they can perceive no manifestations of intellect, and no movements but what are apparently excito-motory or mechanical, that such an organism as they find in the plant is the product of a complex system of mere chemico-physical forces, inanimate as the elements by which it is surrounded, playing its part in the economy of nature, not for its own sake or enjoyment, but merely as a beautiful instrument contributing to the harmony which exists throughout the universe. These physiologists, however, have not been able to show that, in the higher organisms, the processes of cell-development and growth can take place beyond the sphere of the influence of a psychical element; they have never shown that cells, detached from a non-gemmiparous* animal, can continue the phenomena of assimila-

* There is always a source of fallacy from the possible existence of individualized germs in any portion which may be detached from a *gemmiparous* organism.

tion and multiplication apart from any connection with the body in which the immaterial essence resides. Without such proof I imagine that this theory cannot be held to be properly sustained.

In relation to this question I venture to submit the following propositions:—

1st, That under ordinary circumstances, what are termed elementary particles of matter combine to form inorganic compounds alone.

2d, That there must be some medium, through the agency of which the particles of matter forming an organism work in harmony towards a common end, producing thereby the most admirable and complex piece of machinery.

3d, That, whatever its nature and ultimate connection with the body may be, the psychical element is manifested more especially through the agency of the nervous system.

4th, That upon the working of the nervous system is dependent the proper nutrition, and consequently the *development*, of the different parts of the organism.

5th, That the immaterial element is capable of acting upon the material structure.

That matter, in ordinary circumstances, has no tendency to form other than inorganic compounds is sufficiently evidenced by the fact that the chemist has not as yet been enabled to form a single organic compound, much less an organised tissue, from its elements. In conceiving of the formation of an organism, we must suppose either that the particles of matter are possessed of a certain intelligence which enables them to work towards a common end, or that there is some other medium or influence (whether without or within the organism) by means of which this effect is produced, since it appears inconceivable that these particles should form such a machine by accident.

That the nervous system is, in the higher organisms, the medium of psychical manifestation is admitted by every physiologist who believes in the existence of an immaterial element; and that upon this system is dependent the proper nutrition of the body, is a doctrine allowed by all.

That the *immaterial* element is capable of acting upon the *material* is sufficiently evidenced by the action of the will upon the nervous substance conveying stimulus to a muscle, of the emotions upon different secretions, &c.

Do the material particles work intelligently towards the formation of the organised machine? As we have no evidence of their doing so, and as the phenomena presented by their action appears merely mechanical, entering into certain combinations under certain circumstances over which they have no control, these compounds being again decomposed when certain other conditions are presented,—It is therefore necessary to look for some medium possessed of a unity such as may produce this harmony which exists in the working of the organism. Such a *unity* may be looked for either in the great First Cause from whom all effects are primarily derived, or in that immaterial element residing within the organism itself.

It seems to me, that to suppose the Creator to be the immediate agent in the organisation of the body, involves a supposition which we are hardly entitled to admit,—viz., that the inherent properties or tendencies of the material particles were not sufficient for the purposes they were intended to serve. It appears more reasonable to suppose that organisation is the result, not of a direct interposition on the part of the Creator, but of what may be termed an unconscious involuntary action of the psychical element upon matter; that it is the result of laws impressed upon each as it came from the hands of the Creator; and therefore we are not required to suppose any changing of the natural tendencies of the material particles, — the tendencies exhibited by matter in the formation of an organism being, as it were, latent so long as it does not come into contact with that peculiar something which we call a psychical essence. The intimate relation of the nervous system to the psychical element, and, at the same time, to the nutritive processes of the organism, together with the undoubted fact, that a psychical act or influence is capable of producing a physical effect, lead to the same conclusion; and, indeed, one cannot conceive a more natural supposition than that the formation of the body is regulated by that *immaterial unity* for the manifestation of which it was originally destined.

Organisation may be said to result from the exertion of a certain form of force inherent in the ultimate nature of the psychical principle upon material particles with which it is brought into certain relations, from which originates a series of complex chemico-physical processes, the direction and limits of which are so regulated as to produce a structure of a definite shape, such as may be completely adapted to the form or grade of psychical manifestation which is destined to occur, and to its place or sphere of action. The *morphological characteristics* of each species are no doubt due to peculiarities in the ultimate constitution of the material structure with which the psychical element comes into connection, as well as to differences in the *kind* and the *degree* of the action which this element is capable of exercising upon it.

An organism only exists for, and can only be produced by, the manifestation of a psychical or immaterial element.

Thus, on the ground that the vegetable is organised,—*i.e.*, presents those same phenomena of cell development and multiplication which the animal organism does,—I am led to hold that it, or its members, possess an immaterial individualising element.*

Again, the great advance which has been made within a comparatively recent period in vegetable physiology, more especially the demonstration of male and female reproductive structures in the "Phanerogamia," and of moving filaments in the "antheridia" of the "Cryptogamia," and the researches which have been made in vegetable embryology, have brought to light so much analogy between the plant and the animal as to leave us in no doubt that they are produced according to one primary developmental law; and as it were unphilo-

* Professor Goodsir, in treating of "Life and Organisation," refers to the plant as follows:—"We are quite entitled to state, as a legitimate hypothesis, that in every individual plant there is an indwelling psyche; more simply endowed than that of the lowest animal; specific for each species of plant, and therefore incapable of further evolution; never manifesting itself in psychical acts appreciable to us; and performing only the lowest function of the animal psyche, constituting the psychical form in the presence or midst of which the organisation is co-ordinated." I have here to acknowledge Professor Goodsir's kindness in having allowed me to make the above extract from his lecture on "Life and Organisation," delivered before the Royal Medical Society of Edinburgh, and as yet unpublished.

sophical to suppose that the teleological principle accompanying this morphological law is not correspondingly uniform,—in fact, as the abstract primary meaning of an *organism* must be the same in all cases,—it may be concluded that, as in the higher animal organisms, including man,* the primary purpose served by the body is the manifestation of a psychical element, so, in the vegetable organism, is the material structure designed for a like manifestation. If the plant be morphologically comparable to the animal, I cannot but believe in its possession of an immaterial essence.

It may, however, still be objected, that the apparent deficiency of a nervous system in the vegetable organism constitutes a difficulty in our conception of the plant as a medium of psychical manifestation. It is indeed true that in the higher organisms psychical manifestations occur through the medium of a nervous system, and it is equally true that, so far as has been observed, no such system exists among vegetable organisms; but it must not thence be supposed that these have no psychical element to be manifested. In the animal kingdom it is observed that as we descend the scale, we find that those systems which, in the higher organisms, perform their distinct functions, become gradually less and less differentiated, until at last we find all the phenomena of animal life manifested in organisms whose bounding membrane consists of a single cell-wall, where the processes of digestion, absorption, circulation, respiration, and reproduction are carried on without any of the complex special organs which occur in the higher forms. Need we therefore suppose the nervous system to form an exception to this rule? Is it not more consistent to suppose, that a special nervous structure is

* In man, the body is organised primarily with reference to that *psychical* element of his constitution by means of which (through the body) he is brought into relation with the external world.

By the *spiritual* element of his constitution, he is brought into special relations with the Deity, and is rendered capable of observing the workings of his internal or mental world.

This spiritual element stands, as it were, in a secondary relation to the organised matter.

As a medium of relation or of external manifestation, *the body and "psyche" collectively*, may be said to bear to the "*pneuma*," a relation analogous to that which the *body* bears to the *psyche*.

necessary, not for psychical manifestation in the abstract, but only for the higher stages of that manifestation in particular?

The tissues of the vegetable individual may be easily conceived of as capable of receiving or transmitting impressions for the regulation of the functions of the organism (the most complex form of nervous system is indeed nothing more than a mass of peculiarly developed cells); and that this power of transmitting impressions is diffused generally throughout the substance of the vegetable organism, is rendered probable both from the apparent want of a structure specially developed for that purpose, and from the currents of electricity* which seem to pervade its tissues.

Lastly, when we consider the almost insensible gradation in the degrees of psychical manifestation exhibited by the various animals as we descend the zoological scale, and the merging, as it were, of the animal into the vegetable kingdom, through such organisms as the *Diatomaceæ*, those animated cells whose position is yet hardly settled, we cannot reasonably suppose that at any particular point the psychical element ceases to exist, but are rather led to conclude that it exists throughout the vegetable as well as the animal series.

Having thus stated these various grounds for believing vegetable life to be the result of a psychical manifestation, I recur to the statement made at the beginning of this paper, with reference to the divisibility of the vegetable organism, and thence conclude that the plant consists of a series of *individual phyta* so united, and in so far mutually dependent upon each other, as to form what has been appropriately termed a "*compound organism.*"

I would now briefly consider what are the individual members of this compound organism. On this question numerous theories have been started, but I shall confine my attention to the three theories which alone seem to possess any claims to probability,—viz., 1*st*, that the *cell;* 2*d*, that the *shoot;* and,

* It must here be noticed, that although electric currents probably do exist in the vegetable organism, yet the conclusions of phytological electricians on this subject must be received with great caution, until we can be assured that their processes of investigation are free from sources of fallacy.

3d, that the *leaf*, constitutes the *phyton* or vegetable individual.

Although the phyton in all those plants termed Thallophytes is probably unicellular,* yet there are circumstances which render it extremely improbable that the cormophyte is built up of unicellular phyta. In the first place, our power of propagating the cormophyte by detached portions is very limited, not extending farther than the shoot, which consists of a series of leaves, and consequently of an immense number of cells. This I think could hardly be the case had each cell possessed an independent vitality. Added to this, the existence of "serially homologous" members of the shoot, with such distinct differentiation of their several functions as is found in the various modified leaves, reminds us so forcibly of the serial homologies observed in the *organs* of vertebrate, annulose, and molluscous animals, or of that analogous series of *individuals* which constitute the members of the shoot in the zoophyte, as to leave little room for doubt that they belong to one or other of these categories; and thus the first theory may be considered untenable.

The second theory—viz., that the shoot constitutes the phyton—has been supported by several very eminent botanists, among whom may be mentioned Professor Braun of Berlin, whose paper in the Transactions of the Royal Prussian Academy of Sciences for 1853 contains a very able defence of this doctrine. As I would but trespass unnecessarily on your time by entering into a critical examination of all that has been adduced in favour of this view, I shall confine myself to a statement of the ground upon which I feel compelled to reject it.

There are many shoots which have no natural conclusion of their development, and which, at whatever period they may be observed, invariably present provision for further extension in the shape of what is not very correctly called a terminal bud. As the development of these shoots is never observed to come to a definite termination from the continued progressive evolution

* The term "unicellular," thus applied, is not strictly correct, as in most of, if not all such individuals, there exist included secondary cells, but it may be conveniently employed to avoid a circumlocution otherwise necessary.

of new leaves at their extremity, they cannot be said to undergo at any time a natural death. To meet this difficulty, Professor Braun is led to deny the universal occurrence of death among organised beings. On an observation of Schleiden's, that "the idea of individual life necessarily demands as its characteristic the individual death already conditioned in the organisation itself," he remarks, that in many respects this statement possesses no general truth, because, says he, "for the very reason that natural death is the result of a determinate conclusion of the development, those shoots (vegetable individuals) which have no such conclusion frequently undergo no death at all, except that of some of their parts; but this is a concomitant of animal life itself (casting of the skin, moulting, and other organic changes in the body)."*

Throughout the animal kingdom, wherever there have been opportunities for observation, evidence is abundant as to the inevitable occurrence of death to each individual, and it is not easy to see why it should not be equally the case among plants which otherwise present so much analogy to the members of the animal kingdom. The fact that every species is provided with arrangements for the reproduction of its kind, seems to me of itself sufficient evidence of the law of universal death. It appears absurd to suppose that the reproductive apparatus serves as a counter-agent to those causes external to the organism which produce casual death. This reproductive structure must, like all the other organs of the body, have a primary reference to the organism itself, to the laws to which it is subject. The reproductive organs can have primary reference only to a law which tends to exterminate the species, and which operates within the organism itself; and that such a law of death exists in the animal kingdom there can be no doubt. If such be the meaning of the reproductive organs in the animal kingdom, it were unphilosophical to suppose that, as we enter the vegetable kingdom, the phenomena of reproduction should have there acquired an entirely different signification.

* See translation in "Annals of Natural History," vol. xvi., p. 336, and the original in the Transactions of the Royal Prussian Academy of Sciences for 1853, p. 55.

With regard to the third theory, that the leaf is the phyton, it may be remarked, in the first place, that it is free from the objection which has just been made to the individuality of the shoot; and, secondly, the "metamorphoses" of the leaf in performance of the protective, respiratory-nutritive, and reproductive functions of the organism, present such unmistakeable analogies to similar changes in the undoubtedly individualized polypes of the compound zoophyte, as to leave the observer in little doubt as to the true nature of the leaf.

Professor E. Forbes, in his beautiful sketch of the morphology of the reproductive system of the Sertularian zoophytes, has shown that the polypes which, by successive gemmation in definite order, form a branched plant-like coralline, do at certain parts form reproductive vesicles, which result from the coalescence of the polype-cells composing an axis, and often accompanied by a shortening of that axis. He has shown that these polypes occasionally present abnormalities very similar to those observed in plants: one case in which branches, bearing regular cells, seemed to spring out of vesicles, and to be changed in some instances into vesicles again; and another, where the branch was partially transformed into an ovigerous vesicle, whilst the polypes of the basal extremity retained their normal nutritive character.

The shoots of these zoophytes are perfectly comparable to plant shoots. In the greater number of Sertularians, secondary shoots are mere repetitions of those from which they spring. The polype individuals, on the other hand, do not present the slightest analogy to vegetable shoots; their development is perfectly definite, and they resemble leaves in springing from the axis at regular intervals, being opposite, alternate, or uniserial in their arrangement. That these arrangements are, like those of the leaves in the plant, modifications of a spiral evolution of the members of the shoot, may be gathered from an examination of the more regularly developed compound Actinozoa.

The formation of ovigerous vesicles, as described by Forbes, presents a close analogy to the frequent coalescence of the members of the vegetable shoot in forming the floral envelopes, and fruit.

In conclusion, I would state my reasons for differing from Professors Steenstrup, Owen, and Forbes, in their determination of the carpel as the female generative phyton, and from the two first in their pronouncing the stamen to be the male phyton.

Adolphe Brongniart, in his papers upon vegetable monstrosities, has, I think, completely established the fact, that the seed or ovule of the plant is a modified leaf. The female generative phyton would thus be found, not in the carpel, but in the ovule. M. Brongniart, however, has supposed that, while the seeds proceeding from central placentæ are the modified leaves of the prolonged floral axis, those produced on parietal placentæ are merely modified lobes or denticulations of the carpel. In a small notice relating to this subject which I submitted to the Society last year, I argued that it was "unphilosophical to suppose that structures, so manifestly similar to each other in their general anatomical details, and which are identical as regards their physiological function, as the ovules throughout the higher Phanerogamia, should be specific formations in one set of plants, and not so in another." The ovules in *Primula sinensis* have been shown by M. Brongniart to be manifestly modified leaves; and without doubt the ovules of Delphinium have a similar morphological constitution.

I am much inclined to believe that there exist in reality two modes of placentation: the one where the ovules are produced by a process of gemmation from the carpellary leaves (*parietal*); the other where the ovules spring from the prolonged floral axis (*central*). The placenta itself (whether central or parietal) is the axis formed by, or belonging to, the seeds or female generative leaves.

That ovules may be produced upon true parietal placentæ appears strongly confirmed by some curious monstrosities in the flowers of *Salix Andersoniana*, described by Mr Lowe in the Society's Transactions, vol. v., p. 113; where the stamens, more or less united by their filaments, were metamorphosed into carpels, the ovules being produced on the margins of the modified anther. I have myself, within the last month, observed in the flowers of a Salix, which I obtained at Arniston, near Dalkeith, an abnormality very similar to Mr Lowe's, excepting that there was no junction of the filaments of the two modified stamens. That these rudimentary ovules, produced upon the modified anther-lobes, and separated from the floral axis by the long filament of the stamen, should be developed from that axis, or a prolongation of it, is an idea which is hardly admissible. The placentation in this case must, I think, be called parietal.

Much is yet required before we can arrive at a satisfactory determination of the true relations which the *fruit* of the flowering plant bears to the *reproductive vesicles* of the compound Hydrozoön. We must obtain a deeper insight into the precise nature of the structures concerned in the formation of both before any minute comparison can become practicable.

Those vesicles, however, in Laomedea, Campanularia, &c., which Professor Allman has described under the name of "capsular compound gonophores,"* appear to present a close analogy to the fruit of the plant. The medusoid "sporosacs" (when female) are comparable to the seeds of the plant. The "blastostyle" of Dr Allman may be compared to what botanists have called the "placenta." The "capsule," by which the blastostyle, with its medusoid gemmules, is inclosed, corresponds probably to the carpellary whorl of the flower.

The "nucleus" of the seed must, I believe, be considered as the specific reproductive organ, or ovary. Whether this be analogous to those glandular papillæ on the stipules in the Cinchonaceæ, "nectaries," &c., is a question well worthy of attention.

The "embryo-sac" (in "angiosperms") corresponds to the ovum of the animal. The development of several germinal vesicles in this vegetable ovum is not without its parallel in the animal kingdom.†

With regard to the *male* phyton, I believe that there are sufficient grounds for the belief that it appears in the Phanerogamia as the *pollen-cell*. In the first place, the continuation for many months of the life and growth of the pollen-cell after its discharge from the anther, in the Coniferæ, would appear to indicate that this was the case, although an organic

* Transactions of the Royal Society of Edinburgh for 1858; also in Edinburgh New Philosophical Journal, April 1858, p. 295.

† Leydig's Lehrbuch der Histologie, p. 551.

connection with the tissues, through which its tube penetrates, is conceivable without supposing the pollen-grain to be necessarily individualized. *2dly*, Upon tracing the pollen-grain and its homologues from the "Phanerogamia" into the "higher Cryptogamia," we find a gradual exaltation of the development of these fertilizing structures, until, on reaching the mosses and their allies, we find them occupying the position of modified leaves. In the "angiospermous Phanerogamia," we find the pollen-cell filled by a viscid fluid, along with starch and oil-globules; besides this, there is nothing apparent. In "gymnosperms," among the Cupressineæ, cellules appear to be formed in the pollen-tubes during fertilization.* From this first indication of increased elaboration of the contents of the pollen-cell we are led to those pollen-like cells, the "small spores" of the Lycopods and their allies, the cellular contents of which appear to resemble, in all essential particulars, the sperm-cells of the animal organism. In the Spermatozoids of the "higher Cryptogamia," we have a perfectly animal-like elaboration of the fertilizing secretion.

In ferns we find the development carried a stage farther; the structure containing the sperm-cells is no longer composed of a single cell, but is a multicellular, although very simple structure. In the Equisetaceæ we have a still greater development, leading us, without any abruptness, to the club-shaped cellular sacs containing sperm-cells, which are produced by the mosses and their allies, and which are often seen (*e.g.*, in Mnium) clustering at the end of a shortened axis, just as the female reproductive leaves do in the flowering plants.

Again, the apparent substitution of ovules for pollen upon the modified anther-lobes of the salices, observed by Mr Lowe, and subsequently by myself, seems to indicate that the ovule and the pollen-grain are interchangeable, and therefore homologous. The gemmiparous condition of the anther in house-leek, which has sometimes been observed, also favours this view. For these reasons I cannot agree with Professor Owen when he says—"The spermatozoön of the male Aphis answers to the pollen-filament of the male leaf or 'stamen.'"†

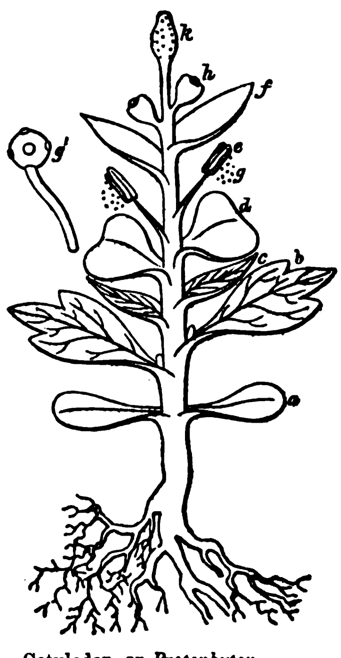
* Griffith and Henfrey's Micrographic Dictionary, p. 518.

† Owen, Parthenogenesis, p. 59.

The pollen-cell must, I think, be considered as the male phyton; and I am very much inclined to compare it, with its long tube, to those minute rudimentary-looking males with long proboscidiform penes which occur in the Cirrhipedia.

If I be correct in the view I have just taken of the male and female individuals in the cormophyte, it is manifest that the names at present connected with these structures are wholly inapplicable. The terms "ovary," "ovule," "placenta," &c., are, indeed, worse than meaningless, as they convey erroneous impressions, whatever be the theory adopted of vegetable individuality. I would propose, therefore, to term the female generative phyton ("ovule" in angiosperms; "corpuscle" in gymnosperms; "archegonium" in lycopods, ferns, mosses, and their allies) *Theleophyton* (from θῆλυς, female, and φυτόν, plant). The "placenta," whether central or parietal, may be called *theleophytal axis*. The male phyton I would call *Arrenophyton* (from ἄῤῥεν, male). The cotyledons may be termed *Protophyta;* the leaves, *par excellence, Phyllophyta;* the sepals, *Sepalophyta;* the petals, *Petalophyta;* the stamen, *Stematophyta* (from στῆμα, a stamen); the carpels, *Carpophyta.* The termination of the theleophytal axis, called stigma, is probably composed of a number of rudimentary phyta, which, by their viscid secretion afford attachment, and probably nourishment, to the pollen-cells, and which may be termed *Stigmatophyta.*

Scheme of a Dicotyledonous Phanerogam.



a. Cotyledon, or *Protophyton.*
b. Leaf, or *Phyllophyton.*
c. Sepal, or *Sepalopyhton.*
d. Petal, or *Petalophyton.*
e. Stamen, or *Stematophyton.*
f. Carpel, or *Carpophyton.*
g. Pollen-grain, or *Arrenophyton.*
g'. Do. do. with tube; enlarged.
h. Seed, or *Theleophyton.*
k. Stigma, composed of *Stigmatophyta.*

Thursday, 10*th June* 1858.—Dr SELLER, President, in the Chair.

The following donation to the Library was announced:—

Examination of species of Algæ, compounded under the name of *Laminaria digitata*. By M. Le Jolis of Cherbourg.—From the Author.

Dr Balfour announced the following donations to the University Herbarium and the Botanical Museum:—

From Dr Greville—Collection of Madagascar Plants, and of Fungi, named by Fries.

Mr Keddie, Glasgow—Specimens of Plants from Syria.

Mrs Nasmyth—Flowering panicles of *Gynerium argenteum*.

Captain Archer—Peculiar long narrow Basket used in the preparation of Cassava Starch.

Mr Thomas C. Davies—Silky Hairs from a Cape Plant (Protea ?).

Mr Archibald—Woods from the Irish Bogs, accompanied by the following note:—

"I send you a few specimens of Oak, Willow, and Fir, which were dug up on the boggy ground of my farm at Deescart, in the county of Monaghan, Ireland, four miles from the town of Carrickmacross. The bog surrounds the Lake of Deescart, the depth of the water of which, by the arterial drainage, a few years ago, was reduced about 3 feet, and in the reclaiming of the bogs, these specimens were found from 1 to 4 feet under the surface. One peculiarity I am not able to account for is, that both large and small blocks are quite black, others the natural colour of Oak, and a few of a very light colour, and found within one or two yards of each other.

Rev. Zerub Baillie, Calabar—Pod of the Calabar Poison Bean, called by the natives "Esere." Pod of a Leguminous Plant, the seeds being furnished with a beautiful aril.

Mr Fortune—Thick stem of *Buddlea globosa*.

Mr Brander—Bark of a Myrtaceous Tree from the Azores.

J. G. Booth jun., Esq.—Cones of *Pinus Coulteri*, *Pinus palustris*, *Pinus pseudo-strobus*, *Pinus caroliniana*, and *Pinus patula;* also specimens of the following plants:—

Specimens of Java plants from J. G. Booth jun., Esq. Among these are the following:—*Krankinia chrysantha*, De Vriese (*Primula imperialis*), collected at the height of 9000 ft.; *Andropogon acicularis; Sericura elegans*, Harsk.; *Phacilanthus multiflorus* (?), 9980 ft.; *Scleria purpurea* (?), 5000 ft.; *Eriocaulon*, sp. (?), 5000 ft.; *Xyris*, sp. (?), 5000 ft.; *Equisetum*, sp. (?), 2000 ft.; *Selaginella*, *sp*. (?), 7500 ft.; *Lycopodium*, sp. (?), 9800 ft.; *Lycopodium Hippuris; Polypodium Horsfieldi*, R. Br., 6000 ft.; *Hemi-*

onitis semicostata; Gleichenia vulcanica, Bl.; *Polypodium*, sp. (?); *Niphobolus*, sp. (?)

Dr Balfour called the attention of the Society to the death of one of its members, in the following terms:—"It is with deep regret that I have this night to record the death of Dr James Barnston, Professor of Botany in the University of M'Gill College, Montreal, who was for several years an active member of the Society, and who prosecuted his botanical studies with great zeal and ability. He was the eldest son of George Barnston, chief factor of the Honourable Hudson's Bay Company, and was born at Norway House, in the territories of that Company, on 3d July 1831. He commenced his studies at Red River Settlement in 1840, and remained there for a period of five years. He then went to Canada. In 1847 he came to Edinburgh and entered on the study of medicine. He was a student of the Botanical class here in 1848 and 1849, and gained prizes for proficiency, and he became a Fellow of this Society on 13th December 1849. He graduated in Edinburgh in August 1852, and wrote a thesis on Scarlatina, which was one of those selected for competition for the Dissertation Prizes. He passed an excellent examination, and returned to Canada in 1853, and commenced practice in Montreal. His love of science did not desert him amidst the cares of professional life. He still continued to prosecute Botany,—a taste for which he had imbibed during his residence here. He was instrumental in getting a Chair of Botany instituted in M'Gill College, Montreal; and he was appointed the first Professor in 1857. His lectures met with high approbation in the College, and he was the means of diffusing a taste for his favourite science. He became botanical editor of a periodical entitled the "Canadian Naturalist and Geologist," which is published bi-monthly at Montreal. He was an active member of the Natural History Society of Montreal. He has been mysteriously cut off in the midst of his usefulness. His loss will be felt in no ordinary degree by that institution in which he was an eminent Professor. Those of us who knew him during his residence here feel that we have lost a friend with whom we had much pleasant intercourse. He was one who secured universal esteem and respect. He was an enthusiastic student, a genial companion, and an obliging friend. I had great reason to rejoice in his success. I saw, with feelings of pride, a zealous pupil attaining eminence as a botanical instructor, and I looked forward to his occupying a still more eminent position among the naturalists of Canada. But the hopes of his friends have been checked by the hand of death. He has been cut off in the prime of life, at the early age of twenty-seven. He exhibited throughout life a Christian deportment; and his latter end was peace. He died on 20th May 1858. In his introductory lectures to the course of Botany in M'Gill College in 1857, the following concluding remarks occur, which seem to be a fit conclusion to this hasty notice:—"The deeper your study of the operations and phenomena of nature, the more intimate your acquaintance with the structure and functions of the plant, the greater will be the pleasure and gratification you will experience, and the more profound will be your admiration of this portion of God's creation. With a knowledge of botanical science, you cannot but take delight hereafter in the contemplation of those beautiful and varied objects of nature that will constantly meet your eye; and if you look on them as living organizations, and study the manifestations of life they exhibit, and the laws which govern them, in the true spirit of wisdom, they will subserve a better and higher purpose than the mere gratification of the mind. They will enrich it with pure and lofty thoughts, and raise your souls in admiring contemplation to Him, at whose fiat, at the beginning, 'the earth brought forth grass, the herb yielding seed after his kind, and the tree yielding fruit, whose seed is in itself, after his kind.' The beauty and perfection of the plant can never be ignored, when we remember that it is recorded that 'God saw that it was good.'"

The following communications were read:—

I. *Notes in regard to the Production of Forked Varieties of Ferns from Spores.* Illustrated by Plants and Specimens. By Professor BALFOUR.

The term spore, as used by botanical authors, has different meanings. It is applied to the small cellular body produced by a direct process of reproduction,—*i.e.*, by the contact of antheridian and pistillidian cells or their contents,—as well to a cellular body produced in certain parts of plants without the influence of reproductive organs. Each of these kinds of spores, when placed in favourable circumstances, germinates, and gives origin to an independent plant or vegetable organism.

As an example of the first kind of spore, we may take that of Confervæ, in which conjugation takes place. As the result of this process, a cellular germinating body is at once produced. Sometimes the cell has cilia, and moves about until it reaches some spot in which it becomes fixed, and then sprouts. The same kind of spore is common in seaweeds, some of which are monœcious or diœcious. In these the contact of the spermatozoids from the antheridian cells, and the archegonial cell of the pistillidium, gives origin to a germinating spore, which forms at once a new plant, bearing, like its parent or parents, antheridia and pistillidia. In the case, however, of the higher Cryptogams, as ferns and mosses, and their allies, the archegonium produces a cell which, after contact with spermatozoids, becomes a spore, which germinates and produces a plant bearing other kinds of sporoid bodies, which are contained in sporangia or cases, and which become finally detached from the plants. When placed in favourable condition, these separable spores or sporoid cells sprout and produce, not the ordinary plant, but a peculiar cellular expansion or prothallus, either external or internal, which bears upon its surface antheridian and archegonial cells, or proper reproductive organs. An impregnated archegonial cell of the prothallus then produces the plant in its ordinary form. These spores, when taken from forking or crisp varieties of ferns, seem to have a remarkable tendency to keep up the variations present in the plants whence they have been taken.

Mr M'Nab has noticed that the forked varieties of ferns are easily propagated in this way. He finds that the spores almost invariably produce these varieties; and he has no difficulty in keeping up a stock of these abnormal forms. These spores would thus appear rather to resemble the buds of higher plants, which keep up varieties more certainly than seeds do. The spores of ferns and of mosses have been looked upon by some as peculiar separable buds, which are contained in cases, and are detached at certain periods. Besides these spores, some ferns, as *Asplenium bulbiferum*, produce fixed buds or bulbils, which germinate while attached to the plant. The spores of these varieties of ferns, in a wild state, do not seem to propagate similar ferns readily; for such varieties are comparatively rare in a native condition. Yet it would appear that when grown in the garden they are abundantly produced from spores.

A point in regard to the fern spores requires attention, and that is, that they do not at once produce a frond bearing similar spores, but they pass through a prothalloid stage with antheridia and archegonia, and after impregnation the archegonial cell produces the sporiferous frond.

Here, then, the analogy with buds will not hold, for the sporoid bud passes through a reproductive stage before producing the frond.

But a question arises, is it necessary that a sporiferous frond must pass through this reproductive stage. It would appear not, for in a tree fern, while there is produced at first a prothallus with reproductive organs, yet this is not the case subsequently. It would appear, therefore, that sporiferous fronds may continue to be regularly produced without any evident direct impregnation.

Some, however, may be disposed to take the view, that when once an archegonial cell has been impregnated, its influence may extend through successive generations, while others may say that these spores, which are not the direct product of organs of reproduction, may be analogous to parthenogenetic seeds, or embryos produced without any contact of pollen; in fact, that they are germinating cells, which require no influence from the antheridia, and are therefore developed by a true process of parthenogenesis.

On such a supposition, a tree fern, produced from a spore at first, and passing through a prothalloid stage, with organs of reproduction, continues to produce ever afterwards parthenogenetic spores or cells. Such cells may have a tendency to propagate particular forms of plants, just as is the case in the *Cœlobogyne*, where female plants have always been produced from seeds not acted on by pollen. In this way we may account for the spores of these fully-developed anomalous ferns always producing varieties like their parents.

The subject is a curious one, and well worthy of further investigation. The experiments of Mr M'Nab are remarkable, and deserve to be recorded. What we want to know is:—

1. Is a sporiferous frond produced without a previous archegonial stage?

2. Is there anything peculiar in the structure of the spores in the sporangia of ferns, and more especially in those of the anomalous forked ferns to which we have referred?

3. Do the spores, when produced on the first frond, directly proceeding from the archegonial cell, differ from those produced on subsequent fronds?

4. Have the spores in the first frond the same tendency to reproduce these marked varieties as those on subsequent fronds without a prothallus?

5. Do these spores exhibit anything analogous to parthenogenesis in the higher orders of plants?

For one who has the patience to investigate the matter, there is an interesting field open. It requires that the observer should examine spores, prothalli, with their antheridia, and archegonia, microscopically in all stages, and that he should have the means of growing these spores under his eye, so as to watch their development in all stages. To any who may wish to undertake such an investigation, the resources at hand in the Botanic Garden will be fully laid open, and all assistance will be given in the investigation. Mr M'Nab has led the way in this interesting cultivation of fern varieties, and he is able and ready to impart fully the result of his observations. On the table are displayed a series of interesting forms of ferns, which he has now cultivated for many years.

In connection with the subject of the production of ferns from spores, Mr M'Nab remarked that it was of great importance to collect the spores properly. He stated that where a number of ferns are growing together, and the spores are allowed to ripen, they seem to spread about in a remarkable way, and to be attracted by the sporangiferous fronds of the ferns around. Thus, he collected spores for two years from the ripe sporangiferous fronds of *Osmunda cinnamomea*, and on sowing them, under bell-glasses, there came up crops of *Polypodium Dryopteris*, and nothing else. So also, spores from the sporangiferous fronds of *Anemia fraxinifolia* for two years gave rise to crops of *Polypodium cæspitosum*; and the spores collected from the ripe sporangiferous fronds of *Darea diversifolia* produced a crop of *Blechnum braziliense*. Mr M'Nab remarked that the spores of the above were matured on the plants, and were growing along with many other species in the neighbourhood of the kinds produced. Spores of the above species taken from plants in a young state, and ripened in a book carried in the pocket, have now come true. In order, therefore, that the spores may produce the species or variety wanted, it seems necessary to collect them in a young state, and to take care that the spores of other ferns do not come into contact with the fronds.

II. *On M. S. De Luca's Claim to be the Discoverer of the Non-presence of Iodine in the Atmosphere, in Rain-Water, and in Snow.* By STEVENSON MACADAM, Ph.D., F.R.S.E., Lecturer on Chemistry, Edinburgh.

A communication, entitled "Recherches sur l'Iode Atmospherique," has lately been published by M. S. De Luca, in the "Journal de Pharmacie," in which the author details the results of a number of experiments conducted by him in reference to the general distribution of iodine, and in which he lays claim to be the first discoverer of the non-presence of iodine in the atmosphere, in rain-water, and in snow. Had M. De Luca confined himself to the recital of the apparatus and re-agents employed by him in his researches, and to the simple expression of the negative results obtained by him, I would not have considered it necessary to ask the Botanical Society of Edinburgh to allow me to protest against his non-recognition of the earlier labours of others; but since he has appended to his memoir an extract from a communication by M. Cloez on the same subject, in which priority of discovery is yielded to M. De Luca, I think it due to myself that the following statement of facts should be laid before the Society:—

At the meeting of the French Academy of Sciences on 5th May 1851, M. Chatin communicated a memoir, entitled "Presence de l'Iode dans l'Air," which was published in the "Comptes Rendus" of same date, and in which the author stated his opinion, that he had experimentally demonstrated the presence of iodine as a natural constituent of atmospheric air, rain-water, and snow. In the early part of 1852, I commenced a series of experiments upon this subject, with the view of being able, if possible, to verify the observations of Chatin; and on the 22d June of that year communicated to the late Professor Jameson the results obtained by me up to that time, and which were published in the "Edinburgh New Philosophical Journal" issued on the 1st July. In that paper it is distinctly stated that the air and rain-water experimented upon had yielded no iodine. The investigation was, however, proceeded with; and on the 8th July I communicated to the Botanical Society of Edinburgh a paper "On the Presence of Iodine in Various Plants, with some Remarks on its General Distribution," in which it is recorded that 4000 cubic feet of air, and successive quantities of rain-water collected at Edinburgh, and at Unst in the Shetlands, had failed to indicate the presence of the faintest trace of iodine. This paper was published in the "Chemical Gazette" (1852), in the Transactions of the Botanical Society, and elsewhere; and the substance of it, with the addition of the records of still further experiments, was published in the "Edinburgh New Philosophical Journal" for 1st October 1852. It is there stated that 100,000 cubic feet of atmospheric air had been passed through an apparatus fitted up to arrest iodine and iodides, and "that in the large volume of air subjected to examination there had not been an appreciable quantity of iodine." Twelve gallons of rain-water were likewise examined for iodine, "but without giving a positive result." The examination was continued; and on the 18th April 1853, I read a paper before the Chemical Society of London "On the General Distribution of Iodine," in which reference was made to my previous researches, and other experiments detailed, in which 12 gallons, and even 36 gallons of snow-water "did not exhibit the slightest indication of the presence of iodine," and that "the negative results of these experiments lead me to believe, that in the air, in the rain-water, and in the snow employed by me, there was not an appreciable quantity of iodine;" and that I differed "from the views expressed by Chatin in reference to the atmospheric distribution of iodine." It is likewise mentioned, that "so far as regards the process adopted by myself, it is worthy of remark that Thenard, in commenting upon the researches of Chatin, recommends that the metals most susceptible of being iodized should be exposed for some time to the action of the air. Some months previous to this suggestion being read to the Academy of Sciences, I had used iron and lead in the search for iodine; and ten days prior to the date of Thenard's paper, a report of some of my experiments was published in the 'Edinburgh New Philosophical Journal,' in which the use of the metals was clearly stated." ("Quarterly Journal Chem. Soc.," July 1854.) In September 1854, the foregoing researches formed part of a memoir "On the Distribution of Iodine in the Mineral, Vegetable, and Animal Kingdoms," read by me before the chemical section of the British Association, at the meeting in Liverpool, and which is published in the Transactions of that body, and in the "Pharmaceutical Society's Journal" for December 1854.

Besides the publication in this country, full abstracts of these papers appeared in the "Jahresbericht Chemie" (edited by Liebig and Kopp) for 1852 and 1853, in the "Journal de Pharmacie" for April 1853, and in other continental journals.

Now, the researches of M. S. De Luca were first noticed in the "Journal de Pharmacie" for October 1854; and the details of his experiments, accompanied by a positive statement as to the non-presence of iodine in the atmosphere, in rain-water, and in snow, did not appear till the numbers of the "Journal de Pharmacie" for December 1857, and January 1858. In these latter numbers we find the following:—

"Voici maintenant les experiences faites directement sur l'air, sur l'eau de pluie, et sur la neige.

"*a*. Le 30 Decembre 1852, j'ai monté dans une Chambre de la rue de Lacepédè un appareil disposé de la maniere suivante: . . . . . cet appareil a fonctionné depuis le 1er Decembre 1852 jus qu'an 4 du mois de Juin suivant, avec quelques jours d'interruption. . . . . . .

"*b*. Pendant que l'appareil précédent marchait j'ai fait d'autres expériences sur l'eau de pluie et sur la neige. . . . .

"*c*. Dans le mois de Fevrier 1854, depuis le 17 jusqu'au 23 une certaine quantité de neige est tombée avec quelque interruption dans Paris. J'ai profité de cette occasion pour rechercher l'iode dans la neige." . . . .

And in detailing the remaining experiments on rain-water, M. De Luca refers to

"1° Eau recueillie du 24 Juillet au 30 Septembre 1853.

"2° Eau recueillie du 1er au 31 Octobre 1853.

"3° Eau recueillie du 1er Novembre au 31 Decembre 1853.

"4° Eau recueillie du 1er Janvier au 1er Mars 1854.

"5° Eau recueillie du 2 Mars au 31 Mai.

"6° Eau recueillie du 1er au 30 Juin.

"7° Eau recueillie du 1er Juillet au 3 Août 1854."

It will thus be apparent that M. De Luca did not *commence* his experiments till the 30th December 1852,—viz., six months after my preliminary note to Professor Jameson had appeared in the "Edinburgh New Philosophical Journal," and three months after my principal researches had been published in detail in the same journal; and he *ceased* to collect material for his researches on 3d August 1854, immediately after which (October 1854) he announced, very shortly and vaguely, the negative results he had obtained. It was thus two years and three months after my preliminary statement, and exactly two years after my principal memoir had been laid before the scientific world, that the researches of M. De Luca were so far advanced as to enable him to record even a brief preliminary statement on the subject. Before this time, my researches had been laid before the Botanical Society of Edinburgh, the Chemical Society of London, and the British Association for the Advancement of Science; and full abstracts of these papers had appeared in many journals published in and out of Britain, including Liebig's and Kopp's "Jahresbericht Chemie," and the "Journal de Pharmacie." Moreover, the statement originally experimentally demonstrated and published by me, as to the non-presence of iodine in the atmosphere, had, previous to the publication of M. De Luca's researches, been corroborated by the labours of M. Casaseca of Havanna (" Comptes Rendus," 9th August 1853), who failed to discover the least trace of iodine in the rain-water which fell in the island of Cuba; and Dr Lohmeyer (" Comptes Rendus," 24th August 1853), who could not find iodine in the atmosphere near Göttingen. Indeed, seven months before M. De Luca published any of his experiments or deductions therefrom, my researches had been referred to by M. Chatin in his review of the labours of MM. Casaseca, Lohmeyer, and myself, which was published in the " Journal de Pharmacie" for March 1854.

It will thus be seen, if priority of publication is to be held conclusive as to priority of research, that M. De Luca cannot even rank second in order in refuting the doctrine of the atmospheric distribution of iodine, but will take the fourth place,—that is, after MM. Casaseca and Lohmeyer.

I may be allowed to state, that whilst repelling the claim of priority on the part of M. De Luca, I have no wish to refer in any way but praise of the processes adopted and the apparatus employed by him in his researches, and the evident care and accuracy of his manipulation; and, at the same time, I have also to express great admiration at the novel and thoroughly satisfactory experiments of M. Cloez on the same subject, which were read before the Institut de France, on the 23d May 1857, and are published in " L'Institut" for 10th June 1857. The conclusions he arrived at are likewise corroborative of the original statement made by me in 1852, that an appreciable amount of iodine or iodides could not be detected in the atmospheric air, in rain-water, or in snow.

III. *Recent Additions to the Cryptogamic Flora of Edinburgh.* By W. Nichol, M.D.

Filices.

Scolopendrium vulgare. Of this fern I collected several examples of the multifid variety in Dunglass Dean in June 1856. With these I procured a frond, which exhibits a monstrosity hitherto I believe unnoticed. In this specimen the apex is rounded and emarginate, and about half an inch below it the nerve separates from the lamina, and projects backwards for about half an inch as a curved process.

Musci.

Sphagnum fimbriatum. Duddingston Loch, in fruit.

Sphagnum contortum. Pool on W. Lomond, in fr.

Weissia crispula. Glen Queich, Ochils, Kinross-shire. Abundant.

Anœctangium compactum. Do.

Rhabdoweissia fugax. Do.

Tortula rigida. On the earthen top of a stone wall by the roadside, opposite Craiglockhart, near Edinburgh. Abundant.

Tortula tortuosa. Rocks in the wood at Craiglockhart.

Tortula revoluta. On stone walls; common at Merchiston and Bowbridge.

Tortula papillosa. On a rock on Arthur's Seat. A very anomalous situation.

Trichostomum rigidulum. Banks of the Esk, near Lasswade.

Didymodon flexifolius. Caerketton Hill, Pentlands. Barren.

Zygodon viridissimus. Rocks, Allermuir Burn, Pentlands. Barren.

Zygodon Mougeotii. Rocks, Glen Queich, Ochils. Rocks near Habbie's Howe, on Caerketton Hill, and at Bonalley, Pentlands.

Bryum julaceum. Glen Queich, Ochils, in fr.

Bryum julaceum β. concinnatum (*B. concinnatum*, Epr.). Rocks, Allermuir Burn, Pentlands.

Mnium stellare. Rocks, Glen Queich, Ochils, and rocks in the wood at Craiglockhart, Edinburgh. Barren. Not previously recorded from Scotland.

Mnium affine. Duddingston Loch. Abundant, but barren.

Bartramia arcuata. Glen Queich. Abundant.

Leskia Polyantha. On a tree by Bonalley Burn, near Dreghorn.

Plagiothecium pulchellum. Glen Queich, Ochils.

Rhynchostegium murale. Rocks in the wood at Craiglockhart.

Hypnum rugosum. Glen Queich, Ochils. One patch only found.

Jungermannia Lyoni. Glen Queich. Rocks near Habbie's Howe, Pentlands.

Metzgeria pubescens. Glen Queich.

Lichenes.

Sticta sylvatica. On a tree, Newhall, North Esk, near Carlops, and on rocks, Glen Queich, Ochils.

Parmelia physodes. In most abundant fructification on a stone wall near Carnbo, at the foot of the Ochils, Kinross-shire.

In an excursion to Perth last summer, I procured in the *Scheuchzeria palustris* marsh, near Methven, *Sphagnum contortum* in fruit, and *Orthotrichum phyllanthum* on a tree in the vicinity.

IV. *Botanical Notices.* By Professor BALFOUR. 1. *Qualities of* Hieracium virosum.

The following notes have been supplied by Dr Christison :—

"There are some poisonous species among the *Cichoriaceæ.* Among them may be mentioned the *Hieracium virosum,* Pall., which is often mistaken for *H. sabaudum,* and more especially *Crepis lacera.* (Tenore, Flora Neap. ii., p. 179, tab. 79, et ejusdem Syn., p. 402. DC. Prod. vii. 161.)

"Tenore says of this *Crepis,* in his Synopsis, p. 403 :— 'Venenatissima planta lacte maximè acri scabens; eademque, cum aliis sponte nascentibus Cichoreis, ad juscula conficienda lecta, sæpe illa comedentes miserrimè necavit.'

"Von Martens, in his 'Italien,' informs us respecting this plant :—'The *Angina* of the Neapolitans, called in the Abruzzi *Castellone,* constantly grows near calcareous rocks, and abundantly in the lower forest districts of the Apennines, from the Abruzzi to Calabria, especially on Gargano, where Micheli (Hortus Pisan., p. 81) represents it is as an herb which kills pigs; also on the mountains of Caserta, Anienza, &c. The leaves resemble those of the dandelion, the chicory, and other species of the same family, which are much used by the country people as food; and as these plants are all used in spring before they flower, mistakes are easily committed, and poisoning with the *Angina* is consequently not uncommon. Gussone pointed it out to me on Mount St Angelo, above Castellamare, near Naples, at an elevation of 2500 feet, and mentioned an instance of poisoning of a whole family by it. The mother and children died in fearful tortures, and the husband alone recovered. On 21st July it was in full flower, and was then easily known by its tuft of gold-yellow flowers, and the mealy bloom which covered particularly the upper part of the plant, giving it a grayish-white appearance. When recognised in this state, the information is spread from mouth to mouth, so that the chicory gatherers may avoid in spring the places in which the *Angina* has been seen during the previous summer.' (Schultz, in Buchner's 'Repertorium für Pharmacie,' 1853, ii. 77, from 'Bonplandia,' i. 4)."

2. *Boethius' Notice of* Solatrum amentiale, *and its effects on the troops of the King of Norway.*

Boethius, in his "Historia Scotorum," says, "when Sueno, king of Norway, saw his brother add England to his Danish kingdom, he wished to equal his brother in glory and in empire. Accordingly, he came with an army to Scotland, alleging as a cause of war his desire to revenge the slaughter of his relative Carnus, and of other Danes slain with him at Barre, Crowdane, and Gemmere. But though Sueno came as it is said, with the view of acquiring fame and honour, yet he was not to be compared to his brother Canute; for he slew innocent children, women, and aged persons. When King Duncan heard of these shameful cruelties committed on his people, he felt called upon to prepare himself for battle. He assembled a large army, and divided it into three parts; the first battalion was given in charge to Macbeth; the second to Banquho; and he commanded the third himself, taking with him the greater part of the nobility. The armies of Duncan and Sueno met at Culross, not far from the place where the abbey of the Cistercian monks afterwards was built. The battle was carried on with great vigour, and with immense slaughter, on both sides. The Scots were defeated, and put to flight. The Danes, however, were so fatigued and broken up that they were unable to pursue their enemies, and they remained on the spot all night under cover. Next day, perceiving that the tents had disappeared, they fell upon the booty which had been left. At the same time, an order was given that no injury should be done to any unarmed person. In this way they hoped to conciliate the people, and make them declare in their favour. After this, Sueno pursued Duncan with his whole army. Having learned that King Duncan had fled to the Castle of Bertha, and that Macbeth was gathering fresh forces to resist his incursions, he laid siege to the said castle. When Duncan saw himself surrounded on all sides by enemies, and after having been closely beset for eight days, he sent, by advice of Banquho, a second messenger to Macbeth, commanding him to remain at Inchecuthill until further notice. At the same, time he despatched a herald to Sueno, with a request that he would allow him and his nobles to depart from the castle with their lives and fortune. Duncan made the request, although he knew it would be refused, with the view of making his enemies suppose that the castle would be given up without any further delay. Accordingly, having sent a messenger, he desired that Sueno would send a commissioner to the city, in order to arrange the terms of surrender. When he came, Duncan pretended that he did not wish to offer further resistance to Sueno, and that he was ready to give up the citadel. At the same time, in order to conciliate Sueno, and to cause a little delay, he promised to send a large quantity of provisions for the use of his army, in the shape of wine, beer, and corn. This offer pleased Sueno and his army, for they were in great want of fresh provisions, in consequence of the cattle and grain having been previously taken away to fortified places by the Scots. Before transmitting the provisions the Scots mixed the wine and beer with the juice of the maddening Solatrum (*Solatrum amentiale*). This is described as follows:—"Herba est ingentis quantitatis, acinos principio virides, ac mox ubi maturuerint purpureos et ad nigredinem vergentes habens, ad caulem enatos, sub foliis latentes, seque quasi retrahentes, vimque soporiferam, aut in amentiam agendi si affatim sumpseris habentes, magna ubertate in Scotia proveniens." An herb of great size, bearing berries, at first green, and, when ripe, purple, or verging to black, attached closely to the stem, and concealed under the leaves, as it were withdrawing themselves; possessing a soporific power, and driving to madness if taken largely; attaining great luxuriance in Scotland.

Sueno and his soldiers eagerly partook of this poisoned wine and beer, and swallowed them in large quantities. Accordingly, they soon fell into a profound comatose sleep. In the meantime Duncan sent a faithful messenger to Macbeth, telling him to come immediately with his army as the enemy were an easy prey. Macbeth accordingly having crossed the Tay, led his army to Bertha, and going out by the gate opposite to the position occupied by the Norwegians, under the guidance of Banquho, he reached the camp of the enemy. Then raising a loud cry, in order to ascertain if any of the enemy were awake or sober, they proceeded to slaughter their foes. The greater part, involved in deep sleep, were murdered in their beds. Some, driven to madness, did not understand what they did, or what was being done by their enemies. Some who had suspected the enemies' gifts, and had been kept free of the drug, ran to the king and endeavoured to rouse him, but finding that all was in vain, they carried him bodily during the night to the mouth of the Tay, where their ships were, and setting sail, proceeded to Norway. Thus the Norwegian army was destroyed. None escaped except Sueno, and those persons who were with him, along with the sailors. It is said that for many years afterwards all who were made knights in Norway were sworn to revenge the slaughter of their friends in Scotland. The other Danish ships which were left in the Scottish Firth were afterwards sunk by the violence of an east wind.

While the Scotch were rejoicing over this victory, the Danes made another invasion, and arrived at Kinghorn. Macbeth and Banquho were sent to oppose them, and gained a complete victory, slaughtering many, and driving the rest to their ships. The latter gave great sums of gold to Macbeth for the purpose of getting permission to bury their friends that were slain on the island of Inchcolm. It is said that old monumental stones, with the Danish inscriptions, were long observed on this island.

The question to be solved is, what is this *Solatrum* mentioned by Boethius. Bellenden, in his translation of Hector Boece's work calls it *Mekilwurt.* It appears to be *Atropa Belladonna*, judging by the characters of the fruit, &c., as they are given in the original. This plant is not very common in Scotland at the present day. It is found, however, near old castles, where it seems to have been cultivated for medicinal purposes. Not very far from Culross, in Fife, there is abundance of it.

V. *Notes on* Muscari latifolium *of Dr Kirk.* By MAXWELL T. MASTERS, Esq. Communicated by Professor BALFOUR.

Dr Balfour, stated that having seen a description of a new species of *Bellevalia* by Mr Masters, in the "Proceedings of the Linnean Society," and having remarked that the plant was obviously that described by Dr John Kirk at a meeting of the Botanical Society, under the name of *Muscari latifolium,** he had written to Mr Masters on the subject, and had received the following reply :—

"Your letter was forwarded to me from Oxford, and I should have replied to it sooner were it not that I have been very much engaged. Permit me now, however, to thank you for directing my attention to an omission on my part, the result of inadvertency rather than of discourtesy.

When my friends Drs Armitage and Playne placed their specimens of the plant to which you allude in my hands for examination, I was told by them that Dr Kirk also had specimens of the plant, which he intended to lay before the Botanical Society of Edinburgh as an undescribed species of *Muscari;* but that it was not his intention to describe the plant accurately. Moreover, till I received your letter, I was not aware that Dr Kirk was one of the party who discovered the plant. My notion was, that his specimens had been given to him by Dr Armitage. Undoubtedly, Dr Kirk's notice of the plant at the meeting of the Botanical Society of Edinburgh must take precedence of anything I have written concerning it; for although soon after Dr Playne's return from the East the specimens were examined superficially by that gentleman and myself, and referred to a new species, yet I did not make a more careful examination of the plant till early in the present year, after (as I *now* know) Dr Kirk had shown his specimens at the Edinburgh Botanical Society. The description I drew up some time before I sent it to the Linnean Society, and several weeks elapsed before my notice was read. In the meanwhile, the April number of the "Edinburgh Philosophical Journal" appeared, which, however, I had not seen till my attention was called to it by your note. Hence, I trust you will acquit me of any intentional lack of courtesy to Dr Kirk. I have written to the Secretary of the Linnean Society to say, that the plant I described is the same as that noticed by Dr Kirk under the name *Muscari latifolium* at the Botanical Society, and to explain how it was that I omitted to make mention of Dr Kirk's name.

I take the liberty of forwarding to you with this a copy of my note to the Linnean Society, which probably you have not yet seen, and from which you will see the reasons why I place the plant in the genus *Bellevalia* rather than in *Muscari.*

If you think it requisite, pray make the substance of this letter known at the Botanical Society; as I should be sorry to rest under the imputation of plagiarism or discourtesy. I am," &c.

Note to Linnean Society.—"Among the plants collected in the Troad by my friends Drs Armitage and Playne, attached to the

* See page 28 of the present volume.

Civil Hospital at Renkioi during the Crimean war, is what appears to me to be a new species of *Bellevalia*, Kunth. The specimens from which the following description is drawn up are all deficient in the bulb and perfect fruit. Presuming it to be a hitherto undescribed species, I would thus characterize it:—

Bellevalia floribus inferioribus campanulatis, basi angulatis pedicellatis horizontaliter patentibus vel pendentibus; superioribus tubulosis, sessilibus approximatis sterilibus: folio unico erecto oblongo-acuto basi in petiolum attenuato.

Habit, that of *Muscari*. Bulb not seen. Leaf erect, oblong acute, tapering into a petiole; six to eight inches long; greatest width, eight to ten lines. Scape erect, twice the length of the leaf, bearing an oblong crowded raceme, one to two inches long. Lower pedicels horizontal or pendent, two to three lines long, decreasing in length upwards. Uppermost flowers sessile. Bracts minute, membranaceous, lanceolate. Perianth in perfect flowers, purple, two to three lines long, deciduous, campanulate, angular at the base, not contracted at the throat; limb divided into six short, ovate, connivent lobes. Upper flowers imperfect, azure blue, tubular, sessile. Stamens six, arising from the middle of the tube of the perianth, included. Anthers adnate. Ovary deeply three-lobed, slightly rugose on the surface, three-celled, each cell with two large flattened ovules. Style, one, tapering, as long as the ovary, included. Stigma entire. Fruit membranous, three-celled. Seeds, two in each cell, large, compressed; testa brown.

If the genus *Bellevalia*, separated from *Muscari* by Kunth, be a good one, the plant above described must be included in it; inasmuch as in the form of the perianth and the cohesion of the styles it entirely agrees with that genus. On the other hand, the habit and general appearance of our present plant are so entirely those of *Muscari*, and so unlike those of any other species of *Bellevalia*, that doubts may be entertained whether this may not be a variety of some species of *Muscari;* and if so, the validity of the genus *Bellevalia*, as distinct from *Muscari*, will be much impaired."

VI. *Remarks on* Daltonia (Cryphæa) Lamyana, *Montag.* By M. Montagne.

Dr Balfour read an extract from a letter from M. Montagne, dated Paris, 28th May 1858, in which he observes that he had read in a late number of the "Annals and Magazine of Natural History" a report of the proceedings of the Botanical Society, in which it is stated that Dr Lawson had noticed the discovery in Britain of Montagne's *Daltonia*

(*Cryphæa*) *Lamyana*, but that owing to the want of an original specimen there was some difficulty in determining the identity of the two names, and of ascertaining the connections of the species.

M. Montagne therefore states, that with the view of shewing his sense of the honour which the Society conferred upon him by electing him a foreign honorary member, he has sent, in a letter, an authentic specimen of the Limoges Moss, in order that it may be submitted to Dr Lawson for his opinion, and for comparison with British specimens.

M. Montagne then refers to his paper in the "Annales des Sciences," where the moss has been described, and gives the characters of the species.

It appears that Bruch and Schimper consider the plant as only an aquatic variety of *Daltonia heteromalla*.

VII. *Remarks on M. Montagne's Specimen of* Cryphæa Lamyana. By George Lawson, Ph.D.

Dr Lawson stated that he had carefully examined the specimen above referred to, which M. Montagne had so kindly sent, and that he had compared it with the series of examples of *C. heteromalla* in the University Herbarium. There seems to be no doubt whatever that the specimen collected by the Rev. C. A. Johns, in the River Taw, belongs to the form named *C. Lamyana* by M. Montagne. Whether that is a good species is another question. Dr Lawson's examination has led him to the conclusion that it is not. M. Montagne refers specially to these characters as the most obvious ones of his species: "Foliis obtusiusculis (non acutis), perichætialibus dentatis (haud integris), operculo conico-incurvo (non acuminato recto)." Now the Limoges specimen exhibits leaves which are acute, the perichætial leaves are mostly entire, and the operculum, while short, conical, and incurved in some examples, is much elongated, acuminate, and quite straight and erect in others. The fact seems to be, that *Cryphæa heteromalla* is subject to considerable variation with respect to these characters, and that *C. Lamyana* cannot be satisfactorily separated as a species. It must be kept in view, however, that the form is a very distinct one as regards habit and habitat. Instead of growing on the trunks of trees like the usual state of *C. heteromalla*, it is submerged and attached to stones, and exhibits all the appearance of a true aquatic moss. It is very robust, and is of a less vivid hue than the normal form. Bruch, Schimper, and Gümbel in the "Bryologia Europæa," Müller in his "General Synopsis," Wilson in the "Bryologia Britannica," Stark in the popular "History of British Mosses," and other recent writers, have ranked the plant as a variety, under the name *aquatilis*; but Schimper, in his most recent work, the "Corollarium Bryologiæ Europæ," omits all mention of it; and, moreover, in his revised character of the genus *Cryphæa* (p. 98), uses the expression "habitatio arborea," which is quite at variance with M. Montagne's plant. The form is so distinct as a variety that it ought not to be overlooked, nor should the name given to it by M. Montagne be discarded. Dr Lawson therefore proposed that it should in future be recognised by botanists as *Cryphæa heteromalla*, *β. Lamyana*. Much praise is due to M. Montagne for the frank manner in which he has facilitated an examination of the claims of his plant to specific distinction, and it is to be hoped that the authors of doubtful species will more generally follow his example.

Dr Lawson placed in the collections at the Royal Botanic Garden a series of microscopical preparations, showing the characters above alluded to in M. Montagne's plant, along with the specimen which that gentleman had presented to the Herbarium.

8th July 1858.—Dr Seller, President, in the Chair.

The following Candidate was balloted for, and duly elected an Ordinary Fellow:—

Thomas J. Call, Esq., Surgeon, Alnwick.

The Curator announced the following donations to the Library:—

Transactions of the Natural History Society of Cherbourg—From the Society.

On the Scope and Tendency of Botanical Study. By Cuthbert Collingwood, M.A.—From the Author.

Professor Balfour stated that the following donations had been made to the Museum at the Botanic Garden :—

From Dr Joseph Fayrer—Specimen of silicified endogenous Stem from Allahabad; Pulicat Basket, made at Madras; Basket from Ceylon, made of plaited palm leaves.

Mr Methven—Roots of Elm, which had got access to a cistern, and spread to a great extent.

Mr Cay—Six varieties of Date Palm Fruit, brought from Cairo, June 1858. It was stated that the varieties are brought to market at different seasons of the year.

Dr Simpson, H.E.I.C.S.—Specimens of Butter from the *Bassia butyracea.*

Mr A. J. Macfarlan—Specimens of Micro-photographs illustrating vegetable structure.

The following papers were read :—

I. *Biographical Sketch of the late Robert Brown.** By Professor BALFOUR.

Robert Brown was born at Montrose on December 21, 1773. His father was a Scottish Episcopal clergyman in that town, who died in November 1791, and was buried in the Canongate churchyard, in the burying-ground belonging to the family of Bishop Keith. His mother died in 1816, and was interred in the same place. His friend, Mr Bennett, is now, in compliance with his wishes, preparing to erect a tablet to the memory of the above. He was educated at Montrose Grammar School, where he was a schoolfellow of Joseph Hume. He entered as a student at Marischal College, Aberdeen, and afterwards studied medicine at Edinburgh, where he attended the botanical class of the University, taught by Dr Rutherford. He completed his studies in 1793, and took the diploma of surgeon. In the same year he was appointed assistant surgeon and ensign to a regiment of Scotch fencibles, stationed in the north of Ireland. He remained there till the end of the year 1800. During his residence in Ireland he prosecuted botany with vigour, and became acquainted with a zealous botanist, Captain Dugald Carmichael, who was then serving in the same regiment. His discovery of a rare and

* In drawing up this sketch advantage has been taken of notices in the "Gardeners' Chronicle," the "Times," and the "Athenæum."

curious moss (*Glyphomitrion Daviesii*) made him known to Sir Joseph Banks, and a friendship was thus commenced between these two eminent men which only terminated with death, and which has materially influenced the progress of botanical science in Britain.

The Admiralty having resolved to fit out an expedition for the survey and exploration of the coast of Australia, Mr Brown, at the recommendation of Sir Joseph Banks, was selected to accompany its commander, Matthew Flinders, as naturalist, in H.M.S. "Investigator." Mr Brown was also accompanied by Ferdinand Bauer as botanical draughtsman, and by Mr Good as gardener. The expedition further included William Westall as landscape-painter; and among the midshipmen was Sir John Franklin, with whom Brown formed a most intimate friendship. The ship sailed in 1801; and after touching at Madeira and the Cape of Good Hope, arrived in the following year at King George's Sound, on the south-west coast of Australia. During a three weeks' stay at this place, Mr Brown collected 500 species of plants, the greater part of which were new to science. After botanizing at various other points along the south coast, Mr Brown landed at Port Jackson, and remained there for several weeks.

In July 1802, the northern survey commenced at Sandy Bay, in lat. 25°, and continued along the north-eastern and northern shores of Australia and the Gulf of Carpentaria to the Pelew and Wellesley's Islands (where the *Livistona australis* was discovered), and then to Wessel's Islands, long. 136° E. Here the rotten state of the "Investigator's" timbers, the ill health of Captain Flinders, and the appearance of scurvy amongst the crew, rendered it necessary to bear up for Timor, where they obtained provisions. Thence they steered along the west and south coasts of Australia, passed a second time through Bass's Straits, and arrived at Port Jackson on June 9, 1803, having lost many of their crew by dysentery, and among others, Peter Good the gardener, after whom Brown named the leguminous genus *Goodia*. The ship in which the expedition sailed was condemned as unseaworthy at Port Jackson in 1803. Captain Flinders then sailed for England in a hired vessel, the "Porpoise;" while Messrs

Brown, Bauer, and Allen remained behind, with the intention of exploring the colony for eighteen months, at the end of which period Captain Flinders expected to rejoin them in another ship, for the prosecution of the survey.

The "Porpoise," however, was wrecked on her homeward voyage, in Torres' Straits, and Flinders and a few companions reached Port Jackson in an open boat. Here the party procured a schooner, with which they proceeded to the wreck, and rescued the remainder of the crew. Subsequently Captain Flinders proceeded by way of Timor and Mauritius; and being compelled by the leaky state of the vessel to put into Port Louis, he was treacherously seized by the French governor, Captain Decaisne, although Napoleon had granted a free pass to his expedition. He was kept partly in prison and partly on parole from December 1803 till June 1810.

Brown and his companions, in the meantime, examined the Blue Mountains and other distant parts of New South Wales. They also visited Bass' Straits and Van Dieman's Land, and made extensive collections of plants. They resided at a station on the River Derwent for many months, including the period of the foundation of the town of Hobarton.

As Captain Flinders did not return, the party returned to England in October 1805, bringing with them a collection of 4000 species of plants, and a large number of drawings. All the living plants obtained during the survey perished in the wreck of the "Porpoise." Soon after his return Brown was appointed librarian to Sir Joseph Banks, in room of Dr Dryander, and he also became librarian of the Linnean Society. One of his earliest papers was published, during his residence in Edinburgh, in the "Transactions of the Wernerian Society of Edinburgh," on the family of *Asclepiadeæ*, an order of plants established by him. This paper showed his wonderful power of research, his capability of examining the structure of plants, and the acuteness and accuracy with which he could trace the development and physiology of organs. He published the results of his Australian researches partly in his "Prodromus Floræ Novæ Hollandiæ," which appeared in 1810, and partly in the "Appendix to the Narrative of Captain Flinder's Voyage," published in 1814. In his "Prodromus," he gave an account not only of the plants collected by himself, but also of those collected by Sir Joseph Banks during Captain Cook's first voyage. The work was published as a first volume, but it was never succeeded by a second. Its descriptions extend from Ferns to Goodenoviæ. It may be said to have been the first British botanical work in which a scientific classification of plants, according to the natural system, is given. Brown must be looked upon as the introducer of this system into Britain; and in this respect he showed himself to be a truly philosophical botanist, much in advance of his contemporaries in this country.

A critic in the "Edinburgh Review" had made rather free remarks on the classicality of the Latin of the Prodromus, at which the author took offence, and recalled the volume; so that it has become rather a rare work, and is generally only known through Dr Nees von Esenbeck's reprint in the "Vermischte Schriften." However, in 1830, he seemed to think better of his production, and issued a supplement, the only one that ever appeared. His second great work, "Plantæ Javanicæ Rariores," was published in conjunction with Dr Horsfield and Mr J. J. Bennett, and was completed within the years 1838–52. Of his other principal publications, we can only undertake to give the headings; but they will be sufficient to show the universality of his botanical knowledge, viz.:—"Observations on the Herbarium collected by Professor Christian Smith in Tuckey's Expedition on the Congo;" "Chloris Melvilleana, being Plants collected on Melville Island in Captain E. Parry's Expedition;" "Characters and Description of Kingia," a genus named after the late Captain Ph. King; "Observations on Plants collected in Denham and Clapperton's Expedition to Central Africa;" "General Remarks, Geographical and Statistical, on the Botany of Terra Australis;" "On Proteaceæ;" "Botanical Appendix to Captain Strutt's Expedition to Central Australia;" "Observations on Organs and Mode of Fecundation in Orchideæ and Asclepiadeæ;" "On the Fructification of Mosses;" "On Woodsia, a Genus of Ferns;" "On Compositæ;" "On some Remarkable Deviations from the usual Structure of Seeds and Fruits;" "Character and Description of Lyellia;" "Remarks on Leptostomum and Buxbaumia;" "Account of the Genus Rafflesia;" and, "On an undescribed Fossil Fruit—Triplosporite," the last named being that with which he concluded his scientific labours; it was published in the Transactions of the Linnean Society in 1851. In 1828 he published, in a separate form, "A brief account of Microscopical Observations on the Particles contained in the Pollen of Plants, and the General Existence of Active Movements in Organic and Inorganic Bodies." These movements he was the first to point out, and to draw attention to their importance. On the Continent it is customary to allude to the phenomena as "Brunonian movements." His writings, when compared with those of many of his contemporaries, are not very numerous; but they have, nevertheless, exercised a lasting influence on botanical science; and no man had ever less reason to regret anything he had written at the commencement of his career than Robert Brown. That he possessed a most wonderfully rich store of knowledge is a fact that becomes evident by perusing his papers; and it will ever be a source of the deepest regret that he has not published more of those accumulated treasures, all of which were irrevocably lost to science when, on the morning of the 10th of June, the cold hand of death laid their possessor low for ever.

Professor George Wilson makes the following remarks in regard to Brown in the "Athenæum" for June 26:—Brown was so modest and undemonstrative a man that it may be feared he has carried to the grave much knowledge on many points which all lovers of science would have preferred should not die with him. On one of these points, interesting to a wide circle of physicists, documentary evidence may yet exist, and it may be well to draw the attention of those in a position to settle the matter towards the question of such evidence existing. Robert Brown took a great interest in the much disputed problem—'Was Watt or Cavendish the discoverer of the composition of water?'—and strongly favoured the claims of the latter, whom he had often met in early life. He supplied Professor Wilson with information regarding Cavendish for the Life of that philosopher, written for the Cavendish Society, and expressed, though with his customary caution and reserve, an unhesitating opinion in favour of Cavendish's originality and integrity. On one of his latest visits to Edinburgh, after the publication of the "Life of Cavendish," he recurred in conversation to the water controversy, and startled Professor Wilson by stating, that there existed a document or documents which would put Cavendish's claims, as the discoverer of the composition of water, beyond dispute. He would not enter into any particulars. It is probable that among his papers, or among those which he inherited from Sir Joseph Banks, may be found documents bearing on the rival claims of Cavendish and Watt, which may deserve a careful examination.

On the death of Sir Joseph Banks in 1823, Brown became, by his will, the possessor of the Banksian Herbarium for life (after which it was to pass to the British Museum), together with the remainder of the lease of Sir Joseph Bank's house in Soho Square, which had become the centre of London scientific society. Brown offered the Herbarium to the British Museum, on the condition that he should be appointed keeper, with a suitable salary, which offer was accepted. The Banksian Herbarium forms the most valuable part of the General Herbarium at the British Museum. He continued until his death to occupy that portion of the house in Soho Square which looked into Dean Street, the remaining portion being let by him to the Linnean Society until the expiry of the lease, soon after which the Society removed to Burlington House, where apartments have been assigned to it by Government, as also to the Royal and the Chemical Societies.

On 20th November 1798 he was elected an Associate of the Linnean Society of London. In 1811 Brown became a Fellow of the Royal Society, and has several times been elected on the council of that body. In 1822 he became a Fellow of the Linnean Society. In 1832 he received the degree of D.C.L. from the University of Oxford, in company with Dalton, Faraday, and Brewster. In 1833 he was elected one of the eight Foreign Associates of the French Academy of Science, his competitors being Bessel, Von Buch, Faraday, Herschell, Jacobi, Meckel, Mitscherlich, Oersted, and Plana. In 1839 the Royal Society awarded him the highest honour at their disposal,—viz., their Copley Medal,—for his discoveries during a series of years on the subject of vegetable impregnation. In 1849 he succeeded the Bishop of Norwich as President of the Linnean Society, which office he held until Mr Bell's election in 1853, still retaining, however, the office of Vice-President. Under the cognomen "Ray," he was a Member of the Imperial L. C. Academy of Germany; he was besides enrolled an Honorary Member in the lists of most of the minor societies in all parts of the old and new world. During the administration of Sir Robert Peel, he received a pension of L.200 as a recognition of his scientific merits. He also received the decoration of the highest Prussian Civil Order, "Pour le Merite," of which his friend and survivor, at the age of 88, the Baron Von Humboldt, is chancellor. Humboldt long since called him "Botanicorum facile princeps," a title to which all scientific botanists readily admitted his undisputed claim.

His interest in the progress of science, and especially in the Royal and Linnean Societies, continued unabated to the last; and his wonderful and almost unique powers of mind, his memory and his sagacity, remained wholly unimpaired till the very day of his decease. In the spring of this year he was attacked with bronchitis, from which he recovered, but which left him for some weeks in a very enfeebled state. Dropsy and loss of appetite supervened, under which he gradually sunk, suffering little pain, perfectly conscious of his condition, and retaining to the end his singularly placid demeanour, his affectionate interest in all who were dear to him, and a most tranquil and peaceful frame of mind.

He died at the age of 83, surrounded by his collections, in the room which had previously been the library of Sir Joseph Banks. He was buried on 15th June in the cemetery at Kensal Green, and his funeral was attended by a large body of his scientific and personal friends.

There are few men among us who, with an equal claim upon the gratitude of their fellow-countrymen, enjoyed less popularity, or obtained less consideration on the part of society in general, than the deceased. Beyond the narrow circle of scientific men his illustrious name was, and is, almost unknown in Great Britain; but go wherever you will on the continent of Europe, or the remotest corners of the globe where science is cultivated, and you will discover a familiarity with his writings and researches truly astonishing. Foreigners have often expressed their surprise on finding how little we seemed to appreciate this great naturalist; but the fact of the matter was, the deceased neither seemed to care to enjoy popularity, nor did he care to avail himself of all those well-known means by which people bring themselves into public notice. If at all ambitious of fame, he trusted to the more lasting immortality that would result from his sterling scientific memoirs; and if he calculated thus he was not mistaken, for so long as botanical science is studied he will occupy a predominant place in the *walhalla* of its heroes.

Mr J. J. Bennet, in the "Times," remarks:—"Those who were admitted to the privilege of his intimacy, and who knew him as a man, will bear unanimous testimony to the unvarying simplicity, truthfulness, and benevolence of his character. With an appearance of shyness and reserve in the presence of strangers, he combined an open-heartedness in relation to his familiar friends, and a fund of agreeable humour, never bitter or caustic, but always appropriate to the occasion, the outpourings of which it was delightful to witness. But what distinguished him above all other traits was, the singular uprightness of his judgment, which rendered him on all difficult occasions an invaluable counsellor to those who had the privilege of seeking his advice. How profoundly these admirable qualities had endeared him to the hearts of his friends was unmistakeably manifested by the sympathetic tenderness with which his last hours were watched and soothed. 'It was in the year 1810,' says one of his distinguished friends, who contributed greatly to relieve the sufferings of his last illness, 'that I first became acquainted with Mr Brown, within three feet of the same place, in the same room, where I saw him so nearly drawing his last breath three days ago. He was the same simple-minded, kind-hearted man in November 1810 as he was in June 1858—nothing changed but as time changes us all.'"

A writer in the "Athenæum" says,—Though less popularly known as a man of science than many of his contemporaries, those whose studies have enabled them to appreciate the labours of Brown rank him altogether as the foremost scientific man of this country. He takes this position not so much from his extensive observations on the structure and habits of plants, as from the philosophical insight he possessed, and the power he displayed, of applying the well-ascertained facts of one case to the explanation of doubtful phenomena in a large series. Till his time, botany can scarcely be said to have had a scientific foundation. It consisted of a large number of ill-observed and badly-arranged facts. By the use of the microscope, and the conviction of the necessity of studying the history of the development of the plant, in order to ascertain its true structure and relations, Brown changed the face of botany. He gave life and significance to that which had been dull and purposeless. His influence was felt in every direction; the microscope became a necessary instrument in the hands of the philosophical botanist, and the history of development was the basis on which all improvement in classification was carried on. This influence extended from the vegetable to the animal kingdom. The researches of Schleiden on the vegetable cell, prompted by the observations of Brown, led to those of Schwann on the animal cell; and we may directly trace the present condition of animal physiology to the wonderful influence that the researches of Brown have exerted upon the investigation of the laws of organization. Even in zoology the influence of Brown's researches may be traced in the interest attached to the history of development in all its recent systems of classification. Brown had, in fact, at the beginning of the present century, grasped the great ideas of growth and development, which are the beacon lights of all research in biological science, whether in the plant or animal world. Whilst Brown's influence was thus great, his works are not calculated to attract popular attention. He was of a diffident and retiring disposition, shunning whatever partook of display, and anxious to avoid public observation. Thus it is that one of our greatest philosophers has passed away without notice, and many will have heard his name for the first time with the announcement of his decease. But for him an undying reputation remains, which must increase as long as the great science of life is studied and understood.

II. *Notice of the Palm-House in the Royal Botanic Garden at Edinburgh.* By Professor BALFOUR.

The Botanic Garden has always had a most important connection with the University of Edinburgh, although it does not form a part of that institution. In all stages of its existence, whether as the Physic Garden in the centre of the city, or in its position at Leith Walk, or in its present site, it has been associated with the Chair of Botany, and the University course of lectures has been conducted more or less completely within its precincts. Thus, from the time of its foundation, in 1670, up to the present day, the garden has contributed, in no small degree, to the cause of botanical education. The value of the instruction in botany, given in this University, has thus been materially enhanced. The student has facilities of becoming practically acquainted with plants which are not afforded by any other school in Britain. And it is satisfactory to know, that from the Edinburgh University there have been sent forth men who have occupied most distinguished positions in the botanical world in this and in other countries; and that, at the present moment, applications are often made to us for medical men to fill the situation of botanists and naturalists in scientific expeditions. Dr Balfour Baikie, who is now conducting so successfully the Niger expedition; Dr John Kirk, who is associated with Livingstone in the exploration of Central Africa; and Dr Hector, who acts as naturalist in Palliser's North American expedition, are all distinguished botanical students and graduates of this University. Much of our scientific fame is thus necessarily connected with our excellent garden.

In its early condition there do not appear to have been any houses for the cultivation of plants from hot climates. In the Catalogue published by Sutherland in the year 1683 no notice is taken of such plants. Such houses were, however, subsequently added, more particularly when the garden was removed to Leith Walk.

In a description of the garden at Leith Walk, it is stated that the soil was light, either sandy or gravelly. In the centre of the garden, a spring of water was formed into a basin. In the east division there was a systematic arrangement of plants. On each side of this area were placed officinal plants, with trees and shrubs. This division contained about 2000 species. In the west division there was a collection of tender plants and of hardy trees properly arranged. The conservatories formed a front of 140 feet, consisting of a greenhouse in the centre, and a hothouse at each end. They were said to be too small for the collection in 1788.

Among the plants mentioned as deserving attention were *Illicium anisatum*, the star anise; *Musa sapientum*, the banana, which produced ripe fruit; a number of Abyssinian plants, and the moving plant of India (*Burrum chundalli*). All these required the protection of hothouses. The extent of glass houses, however, was not great, and there was no house for the cultivation of large palms and the loftier exotics of warm countries.

When the present site was occupied by the garden in the year 1820, Dr Graham, my predecessor in the chair of botany, persuaded the government to increase the hothouse accommodation. A considerable sum was expended on the erection of suitable buildings, and from time to time additions were made.

In 1834 a large palm-house was added, which cost about L.1500. It was intended at first that this building should occupy the vacant space in the centre of the front range, but from a fear that it would encroach too much on the present walk, and might possibly cast too great a shade on the contiguous houses, a site was chosen for it behind the buildings then in existence. Here a house of an octagonal form was erected; the length from east to west, and from north to south, being nearly 60 feet. The sides are 27 feet high, formed of stone pillars set upon a continuous base, and connected at the top with stone lintels, the spaces between the pillars being filled up with glazed wooden sashes. The roof, which is of wooden rafters, is covered with glazed sashes, and is of a conical form, rising to the height of 20 feet above the sides, making in all a height of 47 feet from the floor to the apex of the roof.

At the time of its construction, it was, I believe, the largest palm-house in the kingdom. The heating was at first effected partly by steam and partly by hot water. Subsequently, however, hot water alone was used. There were two cast-iron boilers, with distinct arrangements of cast-iron pipes attached to each, so that one or both might be used as required. The boilers and pipes were renewed about the years 1847–48. This palm-house was found to be admirably fitted for the growth of palms, and, under the judicious management of Mr William M'Nab, it acquired great celebrity. The plan of construction was found so successful, that it has been followed by Mr Matheson in the recent magnificent addition to the building.

In course of time the palms outgrew the house. Several of them, such as *Caryota urens* and *Sagus Rumphii*, sent their leaves through the roof; and a noble specimen of the former, about 41 feet high, had to be turned out into the open ground, where it was an object of interest during the meeting of the British Association in August 1852, and astonished a famous Italian Professor of Botany (Parlatore), who, not knowing the history of its transplantation, was led at first to entertain a very favourable impression of the warmth of our climate. The palm of course died as the cold weather of October approached. Other palms in the house were materially injured by overcrowding. Among them might be noticed particularly *Acrocomia aculeata, Livistona chinensis*, and *Sabal umbraculifera*. These circumstances led me to apply for an addition to the palm-house, and, after a series of representations to the Commissioners of Woods and Forests, more particularly to Sir William Molesworth and Sir Benjamin Hall, aided by an excellent photograph by Dr James Duncan, portraying the mode in which the palms sent their leaves for many feet through the roof, I at length succeeded in getting a sum of L.6000 voted by Parliament in 1855 for this purpose.

After some delay in regard to contracts, &c., the building was commenced in May 1856, and was completed in about two years.

The new palm-house is situated to the west of the old one, with which it communicates by the removal of one of the sides of the octagon, thus making the two to appear as one building, and facilitating much the transmission of the plants. The new house is substantially built of beautiful sandstone from a quarry at Bishopbriggs, near Glasgow, and the roof is formed of curvilinear iron rafters. The advantage of having much solid masonry is great, and was strongly advocated by the late Mr M'Nab, than whom none was more successful in palm cultivation. This mode of cultivation is preferable to the plan of using iron and glass almost entirely. The solid masonry prevents rapid cooling in this variable climate; it retains the heat better, and it gives a certain amount of shade, which is very important in the growth of palms, more especially of such as are social. Moreover, the effect is much more imposing. Too great sun-light in a palm-house appears to be prejudicial, and hence the western exposure of the front of the present palm-house has some advantages, by enabling us more easily to screen the plants from intense light.

The sandy nature of the soil required that the foundation should be laid on two feet of concrete. The laying of this was attended with some difficulty, owing to the vast quantity of water which poured in on all sides. Above the concrete, there is placed six feet of underground solid mason-work. This is succeeded by solidly-built stone pillars 4 feet 4 inches in breadth, separated by arched windows 8 feet 8 inches wide and 22½ feet high. There are about 35 feet of iron-work above the stone building.

The building has the form of a parallelogram, its length on the west side, or the front from north to south, being 100 feet over the foundation, 96 feet 6 inches over the walls, and about 90 feet within the walls; its width from east to west, 57 feet, and its height 70 feet 6 inches. The total length from the west side of the new palm-house to the east side of the old one, is nearly 120 feet.

The sides of our new palm-house form an arcade 35 feet high all round, set upon a continuous base, having the outside face relieved by pilasters and entablature of the Tuscan order—the arches being filled in with glazed cast-iron frames. The roof, which is of cast-iron rafters and glazed sashes, forms a dome of two stages, each about 17½ feet high—the lower one rising from the top of the sides to half the height of the roof, where a base is formed for the upper one. The glass of the roof is sheet-glass, twenty-one ounces to the foot.

Galleries are provided at the base of each of the domes for convenience of access in case of repairs, and the accumulation of snow or ice. Inside there is a series of fourteen light cast-iron pillars placed at a distance of 12 feet from the side, forming a rest for the top of the lower dome, and for the base of the upper one. One gallery is projected from the sides by cast-iron brackets, at the height of 35 feet from the floor, to which the public have access by two cast-iron spiral staircases. Another gallery is formed at the base of the upper dome, 51 feet from the floor. A stone stage, 2 feet high, is formed round the sides, and another, at 4 feet distance inside, for the smaller palms, leaving the entire centre area for the larger ones. During the present session of Parliament L.1000 have been voted for the removal of the wooden roof of the old palm-house, and the substitution of an iron one. This will complete the arrangements for the present.

The ventilation is effected by the lowest centre panes in each of the sashes of the side arches being made to open, and three large valves are placed at the top of the roof, which, being opened, produce a general upward current. When more air is required, it is obtained by opening certain of the upright compartments at the base of the upper dome. The heating is by hot water, supplied by four cast-iron flued saddle-boilers, on an improved principle, suggested by Mr M'Nab. These boilers are connected with 1316 feet of 5-inch bore cast-iron pipes. Two of the boilers are connected with pipes which pass round the whole house, one set of pipes going to the right and the other to the left. The other two boilers are connected with pipes which go to the centre of the building in the first instance, and then return by the outside, the pipes connected with each thus passing round half of the building. By this means, provision is made for increasing and diminishing the heat as may be required.

The building has cost L.6500. It was opened on 1st April 1858, and the palms were transferred to it and arranged by Mr M'Nab by the 30th April. This was a great feat, when we consider that the greater part of the palms had been re-tubbed; and some of the specimens, such as *Livistona chinensis* and *Sabal umbraculifera*, weighed, with the earth at the roots, from seven to eight tons. They have been all successfully placed, and the effect of the whole is such as to give one a good idea of tropical vegetation. The tubs used are large round ones, which are more convenient, and have a better effect to the eye than the square ones previously used. Some of the tubs are 22½ feet in circumference.*

The construction of the house enables one to see the palms in all directions, both from below and from above. On the outside of the upper dome there is a gallery where a fine view is obtained of Edinburgh and the country around it, extending from the Pentland Hills on the west, to North Berwick Law and the Isle of May on the east, and including also a view of Fife and Stirlingshire, of the Ochils, and of some of the Highland hills.

The building does great credit to Mr Matheson of Her Majesty's Works, who planned it. The mason-work has been most substantially built by Messrs Beattie, and the iron-work is highly creditable to the Shotts' Company.

We are certainly much indebted to Sir Benjamin Hall, late Chief Commissioner of Works, for the deep interest which he took in the building, and for the strenuous support which he gave on all occasions. He visited the building several times during its construction, and at all times showed a desire to promote botanical instruction.

* Mr M'Nab states that, among the numerous adventures attending the removal of the palms to their new abode, one circumstance ought to be recorded, viz., the perilous task of cutting the top off the *Caryota urens*, which had to be done before it could be removed from the high lantern part of the roof of the old house. William Bell, one of the journeyman gardeners, volunteered the task, and accomplished it with safety. The glass was broken on the outside, and the top removed with a saw.

Mr M'Nab also gives the following details as to the operations connected with the Palm House:—

1856.		
April	8.	New Palm House staked off.
„	22.	Commenced taking out foundations.
May	13.	Commenced concrete and building foundations.
Nov.	—	Finished stone-work of House.
1857.		
April	9.	Commenced to erect iron pillars.
April	17.	First rib put up.
July	3.	Last rib put up.
Sept.	9	Glazing commenced.
Nov.	17.	Glazing completed.
„	18.	Hot-water pipes commenced.
1858.		
Jan.	29.	Hot-water pipes finished and tried.
April	1.	Commenced removing plants.
„	30.	Completed the removal.

The following is a list of some of the palms which have flowered in the Botanic Garden :—

Caryota urens.	*Chamærops Palmetto.*
C. sobolifera.	*Chamædorea Schiediana.*
Seaforthia elegans.	*C. Hartwegii.*
Euterpe montana.	*C. coronata.*
Sabal umbraculifera.	*Rhapis flabelliformis.*
Harina caryotoides.	*Calamus Wightii.*
Chamærops humilis.	*Areca triandra.*
—— var. *arborescens.*	*Desmoncus elongatus.*

The following are the heights of some of the present palms :—

	Feet.		Feet.
Livistona chinensis, .	43	*Plectocomia elongata,* .	38
Sagus Rumphii, . .	43	*Seaforthia elegans,* .	26
Caryota urens, . .	42	*Corypha australis,* .	23
Euterpe montana, . .	38	*Phœnix sylvestris,* . .	20
Acrocomia aculeata, .	37	*Elaïs guineënsis,* . .	22
Sabal umbraculifera, .	30	*Phœnix dactylifera,* .	21

The above heights include the depth of the tubs.

The following account of the mode of re-tubbing the palms has been supplied by Mr James M'Nab :—

In the January number of the *Scottish Gardener* for 1856, I gave a detailed account, accompanied by wood-cuts, of the method which had been practised in the re-tubbing of the palms, and other large exotic trees, in the old Palm-House of the Botanic Garden.

Previous to removing the plants from the old to the new house, nearly all of the large plants had to be re-tubbed; two of these, *Livistona chinensis* and *Sabal umbraculifera*, grew in large square oak boxes without bottoms, each 4 feet 6 inches in diameter, and 4 feet 3 inches deep; in these boxes they had existed for the last eighteen years. The *Livistona* has a stem 6 feet in circumference at base, and 42 feet high. The *Sabal* has a stem 5 feet 6 inches in circumference at the base, with a globular-shaped top 28 feet in diameter. Owing to their enormous weight, it was found impossible to re-tub these two plants on the plan previously adopted here, and minutely described in the *Scottish Gardener*. The method practised with the two above-named plants was as follows :—Three small mines or borings were forced under the bottom of the plants on the surface of the stone floor, one in the middle, and two others equidistant between the centre and the ends; each of these mines were made large enough to introduce a rope 1¼ inch in diameter. After the three ropes were passed through, a portion of the bottom, 10 inches broad at each side, was undermined, and strong oak staves introduced, sufficiently long to catch under the bottom of the box at each end; these oak planks were placed to prevent the ropes cutting the ball during the process of lifting; two flat iron plates were then laid parallel with the lifting ropes, and resting on the ends of the oak planks, and also beneath the edge of the old oak box which contained the plant, the ends of the iron plates were then racked together by means of ropes. Three long Norway poles were tightly fixed on the stem in a tripod form, in order to support the tree during the process of raising.

As it was found impossible to raise the mass (consisting of six or seven tons) sufficiently high to pass a tub underneath, the following method was adopted, and with perfect success:—After the new tubes (formed of double-strong oak) had been prepared, each 26 feet in circumference and 5 feet deep, they were taken down into four pieces; first fixing in a temporary way portions of hoops both inside and outside, for the purpose of keeping the staves together. Two strong malleable iron rollers, resting in greased cradles, fixed on two strong wooden tresses, 6 feet high, were placed round the plant, and the six ends of the ropes, which were previously introduced under the plant, were now brought up and fixed round the rollers. The plant was then wound up by means of strong handspikes. This heavy and important part of the operation was accomplished by eighteen men; a man was also placed at each of the three tripod poles, to prevent them, by means of a moveable wedge, from slipping back; three guy-ropes were fixed to stationary blocks intermediate between the tripod poles. The under surface of the bottom of the tub having been previously prepared with fixed battens, and raised on small temporary iron rollers, was run beneath the plant when raised, and all the hoops introduced at the same time, with the exception of the smallest or under one. Charred pieces of battens were laid on the surface of the bottom parallel with the lifting ropes, taking care to keep open spaces, so as to allow the ropes to be easily withdrawn. The plant was then lowered, the old sides and superfluous trappings removed, the new tub put round, taking care that the bottoms of the staves were inserted properly into the groove; the iron hoops were then driven up, the lower hoop previously kept out was cut, and the ends prepared, so as to be drawn together by means of a screw; drainage was then inserted, and the tubs finally filled up with soil.

The method here noticed for the re-tubbing of the two large plants was also practised on all the others, where the ball of roots was too large to raise high enough with safety to enable the new tubs to be run under. In these cases the drainage was put into shallow tubs 8 and 10 inches deep, placed on the centre of the bottom, the plants were lowered upon it, and the vacant spaces filled up with drainage after the sides had been put together.

III. *Notice of an Excursion along the Line of the Roman Wall from Chollerford to Wall-Town Crags.* By Mr John Sadler.

The author gave a general description of the Roman Wall and its principal camps, observed on the way from Newcastle to Carlisle, and noticed the following plants which he found on the Wall:—*Trollius europæus*, *Draba verna*, *β. inflata*, *Teesdalia nudicaulis*, *Helianthemum vulgare*, *Viola lutea*, *Drosera anglica* and *rotundifolia*, *Polygala vulgaris*, *Genista anglica*, *Lonicera Xylosteum*, *Valeriana dioica*, *Antennaria dioica*, *Carduus heterophyllus*, *Erica cinerea* and *Tetralix*, *Vaccinum Myrtillus*, *V. Oxycoccus*, *V. uliginosum* and *V. Vitis-Idæa*, *Menyanthes trifoliata*, *Digitalis purpurea*, *Pinguicula vulgaris*, *Utricularia minor*, *Lysimachia nemorum*, *Empetrum nigrum*, *Habenaria albida* and *H. bifolia*, *Allium schœnoprasum*,—a plant which was probably cultivated by the Romans,—*Endymion nutans*, *Athyrium Filix-femina*, *Blechnum boreale*, *Botrychium Lunaria*, *Cystopteris fragilis*, *Lastrea Oreopteris*, *Polypodium Dryopteris* and *P. Phegopteris*, *Lycopodium clavatum* and *L. Selago*, &c.

IV. *On the Occurrence of* Ledum palustre *near Bridge of Allan.* By Mr A. Buchan. Communicated by Dr George Lawson.

The plant has been known for many years to exist in small quantity in a bog near the Bridge of Allan. The drainage of the bog however is causing a rapid decrease in the number of specimens.

V. *List of Cryptogamic Plants collected near Moffat.* By Dr W. Nichol.

The district of Moffatdale is well known to botanists as a locality for several rare flowering plants, and is now probably the only British station where *Woodsia ilvensis* occurs in any abundance. But although the phanerogamic vegetation has, through the researches of several botanists, been well nigh exhausted, the cryptogamia of the district (excluding ferns) have been almost entirely unexamined, the only exception being a few mosses collected nearly thirty years ago by Dr Greville during a visit to the Grey Mare's Tail.

It seemed probable, however, from the height of the principal hills, and the alpine character of their flowering vegetation, that some equally interesting cryptogamic plants would also occur.

Accordingly, during a short stay I made at Moffat in April and May last, I devoted a few days to the exploration of the neighbouring district. The result did not disappoint my expectations; for, besides some rare and interesting plants, chiefly of an alpine character, I found one species of moss new to the British Flora, and another previously unnoticed in Scotland.

In the present paper I have given a list of all the rarer species observed; I have no doubt, however, but that many equally interesting will reward a future examination.

Musci.

Andræa alpina, L. White Coomb,* Hartfell, ravine at the head of Blackhope Burn.

* White Coomb refers to that portion of the hill facing Loch Skene. Hartfell, to the ravines at the head of the stream which flows past the Moffat Mineral Well.

Andræa petrophila, Ehrh. Ravine at the head of Blackhope Burn.

Andræa rupestris, Turn. Do do.

Gymnostomum curvirostrum, Hedw. Grey Mare's Tail. Dr Greville. W.N.

Anoectangium compactum, Schw. Blackhope Glen, Hartfell, Grey Mare's Tail.

Rhabdoweissia denticulata, B. and S. Ravine, head of Blackhope Burn.

Dicranum pellucidum, Hedw. Common.

Dicranum pellucidum, var. *serratum*, B. and S. Beld Craig.

Dicranum squarrosum, Schrad. Hartfell.

Arctoa fulvella, B. and S. Hartfell.

Campylopus torfaceus, B. and S. Blackhope Glen.

Campylopus longipilus, Br. White Coomb, Blackhope Glen.

Fissidens adiantoides, Hedw. Common.

Blindia acuta, B. and S. Common. Blackhope Burn, Beld Craig, &c.

Tortula tortuosa, Web., Mohr. Blackhope Glen, Grey Mare's Tail, &c.

Trichostomum flexicaule, B. and S. Grey Mare's Tail.

Didymodon rubellus, B. and S. Do.

Distichium capillaceum, B. and S. Do.

Tetrodontium Brownianum, Schw. Beld Craig.

Encalypta streptocarpa, Hedw. Bridges over Moffat and Annan Waters.

Encalypta ciliata, Hedw. Ravine at the head of Blackhope Burn.

Zygodon Lapponicus, B. and S. Do.

Zygodon Mougeotii, B. and S. Common.

Zygodon viridissimus, Brid. Trees, Dumcreiff.

Orthotrichum Lyellii, Hook. Common.

Orthotrichum pulchellum, Sm. Trees, Moffat and Annan Waters.

Orthotrichum Drummondii, Hook. and Grev. Beld Craig.

Orthotrichum Bruchii, Brid. Do.

Ptychomitrium polyphyllum, B. and S. Beld Craig, &c.

Grimmia Donniana, Sm. White Coomb, ravine, head of Blackhope Burn.

Grimmia patens, B. and S. Ravine, head of Blackhope Burn.

Grimmia spiralis, Hook. and Tayl. White Coomb, ravine, head of Blackhope Burn.

Grimmia torta, Hornsch. Do. Do.

Racomitrium sudeticum, B. and S. Ravine, head of Blackhope Burn, Hartfell.

Racomitrium heterostichum, Brid. var. *gracilescens*, B. and S. Grey Mare's Tail.

Racomitrium canescens, Brid. Walls near Moffat.

Œdipodium Griffithianum, Schw. Ravine, head of Blackhope Burn, Hartfell.

Physcomitrium ericetorum, De Not. Grey Mare's Tail.

Bartramia pomiformis, Hedw. Do.

Bartramia Halleriana, Hedw. Do.

Bartramia arcuata, Brid. Do. Abundant.

Bryum Zierii, Dicks. White Coomb, Beld Craig.

Bryum polymorphum, B. and S. White Coomb.

Bryum crudum, Schreb. Grey Mare's Tail.

Bryum Wahlenbergi, Schw. Beld Craig.

Bryum pseudotriquetrum, Schw. Caplegill, Grey Mare's Tail.

Bryum pallens, Swtz. Common.

Bryum Duvalii, Voit. Stems two to three inches long, forming large loosely aggregated tufts of a pellucid aspect and a reddish-purple colour. Leaves broadly ovate, acute, largely reticulate, and at the base very strongly decurrent; their margins entire, plane, and not thickened. In wet spots, at the head of the stream which flows past the Moffat Mineral Well. The plant is very abundant in this station, and has a vertical range of about 1500 feet. New to Britain.

Bryum julaceum, Sm. Blackhope Glen, Bell Craig.

Mnium punctatum, Hedw. Hartfell.

Mnium subglobosum, B. and S. Do. Barren.

**Mnium stellare*, Hedw. The plant, which I have referred provisionally to this species, occurs in wet places in the wood by the side of the road from Moffat to the Grey Mare's Tail, and about three or four miles from the former. It agrees very closely with *M. stellare* in the form and texture of the leaves, but has long tomentous stems, in which it resembles *M. Blyttii*, B. and S., a Norwegian species, not found in Britain. Barren.

Oligotrichum hercynicum, D. C. Hartfell.

Pogonatum alpinum, Brid. Hartfell.

Polytrichum strictum, Hedw. Blackhope Glen.

Diphyscium foliosum, W. and M. Hartfell. White Coomb.

Fontinalis antipyretica, L. Near Loch Skene. In fruit.

Neckera crispa, Hedw. Grey Mare's Tail, and Blackhope Glen. In fruit.

Pterygophyllum lucens, Brid. Grey Mare's Tail.

Pseudoleskea catenulata, Sch. Ravine at the head of Blackhope Burn.

Heterocladium heteropterum, Sch. Ravine at the head of Blackhope Burn. White Coomb. In fruit.

Plagiothecium pulchellum. Grey Mare's Tail.

Plagiothecium denticulatum, Sch. Beld Craig, Blackhope Glen.

Eurhynchium longirostre, Sch. Do. do.

* A form of *M. stellare*, according to Wilson.

Eurhynchium piliferum, Sch. Beld Craig. Barren.

Isothecium myurum, Brid. Beld Craig, &c.

Brachythecium rivulare, Sch. Beld Craig. Barren. Identical, according to Mr Wilson, with the form figured by Schimper in the "Bryologia Europæa."

Limnobium eugyrium, Sch. Grey Mare's Tail. In fruit. This plant is not recorded in "Wilson's Bryologia Britannica," having been at that time confounded with *L. palustre*, Sch. It may, however, be easily distinguished by its yellowish aspect, and the much enlarged alar cells of the leaf. The only other British stations are, Turk Cascade, Killarney, and Aber Waterfall, North Wales.

Hypnum stellatum, Schreb. White Coomb.

Hypnum hamulosum, Fröl. Grey Mare's Tail. In fruit.

Hypnum molluscum, Hedw. White Coomb.

Hypnum Crista-Castrensis, L. Grey Mare's Tail. Dr Greville. W. N. Barren.

Hypnum fluitans, L. Near Loch Skene.

Hypnum commutatum, Hedw. Common.

Hypnum rugosum, Ehrh. Grey Mare's Tail. Dr Greville.

Hypnum scorpioides, L. White Coomb. Barren.

Hypnum sarmentosum, Wahl. White Coomb.

HEPATICÆ.

Gymnomitrium concinnatum, Cord. Hartfell. Blackhope Glen.

Sarcoscyphus Ehrharti, Cord. White Coomb.

Sarcoscyphus Muelleri, Nees. Hartfell.

Plagiochila tridenticulata, Tayl. Grey Mare's Tail.

Scapania uliginosa, Nees. White Coomb.

Scapania nemorosa, Lind. Beld Craig.

Scapania nemorosa, β *purpurascens*. Hartfell. Grey Mare's Tail.

Jungermannia albicans, L. Common.

Jungermannia albicans, β. *procumbens*, Hook. Beld Craig.

Jungermannia Taylori, Hook. Moors near Loch Skene.

Jungermannia crenulata, Sm. Grey Mare's Tail.

Jungermannia cordifolia, Hook. Blackhope Glen. In fruit. This plant, although very common in the Highlands, is exceedingly rare in fruit. Calices only are mentioned by Hooker in his British Jungermanniæ, and the only other British specimens with fruit that I have seen were collected by Mr W. Gardiner on Ben Lawers.

Jungermannia pumila, With. Common.

Jungermannia Lyoni, Tayl. Grey Mare's Tail.

Jungermannia incisa, Schrad. Moors near Loch Skene.

Jungermannia bicuspidata, L. Beld Craig.
Jungermannia setacea, Web. Moors near Loch Skene.
Jungermannia trichophylla, L. Grey Mare's Tail.
Lophocolea heterophylla, Nees. Do.
Lejeunia serpyllifolia, Lib. Grey Mare's Tail.
Pellia epiphylla, Raddi. Beld Craig.
Pellia calycina, Tayl. Do.
Aneura pinguis. Dumort. White Coomb.
Aneura multifida. Dumort. do.
Metzgeria furcata, Raddi. Grey Mare's Tail.

LICHENES.

Sticta pulmonaria. Beld Craig.
Sticta fuliginosa. Do.
Nephroma resupinatum. Do.
Squamaria hypnorum. Do.
Cetraria islandica. Hartfell.
Cladonia uncialis. Do.
Cladonia rangiferina. Do.
Cladonia cervicornis. Do.
Endocarpon lætevirens. Moors near Loch Skene.
Collema lacerum. Grey Mare's Tail.

VI. *Notice of Trees struck by Lightning*. By Mr JAMES M'NAB.

Mr M'Nab read a letter from Mr Anderson, gardener at Oxenford Castle, in which he gave the particulars connected with two ash trees which had been struck with lightning in the farm of Fordel, one during 1853, and the other—not 100 yards distant from the first—on the 16th of June last (1858). This tree had a stem 7 feet 3 inches in circumference, and about 30 feet high. The electric fluid first struck the tree on the south side, immediately under the junction of three branches, where a large oval portion of the tree seemed entirely taken out. It then travelled in a slight curve, passing through the tree from one side to the other, the bark still remaining on the side on which it entered; while, on the opposite side, all the bark was torn off, varying from 1 to 2 feet broad. One of the main branches is still entire, although much shaken.

Mr M'Nab stated that he was still in quest of information regarding lightning-struck trees in Great Britain, in consequence of the generally received opinion, that neither the beech nor the birch have ever been noticed to be injured with lightning. For the last fifteen years he has communicated to the Botanical Society the names of various lightning-struck trees, but neither beech nor birch were among the number. He formerly stated to the Society that the inhabitants of America generally resorted to beech trees during a thunder storm, from the fact of their not being liable to be struck with lightning. This he found to be the case through large tracts of country, and it induced him to institute an inquiry in Britain, which up to this period agrees with the information he received in America.

VII. *Remarks on the Applications of Photography to Botany.* By A. J. Macfarlan, Esq.

The applications of photography to botany may conveniently be considered under three divisions,—1*st*, The delineation by the ordinary camera of trees, shrubs, &c., on a reduced scale; 2*d*, The photographic printing of ferns or leaves, the natural size; and, 3*d*, The micro-photographic process of obtaining magnified representations of the various tissues composing plants.

As we have, during the past winter, heard a good deal about the first division of this subject, I need not now say anything regarding it, further than to remark, that those who at the April meeting saw the photograph which illustrated Dr Balfour's paper on the *Narthex Assafœtida*, must have been convinced of the great use this department of photography may be to botany, especially when we call in the aid of the microscope; and were further proof required, Professor P. Smyth's views of the Great Dragon Tree of Orotava, &c., at once afford it.

As regards the photographic printing of ferns, although the results may not be so beautiful as those obtained by "nature printing," and although the process is a little tedious, yet it is so easily managed that it might more frequently be taken advantage of than it is, where accurate impressions of a frond are desired. The printing may be done in the same way as photographers are accustomed to obtain copies of negatives.*

The application of micro-photography to botany much exceeds in interest either of the two to which reference has already been made, and, although as yet it has been but little practised, we may hope that it will not long continue so. Mr Bryson of this city has devised a very convenient form of apparatus, which I shall now describe. It consists of a camera which, being in one piece, cannot be lengthened or shortened, as is the case with the common one. At the one end, or front of the camera, instead of the ordinary lens, is fixed a brass tube for supporting the object-glass of a microscope, and at the other end, as well as at the centre and half way between these last two points, may be inserted the ground focussing-glass, or the frame which holds the sensitive plate. The stage, where the object to be taken is placed, slides upon a brass rod that projects from the front of the camera beneath the lens, thus constituting the coarse adjustment; while a fine focus is obtained as follows:—The object-glass, by means of an adapter, is screwed to a brass tube, which slides within a larger one, attached, as I have already mentioned, to the front of the camera. By a fine screw and an opposing spring the smaller tube may be more or less enclosed within the larger one, and consequently the object-glass brought nearer the stage, or removed further from it. The screw is connected by a metal rod, with a handle conveniently placed at the other end of the camera. Sometimes a microscope itself is attached to the camera, in which case, the stage and focussing apparatus are not required, but the saving in expense is not great. It is probably more than counterbalanced by the inconvenience of the arrangement. Those who are possessed of a microscope and one of the ordinary landscape or portrait cameras, may succeed in the process if they remove the lens from the camera and substitute for it the microscope deprived of its eye-piece; care, however, must be

* An excellent work by Mr Hardwich, late Demonstrator of Chemistry, King's College, London, entitled "A Manual of Photographic Chemistry," may be referred to by those desiring information regarding the processes mentioned in this paper. There are also many smaller works which may be found sufficient.

taken that a line passing longitudinally through the compound body of the microscope shall fall at right angles upon the ground glass, and also that all extraneous light be excluded from the camera.* The photographs may be taken by the ordinary collodion process. The time of exposure of the sensitive plate in the camera varies from a second up to even 5 min. if the day be dull. The light may be obtained by pointing the camera directly at the sun or a white cloud, or more conveniently indirectly from the sun by means of a mirror. The interposition of a piece of ground glass between the mirror and the camera diffuses the light over the field, and also renders it whiter and more agreeable.

VIII. *Additional Localities for Plants in the neighbourhood of Edinburgh.* By Professor Balfour.

Geranium columbinum. Near St David's. (Mr John Hope.)
Sedum reflexum. Near Tynehead.
Senecio sarracenicus. Dunglass.
Mimulus luteus. Arniston and Dunglass.
Mentha sylvestris, β. velutina. Near Tynehead.
Mentha viridis. Near Tynehead.
Neottia Nidus-Avis. Banks of Auld Wharry, Kippenrait Glen, near Bridge of Allan.
Tulipa sylvestris. Donibristle. (Mr R. Reid.)
Eriophorum latifolium. Near Crichton Castle.
Carex limosa. Grangemouth.
Phalaris arundinacea, var. *picta.* Near Tynehead.
Equisetum umbrosum. Banks of Auld Wharry, Kippenrait Glen, Bridge of Allan.

Professor Balfour noticed the addition to the University Herbarium of a large collection of South American plants, including numerous *Ferns*, collected by Mr Spruce.

Dr Balfour also stated that the Rev. John Byers, minister of Bathgate, had transmitted specimens of *Mimulus luteus*, collected by him in that neighbourhood.

Mr M'Nab exhibited living specimens of the variety of *Asplenium Adiantum-nigrum* called *acutum* by the Irish botanists, and showed at the same time living specimens of the typical *species* raised from spores taken from the specimens of the variety placed on the table.

* See Hardwich's Manual, page 302.

TRANSACTIONS

OF THE

BOTANICAL SOCIETY.

VOL. VI.—PART II.

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MDCCCLIX.

TRANSACTIONS

OF THE

BOTANICAL SOCIETY.

11*th November* 1858.—Dr SELLER, President, occupied the Chair, and delivered an Opening Address.

The following donations were announced to the Society's Library :—

Transactions of the Tyneside Naturalist's Club, Vol. III., Part IV.—From the Club.

The Twenty-Second Annual Report of the Warwickshire Natural History and Archæological Society.—From the Society.

Proceedings of the Literary and Philosophical Society of Liverpool, No. 12.—From the Society.

Remarks on the Re-tubbing of Palms, by Mr M'Nab.—From the Author.

Remarks on the Sand-Binding Plants of India, by Dr Cleghorn, Madras.—From the Author.

List of Neilgherry Ferns, by Dr P. Schmid.—From Dr Cleghorn.

Fragmenta Phytographiæ Australiæ, Part I., by Dr F. Mueller. —From the Author.

Observations sur les Phenomenes d'Erosion en Norvege, by J. C. Horbye.—From the Author.

Bericht der Oberheissischer Gesellschaft fur Natur und Heilkunde.—From the Society.

The following collections of plants were reported by Dr Balfour as having been added to the University Herbarium :—

Additional Series of Lichens, by the late Mr Schærer.
Plants from Brazil, collected by Spruce.
Plants from Norfolk, presented by Mr Knight.
Indian Plants, from Mrs Spottiswoode.

The following donations to the Museum at the Botanic Garden were reported :—

From Mrs Miller—Areca Nuts from India, Quandang Nuts from Swan River, and Zamia Seeds.

Dr E. W. Dubuc—Fossil Fruits from the Island of Sheppey, and Fossil Plants and Leaves from the Lower Oolite of Scarborough, from the sea-coast of Hastings, and from the Eocene Tertiary, near Paris.

P. J. Krog, Esq.—Indian Corn (*Zea Mais*), from the interior of Cape Colony, and Cone of *Leucadendron argenteum.*

Mr M'Intyre—Basket made from fruit of Luffa, and specimens of the fruit of Nutmeg.

Dr Cleghorn, Madras—Fruit of *Sterculia*, of *Hydnocarpus inebrians*, of *Inga xylocarpa*, and of *Blighia sapida;* Bark of *Cinnamomum aromaticum*, from Malabar; Cap made from the Spathe of Areca Palm; Twining Creeper; Stem of *Æschynomene paludosa;* Burmese Cloth, ornamented with the fruit of a species of *Coix;* Spadix of *Borassus flabelliformis;* Fruit of *Cerbera Odollum* before and after germination; also, Pod of *Canavalia.*

Alexander Brown, Esq., Bombay—Seeds of Custard Apple.

Mr Robert Hutchison—Specimens of *Stigmaria.*

Dr Douglas Maclagan—Preserved Plant of *Zamia pumila;* and Fruits of Coffee, Chocolate, and Avocado Pear.

Dr James Hector—Sugar made from the sap of *Negundo fraxinifolium.*

Samuel Hay, Esq.—Almonds and Walnuts, ripened in the open air at Trinity Cottage, near Edinburgh, in the autumn of 1858.

Dr J. A. Smith—Large Specimen of *Polyporus versicolor.*

Miss Gibson-Craig—Very large Fruits of *Pyrus Japonica* and *Ribes sanguineum.*

Joseph Fayrer, Esq.—Nest of Tailor Bird, formed by the bird sewing together the leaves and twigs of a species of *Ficus* in a growing state.

Professor Balfour stated that A. W. Mactier, Esq. of Durris House, near Aberdeen, had sent to the Botanic Garden two seedlings of *Picea nobilis*, raised from seed which was ripened at Durris in 1856. In the note which accompanied them Mr M. says,—" I may here mention that on first observing the cones of *Picea nobilis*, I was warned that they would probably prove abortive, unless they were artificially impregnated with pollen from the male flowers, which were numerous but low down on the tree, the cones being on the upper branches. This advice I took, and one-half were impregnated, though somewhat too late, as much of the pollen was lost; the other half was left untouched. Eventually, the only plants I raised (about 100) came from the impregnated cones, the others proving barren. The tree is again forming cones this season—there being fifteen now on it. In 1856, it produced fifty, and its growth for that year was less than usual by one-fourth."

Dr Balfour also read the following note from A. G. Spiers, Esq. of Culcreuch, relative to the formation of cones by a *Deodar* on his property:—"A specimen of *Cedrus Deodara*, at Culcreuch, has this season produced about a dozen young cones. The tree was planted in its present site in 1842; I believe it to be a seedling of 1835 or 1836. The seed came from Simla. The tree is of a dark green colour, and has a robust habit. The stem is somewhat flexuose, and the branches are not nearly so numerous as on the common specimens. Its height, as measured on 9th November 1858, was 25 feet 2 inches; circumference at the base, 3 feet 3 inches; at three feet up, 2 feet 3 inches; spread of branches, 19 feet 1 inch. No male flowers have been seen on the tree."

A note was read from Mr James A. Anderson, Carling, West Kilbride, in which he mentions, that a wilding crab-apple, after cultivation for eight or nine years, produced excellent fruit without grafting. The tree having been transplanted from a wild state into a garden for the purpose of growing the mistleto on it, Mr Anderson asks if it is possible that the mistleto may have had any influence in causing the tree to produce better fruit. The first fruit produced by the tree was a true crab, sour and astringent. Of late years, the fruit has been excellent.

Dr John Low, of King's Lynn, sent for exhibition some flowers of a *Lonicera Periclymenum*, presenting an unusually phylloid form of the calyx, corolla, and staminal whorls. The plant from which they were gathered (a wild one) has produced flowers of this kind for several years.

The following communications were read:—

I. *On the Pauchontee, or Indian Gutta Tree on the Western Coast, Madras Presidency.* Transmitted by Dr Hugh Cleghorn, Conservator of Forests, Madras.

This tree, which is interesting in an economical point of view, is common in the densely crowded tracts of Coorg, the eastern part of Wynaad, Anamally Mountains, and Cochin territories, from lat. 8 deg. 30 min. to lat. 10 deg. 30 min., and at an elevation of 2500 feet to 3000 feet above the level of the sea. It attains a height of eighty to a hundred feet, and a diameter of two to four feet, and it runs up to a great height without giving off any branches. The bark is rusty, often whitish from lichens; its wood is moderately hard, but not of much value. It blossoms from January to April. Its calyx is biserial, outer being deeply 5-cleft valvate, inner of 3 sepals imbricate; corolla hypogynous, with contorted æstivation, deeply 6-cleft, occasionally 5-cleft, deciduous, darkish red. Stamens usually 16, inserted in the throat of the corolla, all perfect, in 2 rows. Ovary 6-celled, each cell having one anatropal erect ovule; style long, stigma simple. Fruit about the size of an almond, with a pulpy mesocarp. Seed exalbuminous, shining, with a long whitish scar on its inner face; cotyledons fleshy. It is the Pauley tree of Wynaad, and the Pauchontee tree of Cochin; it belongs to the order *Sapotaceæ*, and has a close affinity to the gutta percha tree (*Isonandra Gutta*) of the Malayan peninsula. It yields a milky juice which concretes, and is brittle at ordinary temperatures. It softens by the heat of the hand and mouth, and may be moulded between the fingers. It readily melts by the application of heat, and becomes very sticky. This stickiness is gradually destroyed by contact with water. It forms a paste with coal tar naphtha and oil of turpentine. The substance has excellent insulating powers, and may be used successfully for coating the wires of telegraphs. It is probable that at present several thousands of these trees fall annually under the axe of the wood-cutter, as the Government forests in Wynaad give way to the extension of coffee planting, and the private forests in Malabar to raggee cultivation. The tree from which this substance is procured appears to have been first noticed by A. R. W. Lascelles, Esq., coffee-planter, when felling forest at Devallicottah, in September 1854. Specimens were shown to Colonel F. C. Cotton, engineer at Ootacamund. Twigs of the tree and specimens of the gum were sent to Britain in 1855. Lindley, it is stated, named the tree *Isonandra acuminata.* General Cullen found the tree in the Travancore forests. Dr Cleghorn met with the tree during his tour along the Western Ghauts. In some parts of Wynaad, it is stated that one out of four trees was a Pauley or Pauchontee. It is plentiful in the upper half of Carcoor Pass, or is diffused over the country between Devallicottah and Neddiwattim, where it ceases; but it is said to be found under the Great Neilgherry Peak. Again, in the dense shola forest of the Anamallay, the Pauley or Pauchontee has been observed. It abounds in the Anagoondie Pass, leading to Cochin where there appear to be thirty or forty trees to the acre, associated with Ayenee (*Artocarpus hirsuta*), Agilay (white cedar) *Vateria indica*, and the Muttee Pal (*Ailanthus malabarica*). Specimens of the tree and its products were transmitted to the Madras Exhibition by C. H. Levinge, Esq., sub-collector of Tinnevelly, which shows that the tree is found also on the eastern slope of the Western Ghauts. The following are the measurements taken of three Pauchontee trees at Pochamy Uddavy, eight miles north of Cannyattencoodul, nearly parallel with Attay-anur:—

No.	Circumference.		Diameter.		Length between the two Extreme Measurements.
	At base.	At top.	At base.	At top.	
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
1.	9 3	5 6	3 1	1 10	64 0
2.	9 9	7 6	3 3	2 6	48 6
3.	6 4	4 6	2 1½	1 6	57 6

The juice of the tree is obtained by tapping. General Cullen reports that in five or six hours upwards of 1½ lb. was collected from four to five incisions in one tree. Mr Lascelles states that from 20 to 40 lbs. of sap are procurable from one tree. The tree is not figured in Rheede's "Hortus Malabaricus," nor in Wight's "Icones;" nor is it described in De Candolle's "Prodromus," nor in Walper's "Repertorium."

The cotyledons are eaten by the forest people, and the bark is sometimes chewed instead of Betel. Drawings of the tree and its various parts, by native Indian artists, were exhibited.

II. *Notes on the Vegetable Oils of the Madras Presidency.* By Lieutenant HAWKES. Communicated by Dr CLEGHORN.

Although the number of oil-producing plants in Southern India is very large, yet it will be found that of them but few are cultivated to any great extent, the large proportion consisting of trees, shrubs, or herbs growing in a wild state, the fruits of which are gathered by the poorer classes, and the oil pressed as necessity requires. The oils are classed under the following heads:—1. Oils procured from plants which are cultivated for the sake of their products, such as Coco-nut oil (*Cocos nucifera*), Gingely oil (*Sesamum orientale*), Castor oil, often called lamp oil (*Ricinus communis*), Ground-nut or Manilla-nut oil (*Arachis hypogœa*), Linseed oil (*Linum usitatissimum*), Ramtil oil (*Guizotia oleifera*), Mustard oil, much used for anointing the body (species of *Sinapis*), Poppy oil (*Papaver somniferum*). 2. Oils procured from plants which grow spontaneously, and are found in sufficient quantities to admit of the produce becoming an article of inland trade, such as Margosa or Neem-oil (*Azadirachta indica* and *Melia Azedarach*), solid Bassia oil used for candles and for butter (*Bassia longifolia* and *butyracea*), Pinnacotay oil (*Calophyllum Inophyllum*), Kurunj oil (*Dalbergia arborea*), Coorookoo oil (*Argemone mexicana*), Catamunak oil (*Jatropha Curcas*), Piney tallow (*Vateria indica*), and Gamboge oil (*Garcinia pictoria*). 3. Oils procured from plants which grow spontaneously, but to a limited extent, in many parts of the country. These oils are sometimes extracted by the poorer classes for home consumption —Safflower oil (*Carthamus tinctorius*), Belgaum walnut oil (*Aleurites triloba*), Poorana oil (*Sarcostigma Kleinii*), Jungle almond oil (*Hydnocarpus inebrians*), Addale oil (*Jatropha glauca*), Cress oil (*Lepidium sativum*), Cucumber, Melon, and Gourd oil (species of *Cucumis* and *Cucurbita*), Coorgapilly oil (*Inga dulcis*), a common hedge plant. 4. Oils procured in small quantities from plants, and used chiefly for medicinal purposes, and for perfumery, such as Soap-nut oil (*Sapindus emarginatus*), Cashew oil (*Anacardium occidentale*), Cotton oil (species of *Gossypium* and *Bombax*), Croton oil (*Croton Tiglium*), Bryony oil (species of *Bryonia*), Colocynth oil (*Citrullus Colocynthis*), Fenugreek oil (*Trigonella Fœnum Græcum*), and others. Mr Hawkes then referred to the use of fats and oils in currying and buffing leather, in burning in lamps, in lubricating, in preparing woollen cloths, in paints and varnishes, in the manufacture of candles and soap, and as articles of food. The paper was illustrated by specimens of the oils from the Museum of the Botanic Garden.

III. *Muscological Excursions to Ramsheugh and Glenfarg, Ochil Hills, Perthshire, and Habbie's How, Pentland Hills, in September last.* By Mr John Sadler.

1. *Muscological Excursion to Ramsheugh and Glenfarg, and the Ochil Hills, in October* 1858.

The Ramsheugh is a wooded ravine on the northern side of the Ochil Hills, in Perthshire. It is a glen of no great extent, with a small cascade or waterfall at the upper extremity, and is perhaps as interesting for its botany as for its picturesque beauty.

On the trunks of the trees near the bottom of the glen, *Neckera complanata* was seen sparingly associated with *Pterogonium gracile* and *Sticta fuliginosa*, a rather rare British lichen. *Anomodon viticulosus* was abundant, and very fine on the rocks overshadowing the rivulet. On the blocks of stone which lie scattered along the margins of the water, *Isothecium myurum* was plentiful in fruit, *Hypnum striatum* also occurred here and there fertile, along with *Hypnum plumosum*, bearing abundance of capsules. *Hypnum ruscifolium* was frequent on the stones in the water. On the rocks in the immediate vicinity of the fall, and therefore moist, *Isothecium alopecurum* attained a beautiful tree-like form, and was fertile. *Mnium punctatum* was plentiful near their base in fructification, and *Mnium undulatum* was very large. *Orthotrichum Lyellii*, *O. affine*, and

O. crispum were also frequent on the trees growing on the banks.

Glenfarg is a narrow pass running through the Ochil Hills from north to south, with a low stone dyke on one side of the road, and rocks and precipitous banks on the other. The former affords abundance of *Racomitrium canescens*, *R. heterostichum* and *Hedwigia ciliata*, while the latter produces beautiful specimens of *Zygodon Mougeotii*, *Fissidens adiantoides*, *Hypnum serpens*, *H. prælongum*, *H. filicinum*, *Dicranum pellucidum*, and many other common mosses. *Bartramia fontana* and *Bryum Wahlenbergii* occur on the rocks near the Bein Inn.

2. *Muscological Excursion to Habbie's How in September* 1858.*

Perhaps during no single day's excursion near Edinburgh can the bryologist collect more interesting and rare mosses than in going to Habbie's How by Dreghorn and Bonaly. In Dreghorn Park, *Leskea polyantha* occurs plentifully on the trunks of one or two trees. This is the only station around Edinburgh for the plant, indeed, there is only one other recorded Scottish habitat. *Orthotrichum Lyellii* is also frequent in the same situation, associated with *O. affine*. Between this and Bonaly, *Hypnum uncinatum*, *H. denticulatum* and *H. splendens* occur, as well as many other common species. *Leskea subrufa* was found in Bonaly ravine, a moss hitherto confined to Habbie's Howe in our Edinburgh flora. *Zygodon viridissimum*, another rarity, and *Weissia verticillata*, encrusted with carbonate of lime, occur sparingly on the rocks. *Leskea sericea* and *Hypnum molluscum* are also frequent. *Hypnum ruscifolium* is abundant on stones in the burn, and *Hypnum commutatum* grows in wide-spreading patches of a lively green on the wet rocks. The only other mosses met with worthy of notice were *Trichostomum flexicaule*, *Dicranum varium*, and several Bryums, including a curious specimen of *Bryum crudum*, with peculiar elongated capsules.

* In this excursion, I was accompanied by Dr W. Nicol, a zealous muscologist, who has just fallen a victim to typhoid fever at Alexandria, on his way to India. (May 1859.)

On the hills near Habbie's How *Racomitrium canescens* was seen in several places covering the ground, almost to the total exclusion of all other vegetation, except *Cornicularia aculeata*, which is not uncommon in sub-alpine districts. *Leucobryum glaucum* occurred even on some of the highest parts, associated with a stunted form of *Sphagnum cymbifolium*.

On the detached rocks near Habbie's How, *Andrea Rothii* is met with in considerable abundance, rather a rare plant, at least in the neighbourhood of Edinburgh.

At the lower fall, *Racomitrium aciculare*, *R. fasciculare*, *Hypnum plumosum*, and many other good mosses are seen. The little spot between the two falls may be justly termed a cryptogamic garden. *Blindia acuta* occurs here in great profusion, also *Tortula tortuosa*, *Bartramia Œderi*, *Dicranum fuscescens*, *Bryum zierii*, *B. crudum*, *Leskea subrufa*, *Encalypta ciliata*, *Trichostomum flexicaule*, *Didymodon rubellus*, *Gymnostomum rupestre*, *Anœctangium compactum*, *Zygodon Mougeotii*, *Neckera crispa*, *Blasia pusilla*, *Cynodontium Bruntoni*, and *Hypnum ochraceum* which is new to the Edinburgh flora.

It is not unworthy of notice, that all these mosses, without exception, occur on the rocks facing the north, those facing the south being almost sterile. Besides these rarities, other mosses were observed, many of a more common nature, such as *Bryum cœspiticium*, *B. capillare*, *B. pallens*, *Dicranum pellucidum*, *Hypnum ruscifolium*, *H. rutabulum*, *H. molluscum*, and *H. loreum* in fruit, *Atrichum undulatum*, and *Isothecium alopecurum*, the latter occurring sparingly in a fertile state. A little beyond the upper fall, *Bryum pseudo-triquetrum* was found, and in the water abundance of *Fontinalis antipyretica*, bearing its curious sessile capsules.

IV. *On a Mode of Protecting Timber from Fire.* By F. A. Abel, Esq. Communicated by Dr Cleghorn.

After mentioning various methods which have been adopted to render wood less combustible, by saturating it with solutions of phosphate of soda, and muriate or sulphate of alumina and chloride of calcium, the author remarks, that all that can be reasonably expected from the most efficient protective coating or impregnating material is— 1. That it should considerably retard the ignition of wood exposed for some length of time to the effects of a high temperature, or of burning matter in its immediate vicinity. 2. That if the vapours which the wood emits by continued exposure to heat become ignited, the flames thus produced shall not readily affect the fibre of the wood, and shall cease almost directly on the removal of the wood from the source of heat. 3. That the prepared surfaces of wood, when in actual contact with burning unprepared wood, shall have little tendency to ignite or cause the fire to spread. The plan proposed is to impregnate wood with silicate of soda, and to coat its surface with a silicate. The impregnating of the wood is effected by putting it in a solution of the silicate. After an interval of at least two hours, a coating of thick lime wash is applied over the silicate ; and finally, on the following day, a strong solution of the silicate is applied over all. In this way, a protective covering is given to the wood. The process may be used with benefit in the case of timber employed for wooden huts.

V. *Observations on Vegetable Morphology.* By J. M. Norman, M.D., Christiania.

Dr Norman's paper contains careful observations made on the stipules and bracts or glands of *Cruciferæ*, on the stipules of *Lotus*, *Dorycnium*, and *Bonjeania*, on the stipules of *Onagraceæ* and of *Lythraceæ ;* also some observations on *Chloranthaceæ*, on *Anchusa ochroleuca*, on a species of *Lupinus*, on *Trifolium pratense*, and *Aquilegia vulgaris.*

The following are the conclusions at which he arrives :—

The leaves of the greater part of the *Cruciferæ* are accompanied by rudimentary glanduliferous stipules. The stipules are usually two in number, one on the right and the other the left of the axil. Sometimes a whole series of axillary glands represent one stipule. In general, the stipules are situated on the part between the stem and the upper surface of the leaf, and are so placed as to appear lateral. Sometimes they are inserted on the leaf itself, near to its base. They are either sessile, and more or less flat and unequal-sided (which is very common), or equilateral and attenuated into a pedicel towards the base (which is more rare), or they are linear and hair-like.

In the *Cruciferæ* we find frequently traces of rudimentary bracts. Their absence is traced to a simple abortion, or to a union between the abortive rudiments of the bract, and the peduncle which comes out from its axil. In many *Cruciferæ* the lamina of the bract disappears entirely, or we meet with it only exceptionally in a very rudimentary state, whilst the stipules persist in the form of two glands, one on each side of all or of the greater part of the peduncles of the inflorescence.

The genera *Lotus*, *Dorycnium*, and *Bonjeania*, have not ternate leaves with free stipules in the form of leaflets, but their leaves are impari-pinnate, with 2 pairs of leaflets, the lower of which conceal the very small glanduliferous stipules.

In the greater part of the plants in the order *Onagraceæ* or *Epilobiaceæ*, the leaves are provided with lateral stipules which sometimes are continuous, at other times slightly moniliform, that is to say, divided in a jointed manner. In the exstipulate *Epilobiums* the upper extremity of the leaf is often furnished with a small papillose appendage, which dries up before the complete withering of the leaf.

The leaves of *Lythraceæ* are accompanied by stipules, each of which is divided into a row of from 2 to 5 axillary glands.

A primary union between the base of a leaf and the nearest axis takes place in the normal condition of development in the inflorescence of many plants, in which this fact can be tolerably well demonstrated.

The *Chloranthaceæ* show that a hollow organ which grows in a completely continuous manner may be composed of a verticil of leaves; and a primary complete union of leaves which have never been separated may thus be demonstrated.

The siliquose capsule in the *Chelidonium* is like the siliqua composed of the laminæ of two opposite leaves, which, with the exception of their upper extremities, are primarily united by their edges. The placentas are a commissural development of these united edges. The disk of each lamina separates from its persistent edge by a solution of continuity, and thus it forms a valve.

The *Chloranthaceæ* teach us that in the *Leguminosæ*, the *Rosaceæ*, and the *Ranunculaceæ* the ovary is formed by the lamina of a single leaf, the ovuliferous edges of which are secondarily united. The style is the superior extremity of the lamina, elongated and narrowed.

Foliaceous transformations demonstrate that the Gynœcium of *Boraginaceæ* and *Labiatæ* is composed only of the laminæ of two opposite leaves, an anterior and posterior, the edges of which are united from their origin. From each half of these leaves is found the envelope of an achene. The upper parts of the united leaves and the parts placed between the four ovarian sacs form the style and the gynobase, or the apparent receptacle.

Mr M'Nab exhibited Forked and other varieties of ***Blechnum boreale*** from Glenalmond, and of ***Pteris aquilina*** and ***Athyrium Filix-fœmina*** from Mr Jackson of Barnstaple. Mr M'Nab also exhibited specimens of *Ceterach officinarum* gathered by himself on an old wall near Renton, Berwickshire.

9th December 1858.—Dr Seller, and afterwards Mr Andrew Murray, President, in the Chair.

The following Candidates were balloted for and duly elected :—

As Resident Fellows.

John Kenneth Wilson, Esq., 8 India Street.
James H. G. Hill, Esq., 15 Moray Place.
Joseph Fayrer, Esq., Surgeon, H.E.I.C.S., 26 Albany Street.
Alexander Goldie, Esq., 21 Queen Street.
William Carruthers, Esq., 6 Argyle Square.
Augustin Fitzgerald. Esq., H.E.I C.S., 11 Keir Street, Lauriston.
S. H. Ramsbotham, Esq., 3 Shandwick Place.

As Foreign Members.

Signor Montolivo, Nice.
Dr Edouard Rostan, Vallée de Pérouse, Piedmont.

As Associates.

Mr William Mitchell, 9 Beaumont Place.
Mr Charles Birtill Dunn, 47 Cumberland Street.
Mr John Sim, 9 Commercial Road, Perth.

The Office-bearers for the ensuing year were elected as follows :—

President.

Andrew Murray, F.R.S.E.

Vice-Presidents.

Professor Allman.
Professor Balfour.
Dr W. H. Lowe.
Dr Seller.

Council.

Professor Simpson.
Henry Paul.
James M'Nab.
J. Montgomerie Bell.
David Philip Maclagan.
Findlay Anderson.
J. G. Booth, Jun.
George S. Lawson.
Dr John Cleland.
A. J. Macfarlan.

Honorary Secretary........Dr Greville.
Foreign Secretary............Dr Douglas Maclagan.
Auditor......................William Brand, W.S.
Treasurer....................Patrick Neill Fraser.
Artist.........................Neil Stewart.
Curator......................Alexander Dickson.
Assistant-Secretary..........William Carruthers.
Assistant Curator..........John Sadler.

The Council reported that the arrangements for the incorporation of the Wernerian Natural History Society with the Royal Physical and the Botanical Societies having been completed, the Members of the Wernerian Society have been added to the roll of the Botanical Society, as follows :—

MEMBERS OF THE WERNERIAN SOCIETY.

(*So far as known, with the date of their Election.*)

1. *Resident Members.*

Alexander Monro, M.D , Craiglockart, late Professor of Anatomy, 12th January 1811.

Sir Arthur Nicolson, Bart., 30th March 1816.

Alexander James Adie, Esq., Canaan Cottage, 7th December 1816.

George Berry, Esq., Rosefield, Portobello (Life Member), 18th April 1818

Patrick Small Keir, Esq., of Kindrogan, 18th April 1818.

*William MacDonald, M.D., Professor of Civil History, St Andrew's, 5th December 1818.

Prideaux John Selby, Esq. of Twisel, 15th April 1819

*Robert Kaye Greville, LL.D., 33 George Square, 15th April 1819.

Sir Andrew Smith, K.C.B., 15th April 1819.

*Dr Thomas Stewart Traill, Professor of Medical Jurisprudence, April 1819.

John Deuchar, Esq , Morningside House (Life Member), 29th December 1819.
*Sir William Jardine, Bart., Jardine Hall, 2d December 1820.
Robert Edmond Grant, M.D., Professor of Comparative Anatomy. University College, London. 21st April 1821.
Robert Knox, M.D., London, 21st April 1821.
Adam Gib Ellis, W.S., 4 Royal Terrace, 1st December 1821.
Robert Hamilton, M.D., Sciennes House, 20th April 1822.
*George A. Walker-Arnott, LL.D., Professor of Botany, Glasgow, 30th November 1822.
James Syme, F.R S.E., Professor of Clinical Surgery, 3d April 1824.
John Geddes, Esq., Mining Engineer, 5th April 1826.
George Lees, LL.D., 5th April 1826.
Rev. John Gibson M'Vicar, Moffat, 19th April 1828.
John Coldstream, M.D., 51 York Place, 9th January 1830.
Robert Paterson, M.D., 32 Charlotte Street, Leith, 3d December 1836.
James Smith, Esq. of Jordanhill, 21st January 1837.
David Milne Home, Esq. of Milnegraden, 10 York Place, 18th April 1840.
*John Goodsir, F.R.S., Professor of Anatomy, 29th November 1840.
*John Hutton Balfour, A.M., M.D., F.R.S., Professor of Medicine and Botany, 28th March 1846.

2. *Non-Resident Members.*

Sir Wm. Jackson Hooker, K.H., Director of Royal Gardens, Kew, 4th November 1809.
Robert Bald, Esq.. Mining Engineer, Alloa, 7th April 1810.
*William Borrer, F.L.S., Sussex, 1811.
*Sir Walter Calverley Trevelyan, Bart. of Wallington, Northumberland, 29th December 1819.
General Sir Thomas Makdougall Brisbane, G.C.B., G.C.H., Pres. R S E., 1st December 1821.
Sir John Richardson, C.B., 26th November 1822.
George Bentham, F.L.S., 13th January 1827.
Captain Henry Drummond, H.E.I.C.S., 3d December 1836.
Robert Alexander Maingy, Esq., Mining Engineer, 28th March 1846.
George Buist, LL.D., Bombay, 28th March 1846.

3. *Corresponding Members.*

*John Torrey, M.D , New York, 19th April 1823.
Joseph Mitchell, Esq., Superintendent of Parliamentary Roads, 5th February 1825.
Laurence Edmonston, Esq., Surgeon, Shetland, 30th November 1832.
Rev. James Duncan, Denholm, 14th December 1832.
Rev. John Anderson, D.D., Newburgh, 11th August 1838.
David Mushet, Esq., Mining Engineer, Gloucestershire, 18th April 1840.
*John MacLelland, M.D., Calcutta, 29th November 1840

4. *Foreign Members.*

*Alexander Baron Von Humboldt, 12th January 1808.
Alphonse de Brebisson, 3d May 1817.
*Adolphe Brongniart, M.D., Professor of Botany, Paris, 19th April 1823.

N.B.—Those marked with an asterisk are already Fellows of the Botanical Society.

It was also reported by the Council that the Assistant-Curator will be in attendance at the Society's Rooms, College, on Mondays, from Twelve to Two o'clock, when Members may consult the Society's British Herbarium and the Books in the Library.

The Treasurer presented the Annual Financial Report, duly audited; and the Curator gave in his Report on the state of the Herbarium and Library.

The death of Gavin Watson, M.D., one of the Foreign Members of the Society, was announced. This event took place in Philadelphia, on 28th October 1858. Dr Watson was born in Lanarkshire, and received the degree of Master of Surgery from the University of Glasgow. He first practised in Scotland, and finally, in 1828, emigrated to America. He settled as a medical man in Philadelphia, and sent large collections of plants, at different times, to the Society's Herbarium. He received the degree of M.D. from the University of Pennsylvania, and he died at the age of 63.

The following donations to the Library were announced:—

Journal of the Royal Dublin Society, Vol. I.—From the Society.

Graduation Address by Professor Balfour in August 1858.—From the Author.

Synopsis of North American Willows, by N. J. Andersson, Professor of Botany, Stockholm.—From the Author.

Address by Professor Lawson at the Opening of the Session of Queen's College, Kingston, Canada.—From the Author.

The following donations to the University Herbarium were intimated by Dr Balfour:—

From N. J. Andersson, Professor of Botany, Stockholm—A collection of between 500 and 600 Swedish Plants.

Swiss Plants, collected in August 1858, by Professor Balfour and party.

Dr F. Mueller, Melbourne—A large collection of Australian Plants.

J. T. Syme, Esq.—Specimen of *Gladiolus imbricatus*, from Lyndhurst, Hants.

Mr Buchan, Dunblane—Specimen of *Centunculus minimus*, from Loch Watson, near Doune.

The following donations to the Museum at the Botanic Garden were reported :—

From James Balfour, Esq., Melbourne, per Balfour Stewart, Esq.—Caterpillars with a species of *Sphæria* growing from their bodies.

R. C. Bell, Esq , Milton, Lockerbie—Bark of *Quillaia Saponaria* from South America. Mr Bell remarks—" I practised for fifteen years in Chile, where an extract and infusion of this bark have been long in great repute for the cure of baldness and for promoting the growth of hair. Its saponaceous qualities render it useful in cleansing the hair. It is also administered medicinally as a febrifuge."

Messrs Drummond, seedsmen, Stirling—Specimen of a large Palm stem, inclosed by a twining species of *Bauhinia*.

James Wright, Esq.—Seed of *Entada scandens*, collected by the Rev. Mr Gerard, in 1820, on South Ronaldshay, Orkney.

Mrs R. Brooking, Rossville, per Mrs Miller—Cones and roots, of a remarkable length, of *Abies nigra ;* also basket and cloth, made from the roots by the Indians. Mrs Brooking states—" I send some of the roots of the Pine used by the Indians in making their canvas. The native name for these roots is Wa-tasse. The way in which it is prepared for use is by taking off the bark, splitting it down the middle and soaking it in hot water for some time, which makes it very pliable. This is the only use to which the Indians in these parts put it. I have also sent you some of the twigs with the cones attached." Mrs Miller states that Rossville, where Mrs Brooking is located, is an Indian mission settlement, two or three miles distant from Norway House, one of the Hudson Bay Company's stations, about 53 deg. 30 min. north latitude. The small basket made of these pine roots, which Mrs Brooking sent last year, was from Oxford House, a station a few degrees farther north.

Dr Alexander Hunter, H.E.I.C.S., Madras—*Poinciana regia* pod ; seed of *Entada scandens*, used by the Indians in their games ; dried leaves of an aromatic plant used at Pondicherry as a substitute for tea ; set of dyes from India, viz., Mysore Gamboge, procured from the Nuggur Division ; Red dye from Shell-lac ; Kuplah rung, or pubescence of the capsule of *Rottlera tinctoria*, which yields a fine orange dye; *Sooroogoodoo ekecka*, used as a dye; seeds of *Parkinsonia*, burnt and used for making printing ink; flowers of *Butea frondosa* or Pullas tree, used for yielding a red dye; *Ratevaria* (*Parmelia perlata*, Ach.; var. *ciliata*, DC.), a lichen used as a dye. This lichen is the Canary Rock-moss of the London orchil-makers, who import it in great quantities from the Canary Islands.

John Gair, Esq., Falkirk—Branch of *Cupressus Lambertiana*, with cones.

Thomas Barclay, Esq., Cupar-Fife—*Sammlung Deutscher Laubmoose*, *Lebermoose*, &c.

Professor Cosmo Innes—Six photographs of ferns and lycopods.

1. Professor BALFOUR read the following notice from Mr Gair relative to the cones of *Cupressus Lambertiana*, from a a plant grown at the Kilns near Falkirk:—" The plant from which these cones are taken is of the hardy spreading variety of the species known as *C. Lambertiana*. It is only about 8½ feet high, and 7½ feet through at the widest part, and the stem near the ground is about one foot in circumference. It was got from Messrs Lawson's nurseries in the spring of 1853, then a small plant about 18 or 20 inches high, and raised from a cutting. It was grown here for two years in a very exposed situation, and was then transplanted to the place where it still grows, which is not quite so much exposed, but still open. The soil is rather poor, with a gravelly subsoil. The plant has always been healthy, but more stunted in its growth than others of the same variety grown here,—probably from its being a poorer soil,—and it has a closer and denser appearance than most of those varieties which have the spreading habit. The foliage is of a rich deep green. The plant has never been injured by frost, while others of the same spreading habit, got at the same time, have been severely injured here; and many of the upright growing species, generally known as *C. macrocarpa*, have been completely killed by frost and exposure. The plant stands fully exposed to the south. There are twenty-three cones upon it, and it is remarkable that they are all on the northern side of the tree, and generally on that part of the tree which is between two or three feet from the ground. There are two clusters of four cones, one cluster of three, two clusters

of two, and the rest are single cones. They are all towards the extremity of the branches, as in the specimen sent."

2. Mr Robertson, of Golden Acres Nursery, sent a dried specimen of *Œnothera tetraptera*, grown from seeds fifty years old, which had been enclosed in gum. The seeds had been received from Mr J. E. Hussey Taylor, with the following letter:—"Thinking that it may be interesting to you physiologically to endeavour to bring about the germination of some seeds preserved in gum fifty years ago, I send you in their envelopes, just as I found them, some packets I have come across while looking over the papers of Mr Hussey Delavel, a man once well known in science. I believe he received them from Sir Joseph Banks. I myself never before heard of gum being used for this purpose, and it is certainly putting the experiment to the most severe test now, after so great a lapse of time. Should you think it worth your while to attempt their growth, perhaps you will some time or other let me know should you be successful."

Mr Robertson says—"The seeds were soaked in cold water about twenty hours before they were sown, and they were then placed in heat until they grew. The gum above referred to contained seeds of poppies, lentils, acacias, mesembryanthemums and convolvulus, but none of the sorts grew except the *Œnothera tetraptera*, which seems to come up very freely. I think that nearly every seed which was sown germinated."

The following communication was read:—

Account of a Botanical Excursion to Switzerland, with Pupils, in August 1858. By Professor Balfour.

I propose this evening to give an account of a botanical excursion to Switzerland, which I undertook with some of my pupils in August last. Although the trip was not signalized by any botanical discovery, still a notice of it may be interesting to the members of the Botanical Society (some of whom were of the party), and may be a useful guide to others who undertake similar expeditions. When I announced last summer to my class my intention of visiting Switzerland, I had calculated that ten or twelve pupils might possibly avail themselves of the opportunity of accompanying me; and I was surprised to find that the number of the party finally reached twenty-four. Never before did such a party of botanical pupils proceed from Edinburgh to the Continent under the direction of the Professor. In this respect the affair is a novel one, and is worthy of notice. The result of the experiment is such as to encourage similar trips in future.

It is of importance for a student of botany to see the floras of different countries. It is thus only that he can acquire a clear view of the geographical distribution of plants, and correct his notions regarding the species found in his own country. Bentham remarks,—"There is probably not a single species of flowering plant peculiar to our islands. Those which are confined to our western counties and to Ireland may generally be traced down the western departments of France to Spain and Portugal; the mountain plants of Scotland are mostly to be found in greater abundance in Norway and Sweden, and often, though at great elevations, on the Alps and Pyrenees; in our eastern counties there are occasionally found a very few of the east European species, which, although extending over the Scandinavian Peninsula and Denmark, do not, in central Europe, spread much to the westward of the Rhine; our southern coasts, here and there, shelter the extreme northern representatives of species common in the warmer regions of southern Europe; whilst the bulk of our flora, the more common inhabitants of our lower hills, plains, and seacoasts, is, in similar situations, more or less spread over the Continent of Europe, and that vast portion of temperate or northern Asia now under the Russian dominion, extending frequently beyond eastern Siberia and the shores of the Pacific."*

During our excursion, we met with a great number of plants belonging to the British flora. In the alpine districts which we particularly examined, we found many of the rare species of our Scottish mountains, while on the less elevated districts the flora of our islands, called *Germanic* by Forbes, was commonly met with. By an examination of the same species in different parts of the world, and

* Bentham's "British Flora," preface, 1858.

by a careful study of the variations which it undergoes in different localities, we are enabled to come to a correct conclusion in regard to its limits, and are thus less likely to be led into the error of constructing species on a contracted view of the flora of Britain. British botanists who have travelled much on the Continent of Europe, have generally shown a tendency to reduce the number of species in our flora, while those who have limited their view mainly to our own islands have often multiplied species. This is well seen in the case of the recently published British Floras. Whilst the last edition of Babington's Manual contains 1708 species (exclusive of Chara), that of Hooker and Arnott's Flora contains 1571, and Bentham's work 1285. Both Arnott and Bentham have been continental travellers, and have examined European plants *in situ*.

Having made these preliminary remarks on the value of such extended views of species as are implied in continental botanizing, I shall now proceed to give a brief narrative of the proceedings of my party. Having procured passports, knapsacks, and other appendages, a party consisting of Messrs Barclay, Fayrer, Fraser, Buchan, A. Graham, Ramsbotham, Radford, Jones, Maverick, Hill, Soper, Meintjes, Rodger, Turnbull, Logan, Bell, Dubuc, Johnston, R. Maclagan, Patrick Graham, G. Williamson, and myself, met at the Docks at Leith on Saturday 7th August 1858, at half-past 11 A.M. Two of our party, D. P. Maclagan and Sconce, joined us on the Continent afterwards, thus making the total number twenty-four. We sailed at 1 o'clock with scarcely a breath of wind (what did blow being from the S.W.), and with the sea like a sheet of glass.

In our progress down the Firth of Forth, we passed, near North Berwick, a party composed of members of the Royal Physical Society, who were engaged in a dredging expedition. Such expeditions are of great value to those who are prosecuting science. They initiate the student into actual natural history work, and they give him a much better lesson than can be instilled by any mere lecture in a class-room. Lectures and excursions must be combined, if a student means to learn science. Hence the value of such working committees as those annually organized by the Royal Physical Society, and of such excursions as are taken regularly by Professor Allman and myself in the course of our summer lectures.

The sunset was beautiful, and was accompanied with a peculiar phenomenon. When looking at the sun as it was sinking in the west we saw, as it were, small clouds rising into the air in succession. The appearance was observed by most of the party, and it was referred by us to some unknown effect on the retina. The colours of red and green were also developed when gazing stedfastly on the sun. These are complementary colours, which, by their combination make up white light. Wilson remarks, that they are often present to the eye,—when one of the colours is seen the other is also frequently present. The normal eye reduces its colour-sensations to three, and analyzes white light into three elements, one of which is red. The other two combined (yellow and blue) make green, and this colour is often presented to the eye when gazing steadily on a bright red colour.

St Abb's Head was passed about 6 P.M., without the slightest swell being observable, and the vessel sailed quietly and safely among the Ferne Islands, which have been the scene of many wrecks,—one of them, that of the Pegasus, being connected with the interesting history of Grace Darling.

On the 8th August we rose to witness a calm and beautiful Sabbath morning at sea, and we spent the day, we trust, profitably. The Rev. J. E. Cumming of Perth, at my request, had service on board, and it was a very interesting sight to behold passengers, captain, and sailors, seated round him, listening attentively to his excellent address, in the course of which he took occasion to allude specially to the evil as well as the beneficial effects of such an excursion as that in which we were engaged. The day continued fine, but towards evening the barometer began to fall; the vessel exhibited more motion, and symptoms of a squall were evidenced by the effects produced on some of our friends.

Monday, *9th August*.—This morning the sea was rather rough, and many prudently stuck to their berths, while others more rash suffered severely. The breakfast party was very small. Between 12 and 1 we reached the bar on the Dutch coast, and soon after we were in smooth water, and landed at Rotterdam at 4 P.M., an event which was telegraphed to Edinburgh, and was noticed in the newspapers of next morning.

The sail up the Meuse to the large commercial city of Rotterdam (which is about 20 miles up the river), brought under notice the Dutch scenery, which was new to many of us,—consisting of flat, marshy ground, intersected by canals, and bordered by willows. After landing at the quay, and getting our baggage and passports examined, and our money changed, we proceeded directly to the station of the railway for Utrecht—not without some unpleasant adventures, caused by the temporary illness of two of our party. Notwithstanding this unfortunate commencement, we all were seated, ere long, comfortably in the railway carriage. We started at 6.40 P.M., and passed through the characteristic scenery of Holland, with its wind-mills, "its ubiquitous canals, bowling-green flatness, and swampy meadows." We formally installed Mr William Turnbull in the office of Treasurer to the party, and we subsequently invested him with the insignia of office—the badge being retained as a memento of the trip. He performed the arduous duties to the complete satisfaction of all, and earned our warmest thanks for his disinterested labours.

During our journey this evening we observed many aquatic plants, such as species of *Nymphœa* and *Nuphar*, *Acorus*, *Butomus*, *Sagittaria*, and *Potamogeton*, but there was no getting specimens by rail. We steamed "through flat, watery meadows, studded with sleek kine, such as one sees in the pictures of Cuyp or Ruysdael, and fenced with broad ditches in lieu of hedges, and passed pleasant Dutch homesteads which are dotted over the landscape."

We reached the University town of Utrecht about 9 P.M., and repaired to the Hotel du Pays Bas, where we were all accommodated after some delay, which enabled the party to make sundry attempts at French, Dutch, and German, to the no small amusement of our host and his attendants.

As a school of medicine Utrecht occupies the highest place among the Universities of Holland. At the present day it possesses some celebrated Professors, such as Schrœder van der Kolk, Donders, Harting, and Mulder. The University was founded in 1636. Dr Adam states that there is a fine hall in the university buildings, at one end of which is a gallery where musicians perform during the ceremonies of the graduations, and which is densely bedecked with flags, swords, spears, and drums—trophies of the gallant part which was played by the alumni of this college during the struggle for independence at the time when Holland was separated from Belgium in 1830. There are 400 students, of whom 70 are medical.*

August 10*th*.—An early start at six enabled such of us as were active to visit the Botanic Garden, where we roused the Professor of Botany, M. Bergsmal, and had the benefit of his company in our perambulation. He was most attentive and kind, and gave us descriptions in French of all we saw. The garden is small, but it contains some valuable plants, chiefly those sent from the Dutch possessions in Java, &c. The stoves are not extensive. The pupils attending the lectures are said to be about 40. The Professor's house adjoins the garden, and opens into it.

Among the plants noticed by us we may enumerate the following:—Large standard tree of *Salisburia adiantifolia;* fine *Magnolias* in fruit; many varieties of *Olea europæa;* large specimen of *Alnus americana, Nepenthes ampullacea, Chamærops humilis* and *arborescens, Pandanus furcatus;* some good Cycadaceæ; *Pawlonia imperialis,* in fruit; *Dracæna elegans;* a shoot of *Dracæna* cut off and planted in a pot; *Amherstia nobilis, Antiaris toxicaria, Caladium pinnatifidum, Dracontium pertusum, Cephalotus follicularis, Philodendron bipinnatifidum, Polygonum perfoliatum, Laurus Sassafras, Sanseviera zeylanica, Hura crepitans, Cinchona pubescens* and *condaminea, Casuarina sumatrana, Livistona chinensis, Garcinia Mangostana;* various Palms; Ferns from Java; *Angiopteris angustata, Marsilea ægyptiaca, Araucaria excelsa* and *Cunninghami*, and *Punica Granatum* in fine flower.

We had no opportunity of seeing any of the other Professors at that early hour. Donders, the famous ophthalmologist, was absent; we had the pleasure of meeting him afterwards in Paris. After seeing the garden we ascended the lofty spire or tower near the cathedral. It is between 300 and 400 feet high, the number of steps being 365. As the morn-

* Adam, in *Edinburgh Medical Journal*, September 1858.

ing was rather misty, the view was not so extensive as we could have wished. After breakfast we started for Cologne, leaving Utrecht at 8.50, and reaching Cologne about 5 P.M. On the way we noticed the extensive cultivation of buckwheat, and in some moorish spots we observed the *Calluna vulgaris*. We passed on the way Arnheim, Emmerick, and Dusseldorf.

The Hotel Belle-vue was our rendezvous at Cologne, or rather at Deutz,—Cologne being on the other side of the river and united by a bridge of boats. From our rooms we had a fine prospect before us. We visited the cathedral and the church of St Ursula, to which we were accompanied by the Rev. Dr M'Cosh of Belfast, whom we met in the cathedral. Our dinner at 8 P.M. gave the uninitiated of the party some idea of a Continental repast as regards its extent and *re-chérché* nature. Café, with music, on the esplanade behind the inn and on the banks of the Rhine, concluded the day's work.

August 11.—The steamer on the Rhine called for an early start, and we were astir between 4 and 5 A.M.; we crossed the bridge of boats and went on board the steamboat at 6. The sail up the Rhine was delightful; the day was charming, although the heat was rather oppressive, and we were glad to get the shelter of an awning. After passing Bonn we entered on the magnificent scenery of the Siebengebirge, Drachenfels, and Rolandseck, with the romantic island of Nonennwerth. We had a good view of the scenery on the Rhine,—its ruined castles, its fortifications, and its vineyards, famous for their wines, covering the terraced rocks, and all those objects which have called forth the poet's praises of the castled Rhine.

Our boat was crowded with passengers, so that it was no easy matter to move. The cabin was very small, sufficient perhaps for breakfasting operations, but by no means fitted for a *table d'hôte*. The preparations for this were made on the deck under an awning, which, however, failed to keep out completely the burning rays of the sun. As the space on deck was occupied by tables, it became necessary for the passengers to seat themselves at once; and the situation was such as to give all an opportunity of observing the scenery, while they were indulging in the protracted discussion of a German meal. The party were actually seated at table from about 12½ till 5, and during the greater part of this time dishes were presented at certain regulated intervals, so that the palate was pampered, and the appetite morbidly increased. Fruit and seltzer-water were in great request, from the sultriness of the day,—not to mention beer and light wines of all descriptions. Passing Neuwied, Coblenz and Ehrenbreitsten, Bingen and Biebrich, and many vineyards famous for their wines, as Assmannshausen, Rudisheim, and Johannisberg, we reached Castel, near Mayence, about 8 P.M. We arrived at Frankfort by railway about 10 P.M., and were distributed between the Hotel de la Russie and the Hotel of the Roman Emperor.

The 12th August was not a day on the hills with us. We were in all the heat of Frankfort, and sighed for some mountain breezes to cool us. We visited the various sights in Frankfort after breakfast, under the guidance of Dr Sanders, who knew the town well. We did not forget the cathedral, Luther's House, the statue of Ariadne, the market-place with its fruits, some of them not common in Scotland, as mulberries and tomatoes; and the walks around the town, where we observed *Robinia Pseudo-acacia*, horse-chestnuts, elms, planes, limes, weeping willows, weeping birches, *Pawlonia imperialis*, *Acer*, *Catalpa*, and *Rhus*. We crossed the Maine, and saw the old palace of Saxenhausen. At 12.25 we started by train for Heidelberg, which was reached about 4 P.M. In going from Frankfort-am-Maine to Heidelberg, we passed through the "lovely district of the Odenwald, along the Bergstrasse, where the railway winds through clustering orchards, past sunny vineyard slopes, and under the shadows of overhanging mountains, with the ruins of feudal towers peeping out from their wooded summits." We observed fields of maize, tobacco, hemp, flax, mangold-wurzel; also vines, hops, potatoes, opium poppies, but not much buckwheat; large trees of Robinia and walnut; *Gnaphalium arenarium*, *Acorus Calamus*, *Rhus typhina*, *Lythrum Salicaria*, &c.

At Heidelberg we took up our quarters at the Prinz Carl Hotel, and sat down to a *table d'hôte* at 5 P.M.; after which we sallied forth to see the castle. The town is beautifully situated on the banks of the Neckar, which, however, was so low in its waters at this time, that the steamboat could not ply on it. Dr Friedlander who lives at the dorf called Neunheim, kindly accompanied me in my rambles through the town.

We all knew something about the famous university of Heidelberg and its professors, many of whom had a European reputation in medicine, such as Tiedemann, Chelius, Gmelin, and others. Bunsen keeps up its celebrity as a school of chemistry. The students have become notorious in many ways,—not so much for their attention to their university work, as for their social meetings and their duels. Some of the party expressed a great desire to be present at one of these bursch meetings; and at the request of Dr Friedlander, the landlord of our hotel got us introduced into one of these, which was held in a Wirtschaft close to the hotel. The session had just terminated, and the club had met with its president and members in their private room, with a good supply of mugs, beer, pipes, and tobacco. Around this secret chamber were hung pictures of various kinds, marking adventures of student-life, and especially duels of all sorts. Glees were sung, and choruses chaunted with great vigour, while beer was supplied liberally from barrels which contained the club-store. The songs, the laughter, the clatter of the lids of the mugs, and the fumes of tobacco, rendered the room by no means an agreeable place of sojourn. One student made his appearance with his head covered with a rag, indicating that he now enjoyed the distinguished honour of having been wounded in a duel. Our party remained for a short time, as it was not convenient on that evening for strangers to be present, some private business requiring closed doors. These Burschen meetings seem not to be confined to any particular class of students. Some of our party found divinity students similarly engaged. German divinity, I fear, offers no obstacle to such scenes.

Among the students there appears to be very lax discipline and very absurd extravagance. Altogether we were not a little astonished at the scenes we had witnessed, and we returned with a higher appreciation of our Scottish University system as a whole. "In Edinburgh," Dr Adam remarks, "our medical students attain all the happy results of life-long friendships and pleasant professional connections, by enrolling themselves as members of the Royal Medical Society—where their weekly meetings are decidedly more intellectual than a *kneipe*, and the gladiatorial encounters at public or private business are less bloody than the duels of the students of Heidelberg."

Friday, August 13.—At an early hour a few of us walked to the castle and the grounds in its vicinity, and gathered a number of interesting plants, such as *Sideritis spinosa, Campanula Trachelium, Linaria Cymbalaria, Gnaphalium arenarium, Dianthus Carthusianorum, Geranium pratense, Cirsium oleraceum, Chelidonium majus, Lamium maculatum, Centaurea Jacea* and *alba, Diplotaxis tenuifolia, Iberis amara, Malcomia maritima, Bryonia dioica, Euphorbia platyphylla, Circœa Lutetiana, Campanula rhomboidalis, pusilla*, and *rotundifolia.* The morning was fine, and the view extensive and picturesque.

On our way to the Basle railway we met Mr Archibald Stevenson, an Edinburgh pupil, who had been studying practical chemistry under Bunsen; and we made acquaintance with Mr Crumpe, teacher of mathematics at Eton. Having taken our place in the train we proceeded on our way to Basle. Dr Sanders left us at the Appenweim junction, in order to go to Strasburg. We parted from him with regret, and during the remainder of our trip felt much the want of his pleasant company. The Vosges Mountains were seen, and the fine spire of Strasburg.

The famous university town of Basle or Basil was reached at half-past 2 P.M. As our object was to get to the Swiss mountains as soon as possible, we only remained at Basle a short time, getting refreshments at the Hotel de la Poste. At the Basle station Mr Sconce joined the party, having travelled very rapidly from Edinburgh. Starting from Basle at 4.55, we reached Berne about 9.30 P.M. The most of the party were accommodated at the L'Abbaye des Gentilhommes, while some of us went to the Hotel au Maure.

August 14.—The morning tempted us to be astir early; we visited the plateau or platform behind the Minster; it is about 108 feet above the River Aar. We had a magnificent view of the Bernese Alps. We visited the Cathedral or Minster, saw the monument to Berthold Duke of Zaeringen, the founder of the city of Berne, visited the beautiful walks on the banks of the Aar, and the promenades on the fortifications—one of them is called L'Enge—and called on our Botanical Society member, Mr Shuttleworth, but found that he was in England. M. Guthnick, one of our foreign members, received us courteously, and gave us much assistance as well as valuable hints in reference to our route. Berne is built on a lofty sandstone promontory or elevated peninsula, round which the Aar sweeps alternately east and west in a deep channel. The situation is picturesque, and fine views are seen from the ramparts. The houses rest on arcades, under which are walks and shops. Rills of water are carried through the streets, and there are numerous fountains,—the Kinderfesser's (child-devourer's), or the ogre's fountain, being one of the most celebrated. After breakfast we paid a visit, along with Guthnick, to the famous clock-tower. We then went to the museum of Natural History. It is not large, but it is very good. There is an excellent collection of minerals and fossils made by Studer. Bears are seen in the museum as everywhere in Berne. D. P. Maclagan joined us in the museum, having come from the Vaudois country. Our party was now twenty-four. We met Professor Meisner of Basle, who accompanied us to the Botanic Garden, which is very circumscribed, but contains some good alpine plants. On the part of the Botanical Society I promised that collections of plants and copies of our transactions and proceedings should be sent to our Swiss members, who were complaining of our negligence as regards them. The party purchased paper and pasteboard for drying plants. I also got the abridged edition of Koch's *Synopsis*, which, along with Wood's *Tourists' Flora*, were our botanical guide-books. Having joined an early *table d'hôte* at half-past 12, and sent our heavy baggage by post to Geneva, we went to see the Palais Federal, from the terrace of which we viewed the Bernese Oberland. At 5.15 we started by diligences and carriages of various kinds for Thun. Some of us had excellent open conveyances, which enabled us to see all around. The snowy mountains of the Oberland particularly attracted our notice. Between Berne and Thun we observed in several places *Cichorium Intybus* and *Verbascum Thapsus*. Reached Thun about 8 P.M., and took up our quarters at the Freienhof Hotel, kept by M. Stæhli. We had previously telegraphed for twenty-four beds. Telegraphs in Switzerland are carried across the country independent of rails.

Sunday, August 15.—We rested at Thun; attended service at the English chapel, which is charmingly situated above the Lake of Thun, behind the Hotel de Bellevue. A quiet walk afterwards along the shores of the lake brought under our notice many exquisite points of scenery—the Stockhorn, Niessen, and the Snowy Alp, with the lake in its calmness and beauty.

On 16th August we left Thun at half-past 8 A.M., and sailed to Neuhaus. During our voyage the mountains around the lake came forth in all their grandeur, and the snowy summits shone in the sun's rays. From Neuhaus the whole party walked, carrying knapsacks and the bundles of paper by relays to Interlaken, through a beautiful valley shaded by walnut trees, which continued all the way to the Lake of Brienz. The Jungfrau (13,663 English feet) came forth in striking characters, and gave us an idea of the Swiss snowy mountains. At Interlaken the greater number of the party supplied themselves with alpen-stocks, at 1 franc or 1½ franc each—some plain, some with real, and others with false Chamois horns. The poles were made use of for carrying the paper, four bearers being employed for each bundle. Passing through the English villages of Interlaken and Unterseen, we reached the Lake of Brienz, where we went on board a steamer, and landed at Rauf, below the Giessbach waterfall. Here there are a series of falls, which come from a great height through successive rocky channels; we passed behind one of the falls by a gallery. There are several bridges over the stream; at the highest of which the water rushes forth from a narrow dark ravine, with rocks on either side 400 feet high; and after passing below the bridge it has a fall of 180 feet. The scene is wild and romantic. So much are these falls frequented by the English, that printed directions are given to every one in the English language. There is also a hotel on the way for travellers to rest. Logs of wood are thrown from the bridge by the guides, so as to be carried down by the waterfall. In the wooded banks and on the rocks of the Giessbach there are many excellent lowland and subalpine plants. Our botanical zeal was excited, and we proceeded to pluck them with avidity. Not attending to my footing, I here met with a fall which caused a severe sprain of the hip-joint. I was thus completely lamed and unable to proceed with vigour and alacrity. The plants were however so attractive that I contrived to limp on with the aid of my staff, and although I could not climb the rocks, I gathered some excellent species, and regretted my inability to do as I would have wished.

These woods are well worthy of a full examination, as may be seen by the enumeration of the plants.

Plants gathered at the Giessbach, and in the vicinity of Thun, August 16, 1858.

Aquilegia vulgaris
Aconitum Lycoctonum
paniculatum
Actæa spicata
Thalictrum minus
Hepatica triloba
Trollius europæus
Clematis virginiana
Berberis vulgaris
Dentaria digitata
Dianthus atrorubens
carthusianorum
Möehringia muscosa
Saponaria officinalis
ocymoides
Gypsophila repens
Silene Otites
Viola mirabilis
Impatiens noli-me-tangere
Lythrum Salicaria
Myricaria germanica
Erodium cicutarium
Geranium pyrenaicum
robertianum
pratense
columbinum
cinereum
Hypericum montanum
Althæa officinalis
Malva rotundifolia
Onobrychis sativa
Coronilla varia
Emerus
Lotus major
Medicago sativa
Genista sagittalis
tinctoria
Melilotus Leucantha
Spiræa Aruncus
Rubus cæsius
Poterium Sanguisorba
Sanguisorba officinalis
Alchemilla vulgaris
alpina
Sedum album
Silaus pratensis
Galium verum
Asperula taurina
Adenostyles leucophylla
Cichorium Intybus
Centaurea alba
montana
Echinops sphærocephalus
Inula germanica
Erigeron canadensis
acris
Carduus defloratus
Filago arvensis
Gnaphalium sylvaticum
Artemisia Absinthium
Aster Amellus
Hieracium angustifolium
Pilosella and vars
præaltum
prenanthoides
rigidum

Lactuca perennis
  Scariola
  muralis
Prenanthes purpurea
Senecio erucifolius
  Fuchsii
Taraxacum officinale
Solidago Virgaurea
Scabiosa Columbaria
Jasione montana
Campanula Trachelium
  cæspitosa
  linifolia
  pusilla
Erica carnea
Monotropa Hypopitys
Pyrola secunda
Convolvulus arvensis
Melampyrum sylvaticum
Rhinanthus major
Verbascum Thapsus
  nigrum
Solanum Dulcamara
  nigrum
Physalis alkekengi
Hyoscyamus niger
Echium vulgare
Veronica urticifolia
Digitalis lutea
  grandiflora
Linaria genistifolia
  minor
Anarrhinum bellidifolium
Euphrasia Odontites
Ajuga genevensis
Galeopsis Ladanum
Hyssopus officinalis
Leonurus Cardiaca
Mentha sylvestris
Nepeta Cataria
Origanum vulgare
Prunella grandiflora
Salvia glutinosa
  pratensis
Sideritis spinosa
Teucrium Scordium
  Chamædrys
Lycopus europæus
Verbena officinalis
Hippophäe rhamnoides
Mercurialis annua
Epipactis latifolia
  rubra
Listera ovata
Goodyera repens
Epipogium aphyllum
Allium schœnoprasum
Anthericum ramosum
Convallaria bifolia
Paris quadrifolia
Carex sylvatica
Setaria glauca
Oplismenus Crus-galli
Molinia cærulea
Bromus secalinus
Polypodium calcareum
Lastrea dilatata
Asplenium viride

Leaving the Giessbach with reluctance, we joined our rowing-boats and reached the upper part of the lake, taking up two of our party, who had gone by steam to Brienz. On reaching the inn at Tracht, at the upper part of the lake, we hired a conveyance for our baggage, and my lameness was so great that I was compelled to avail myself of a carriage. It was a great trial to be compelled to leave the party, who enjoyed their walk in the evening through the beautiful vale of Hasli. While waiting for our conveyance, we tried the quality of our alpen-stocks, and found that they were not to be trusted when the weight of the body rested on them. The stocks require to be tested, for in more than one instance they gave way when some of our party were leaping by means of them on the mountains.

We all reached Meyringen (about 2000 feet above the sea) in the evening. This is a large village of the Oberland at the upper extremity of the vale of Hasli. We could not get accommodation at the Pension Ruof, kept by Mr Fluchs, to whom we had been recommended by Guthnick, and we therefore took up our residence at the Hotel Sauvage, where we found ample accommodation. After the *table d'hôte*, we were occupied putting our plants in paper. There is a fine view of the Rosenlaui glacier from the back of the inn.

Tuesday, 17*th August*.—We were now entering on our alpine botanizing. We left at 7 A.M. for the Grimsel, with porters to carry our baggage, a guide whom we had hired for three days, and three horses to carry some of the party. My sprain being very bad, I was forced to avail myself of one of the horses. The weather continued excellent, and all the party were in high hopes. We passed the Reichenbach waterfall, and walking up the Oberhasli valley, reached the village of Gutannen (3290 French feet), which is midway between Grund and the Grimsel. We rested at the chalet of Handeck, which is about 1½ hour's walk beyond Guttanen. The place where we rested is about 4000 feet above the level of the sea.

We visited the famous waterfall of Handeck, which is one of the finest in Switzerland, being more than 200 feet in height. There are two views of it, one above and the other below. At the upper part of the fall a beautiful iris or rainbow is seen from the bridge. Just after the water takes the leap, the waters of the Aar mingle with those of a powerful stream, which comes rushing through the forest on the left, and plunges into the deep abyss.

Leaving Handeck, we reached the Hospice of Grimsel at half past 4 P.M., after a fatiguing walk, and by no means a comfortable ride. The hospice is 6665 French feet above the level of the sea. The path for the horses is often very narrow, precipitous, and rugged, and runs along the tops of perpendicular cliffs. One feels particularly nervous in such circumstances. The less you interfere with the animal the better. The horses are wonderfully sure footed, although they have always a tendency to walk along the dangerous edge of the road.

A short walk in the evening to some of the rocks near the hospice gave us very good alpine plants, many of them being recognised as natives of our Scottish mountains.

The wooden building at the Grimsel is an important station. It brings us close to the best alpine botanical ground. The material of which the building is constructed makes it very noisy from the movements of travellers, especially at night and in the morning.

The following is a list of some of the plants collected in the Oberhasli valley during the journey from Meyringen to the Grimsel.

Ranunculus aconitifolius
Alyssum calycinum
Arabis bellidifolia
Medicago sativa
Trifolium agrarium
arvense
medium
fragiferum
ochroleucum
Vicia Cracca
Agrimonia Eupatorium
Lonicera alpigena
Valeriana tripteris
Asperula taurina
Achillea Millefolium
Artemisia Absinthium
Carduus acaulis
defloratus
Carlina acaulis
vulgaris
Erigeron canadensis
acris
Crepis bulbosa
setosa
Centaurea Scabiosa
Cirsium oleraceum
Hieracium præaltum
Campanula barbata
Phyteuma orbiculare
spicatum
Gentiana asclepiadea
Gentiana campestris
purpurea
ciliata
punctata
Erythrea Centaurium
Cynanchum Vincetoxicum
Cuscuta europæa
Rumex alpinus
Pinus sylvestris
Juniperus Sabina
Habenaria viridis
albida
Veratrum album
Luzula lutea
nivea
Brachypodium pinnatum
Bromus secalinus
Cynodon Dactylon
Festuca sylvatica
Melica ciliata
Panicum miliaceum
Poa nemoralis
Balfourii
Setaria glauca
verticillata
Asplenium viride
Cystopteris fragilis
Lastrea dilatata
Polypodium calcareum
Polystichum aculeatum

My friend, Charles Martins of Montpellier, gives the following statements relative to the vegetation of the Grimsel :—

Meyringen, at about 2018 feet above the level of the sea, is surrounded by plum-trees, cherries, pears, walnuts. Ascending the small mountain called Kirchet, on the route to the Grimsel, at about 600 feet above Meyringen, we come to a forest of magnificent oaks. We then descend into the fertile valley of Im Grund, at 2066 feet above the level of the sea, and soon traverse a narrow gorge, where gneiss succeeds limestone. The beech and the birch, the sycamore and *Sambucus racemosus*, replace the oak. The beech does not cease until we get beyond the village of Im Boden, and about 3230 feet above the level of the sea. At Guttanen, 3476 feet, we reach the limit of the sycamore, the hazel, the cherry, flax (*Linum usitatissimum*), rye, and barley. In the gardens of this village we meet with cabbage (*Brassica oleracea*), Indian cress (*Tropæolum majus*), and peas (*Pisum sativum*). Immediately above the village the valley is again contracted. The spruce (*Abies excelsa*) forms thick forests, mingled with the mountain fir (*Pinus sylvestris β. montana*), and at 3963 feet, with *Rhododendron ferrugineum*, and *Vaccinium Myrtillus*. After passing Handeck, at 4957 feet, we come to the upper limit of the spruces at 5067 feet, although some isolated specimens attain to 5114 feet. From this point the mountain fir predominates. It is mixed with some birches and alders (*Alnus viridis*), all of them ceasing at 5938 feet above the sea level. Around the hospice of the Grimsel, at 6233 feet, all arborescent vegetation ceases, and the botanist is surrounded by herbaceous plants peculiar to the high Alps. On proceeding, however, along the banks of the Aar to the glacier whence it proceeds, we find on the slope exposed to the south the alder (*Alnus viridis*), the larch (*Larix europæa*), and the birch, at a mean height of 6479 feet. The *Pinus Cembra* ascends about 492 feet above the birches. Under these trees, and at the foot of the glacier, we meet with many plants which are also found at 70° of north lat., such as *Euphrasia minima*, *Empetrum nigrum*, *Vaccinium Myrtillus*, *Juniperus communis*, and *Calluna vulgaris*. The following table gives the limits of the different arborescent plants of the Grimsel:—

Quercus Robur, oak, . . .	2624 English feet.
Fagus sylvatica, beech, . .	3232 ...
Prunus Cerasus, cherry, . .	3478 ...

Corylus Avellana, hazel,	**3478**	**English feet.**
Abies excelsa, spruce,	**5068**	**...**
Pyrus Aucuparia, mountain ash,	**5315**	**...**
Pinus sylvestris, β. montana, var. of Scotch fir,	**5927**	**...**
Betula alba, birch,	**6479**	**...**
Pinus Cembra, Siberian fir,	**6890**	**...**

Wednesday, 18*th August* 1858.—The morning was fine, and the alpine scenery grand. The tinkling of the bells of the goats going to pasture was cheering and inspiriting. Numerous guides and porters were waiting for English travellers, most of whom are easily imposed upon. We had arranged with our guide to have provisions for our trip this day. Accordingly at 8½ A.M., after doing full justice to the breakfast at the hospice, we started on our alpine ramble. Passing the end of the little lake near the hospice, called Kleinensee, we proceeded in full botanical equipment to ascend the Sidelhorn. We carried boxes of moderate size, spade, field-book, alpen-stock, compass, whistle or horn, thin oil-cloth coat, not forgetting a thick piece of white muslin round the hat to prevent the effects of the sun's rays on the forehead, as suggested by Dr Fayrer, from his Indian experience.

During the ascent we met with numerous alpine plants belonging usually to genera with which we were familiar at home, and many of them species found, although it may be sparingly, on our Scottish Alps. Some of the latter displayed here a more vigorous growth, and had a more extensive range. Every now and then a loud and joyful exclamation burst forth as some floral treasure was discovered; and the beauty of the Gentians, Androsaces, Aretias, Saxifrages, Silenes, Potentillas, and Geums, called forth the admiration of all. The boxes and field-books were replenished with specimens. Roots were taken of the rarer and more beautiful; and some of them will, I hope, ere long, bloom in our Botanic Garden as a memento of our trip.

On reaching the summit of the Sidelhorn, we had a magnificent view of the Alps. The valley of the Grimsel was on the one side, with the Aar traversing it, the valley of the Rhone on the other. The height of the mountain is about 8650 French feet. The mountains of the Bernese Oberland, and those on the other side of the Vallais were well seen. The Finsteraarhorn, and Shreckhorn, white with snow, rose in all their grandeur, and the glaciers of the Aar and the Rhone, with their immense frozen masses and moraines, filled the depths of the valleys below. We recorded our names on a paper at the summit, with the names of our guide and two porters, one of whom was the brother of our guide. The plants gathered were as follows:—

Plants on Sidelhorn and mountains at Grimsel.

Ranunculus glacialis
aconitifolius
montanus
Philonotis
pyrenæus
Arabis bellidifolia
cærulea
alpina
Cardamine resedifolia
Dentaria digitata
Myagrum saxatile
Sisymbrium pyrenaicum
Thlaspi sylvium
Viola biflora
calcarata
lutea
Allionii
Helianthemum vulgare
Polygala vulgaris
Arenaria ciliata
biflora
fasciculata
laricifolia
norvegica
verna
Cerastium strictum
trigynum
arvense
alpinum
latifolium
Dianthus actinopetalus
Cherleria sedoides
Gypsophila Saxifraga
repens
Möehringia muscosa
Silene acaulis
rupestris
quadridentata
Lychnis alpina
Linum tenuifolium
Geranium cinereum
Tetragonolobus siliquosus
Trifolium badium
alpinum
agrarium
montanum
cæspitosum
Alchemilla alpina
vulgaris
pentaphylla
Cotoneaster vulgaris
Dryas octopetala
Geum montanum
Potentilla aurea
cinerea
ambigua
opaca
Sibbaldia procumbens
Epilobium alpinum
palustre
alsinifolium
angustifolium
Dodonæi
Herniaria glabra
alpina
Crassula rubens
Sedum atratum
dasyphyllum
reflexum
album
Sempervivum montanum
arachnoideum
Ribes petræum
Saxifraga Aizoon
bryoides
cuneifolia
aspera
rotundifolia
aizoides
stellaris

Saxifraga androsacea
cæsia
oppositifolia
umbrosa
Gaya simplex
Astrantia minor, said to give a peculiar flavour to Chamouni honey.
Meum Mutellina
Asterocephalus columbarius
Valeriana tripteris
Asperula aristata
taurina
hirta
Galium sylvestre
rubrum
Achillea Millefolium
atrata
macrophylla
nana
tomentosa
Antennaria dioica
Gnaphalium norvegicum
pusillum
Arnica montana
Aster alpinus
Bellidiastrum Michelii
Chrysanthemum alpinum
coronopifolium
Crepis aurea
Erigeron alpinus
uniflorus
Hieracium Halleri
angustifolium
Bauhini
obscurum
Apargia autumnalis
Solidago Virgaurea
Tussilago alpina
Campanula barbata
rhomboidalis
pusilla
parviflora
Phyteuma hemisphæricum
betonicifolium
Vaccinium uliginosum
Vitis-Idæa
Arbutus Uva-Ursi
Azalea procumbens
Rhododendron ferrugineum
Gentiana bavarica
Gentiana brachyphylla
alpina
acaulis
verna
Myosotis alpestris
Bartsia alpina
Euphrasia lutea
minima
salisburgensis
Pedicularis rostrata
recutita
Veronica saxatilis
alpina
serpyllifolia var. humifusa
spicata
bellidioides
Calamintha alpina
Teucrium montanum
Thymus alpinus
Androsace obtusifolia
pennina
Chamæjasme
bryoides
Aretia tomentosa
Primula latifolia
viscosa
farinosa
Soldanella alpina
Statice pubescens
Plantago alpina
Oxyria reniformis
Polygonum viviparum
Rumex Acetosella
alpinus
Salix arenaria
herbacea
reticulata
pyrenaica
retusa
Juniperus Sabina
Ophrys alpina
Orchis nigra
odoratissima
Anthericum serotinum
Tofieldia palustris
glacialis
Juncus trifidus
filiformis
alpinus
bufonius

Juncus Jacquini
Luzula lutea
spicata
nivea
pediformis
spadicea
Carex curvula
firma
fœtida
ovalis
nigra
atrata
capillaris
chordorhiza
curta
rigida
ferruginea
brachystachys
ciliata
decipiens
lagopina
Elyna spicata
Eriophorum capitatum
angustifolium
Scirpus cæspitosus
Agrostis alpina
Avena Scheuchzeri
sempervirens
tenuis
Festuca pumila
tenella
Lemanni
heterophylla
Aira alpina
Phleum Michelii
Bœhmeri
alpinum
commutatum
Poa alpina var. vivipara
laxa
Sesleria cærulea
disticha
Polystichum Lonchitis
Pseudathyrium alpestre
Allosorus crispus
Asplenium septentrionale
Lycopodium annotinum
Cetraria islandica
nivalis

After enjoying for some time the extensive prospect presented to us from this lofty mountain, we descended towards the valley with the view of visiting the Aar glaciers. On the part of the mountain nearest the upper Aar glacier we gathered many good alpine plants, and we were detained there a long time. Among the plants may be noticed *Ophrys alpina*, *Orchis nigra*, *Lloydia serotina*, *Salix reticulata*, *Elyna spicata*, *Filago norvegica*, *Euphrasia minima*, &c. Some of the party, in place of botanizing, proceeded at once to the upper Aar glacier (*Oberaar Gletscher*). This glacier has no extensive moraine, and is distinctly icy throughout its whole depth.

We crossed the river on a rustic bridge, near a chalet, where a shepherd boy resided. Proceeding to the opposite bank of the stream we gathered many good plants, and then reached the side of the lower or greater Aar glacier (*Unteraar Gletscher*). Here we had a good opportunity of seeing an extensive glacier with an enormous moraine, consisting of masses of rocks of all shapes and sizes, covering the ice so thoroughly as to make one believe that there was nothing below but a mass of stones. The rocks were very sharp and angular. To this fact I can speak, inasmuch as a fall on one of them caused a severe cut of my leg, which, in addition to my sprain, tended much to retard my progress during the whole trip.

On walking on the glacier we found remarkable irregularities. In some places there were deep hollows, which concealed some of the party from the rest, and led to an unexpected separation. In these hollows we could see the icy nature of the glacier. Here and there were deep holes full of water, with clear streams flowing. In other parts there were large hummocks covered with debris.

Two of the party who had not risen in time in the morning visited this glacier before us, and ascended higher than we did. They saw a large stone or table supported on a conical piece of ice—the stone acting so as to prevent the sun from melting the ice. They also visited the Nevé or Firn, at the upper part, and saw the remains of a hut.

In some instances we observed large stones which had formed cavities by the melting of the ice around them under the sun's influence. Leaves carried up by birds occasionally produce similar results. Sometimes when the debris is accumulated in these cavities a reverse process takes place, and the debris becomes raised up, forming a mound or hummock supported on ice. We were enabled to see the course of the glacier, and to observe some of the phenomena which had led to Professor Forbes's observations regarding the plastic nature of glaciers and their movements—views which, though recently challenged by Tyndall, have been shown to be correct, and are generally adopted by most geologists and natural philosophers.

The Aar was observed as it issues out from a vault deep in the ice (height of arch about 50 feet), through which its turbid waters flow. This water is produced by the melting of the glaciers and from the pure springs below. In the turbid, clayey look of their waters, the rivers struck us as being inferior to those of Scotland, where the water is clear and sparkling. The superficial streams of the glacier are clear. These streams are flowing during the day and cease at night, when all becomes quiet and still. The contrast is stated by Forbes and others to be very marked.

Thursday, August 19.—The morning was wet and misty, but we nevertheless determined to proceed on our journey. We left the hospice at half-past 8 A.M., and walked towards the Vallais. We passed the Todten-see (*Lac des Morts*), or Lake of the Dead, so called on account of having been the place into which the dead were thrown on the occasion of an encounter near Nægelis-grat between the French and the Austrians.

After reaching the Col we descended by a very rough and slippery path to the valley of the Rhone. On the road we gathered *Hieracium blattaroides* and *Hypochœris maculata*, besides many alpine plants.

We visited the celebrated glacier (below the Furka, which is 7499 French feet above the sea) whence comes the arrowy Rhone, which is here very turbid, and does not present the blue colour which it exhibits when issuing from the Lake of Geneva. We mounted on the glacier for a short way, saw a deep crevasse, examined the beautiful vault of blue ice whence the Rhone issues, and observed some enormous pieces of ice which had recently fallen. Soon after our visit to the glacier the rain began to cease, and ere long the sun broke forth. We walked to Obergasteln, passing some remarkably ornamented chapels. We rested about midday for lunch, and thence proceeded by the Vallais to Munster, where we took up our quarters.

Among the plants we gathered on the way the following may be mentioned :—

Plants in the Vallais,—from the glacier of the Rhone to Visp.

Biscutella coronopifolia
        lævigata
Bunias Erucago
Camelina sativa
Erysimum ochroleucum
        cheiranthoides
Raphanus Landra
Reseda lutea
Silene nutans
Ononis Natrix
Potentilla argentea
Myricaria germanica
Sempervivum tectorum
        arachnoideum
Athamanta cretensis
Bupleurum stellatum
        pyrenaicum
        ranunculoides
        falcatum
        caricifolium
Laserpitium hirsutum
        Siler
Ligusticum actæifolium
Myrrhis odorata
Centaurea paniculata
Hieracium staticifolium
        grandiflorum
        montanum

Hieracium prenanthoides	**Euphorbia platyphylla**
rigidum	**segetalis**
Artemisia campestris	**Mercurialis annua**
Campanula speciosa	**Stipa capillata**
Linaria vulgaris	**Bromus tectorum**
Veronica acinifolia	**Melica ciliata**
Thesium alpinum	**Panicum miliaceum**
Euphorbia Cyparissias	

We had some difficulty in procuring the needful accommodation at Munster. Our host, who enjoyed the name of Jean Baptiste Guntren, was very attentive and polite, and did all he could to promote our comfort. His constant obsequious repetition of "Herr Professor" was ludicrous.

Plants were arranged and prepared, so as to be sent off to M. Guthnick at Berne, who had kindly offered to take care of them, and transmit them to Edinburgh after being dried. This promise he faithfully fulfilled, and the party are under deep obligations to him for his kindness.

Friday, 20*th August* 1858.—We bade farewell to Munster this morning at half-past 8. We started with two horses for our baggage, and two for certain members of the party. Our host accompanied us for some way without his hat, and seemed highly pleased with all that had occurred,—our well-paid bill being not the least important matter in his eyes.

We reached Viesch, famous for its glacier, and remained there till about half-past 1. After lunch we got five *chars-a-banc*, as they were called, holding five each besides the driver, to carry us on our way, as we were anxious to get to the alpine ground at Zermatt as speedily as possible. The road was a very remarkable one, and by no means safe at some places. We descended at one place to the Rhone by a zigzag road cut on the sides of a precipitous cliff. The descent might probably extend to 400 or 500 feet. It was dangerous work with the cars, and we had occasionally to leave them. We passed the Rhone by a bridge which spanned two precipitous rocks, with the river at a vast depth below. We passed Laax, Massa, and Aletsch, celebrated for its glacier. Between this and Brieg some good plants were picked, *Artemisia campestris*, *Asplenium septentrionale*, and others. We reached the latter town in the evening. At this point the pass of the Simplon commences. The town was recognised at a distance by its glittering tin-topped domes. Our quarters were taken at the Hotel d'Angleterre, and our plants were dispatched by diligence to Berne.

Saturday, 21st August 1858.—At 6 A.M., we left Brieg in two *chars-a-banc*, leaving three of our party behind. We travelled by the valley of the Rhone, through a beautiful country, as far as Visp or Viege. We breakfasted at the Hotel de Soleil, J. B. Viotty being landlord. We then proceeded along the banks of the Visp. Our baggage was conveyed on two horses, and three others were hired by members of the party. We noticed many evidences of the effects of an earthquake which had taken place about three years ago in the valley. In about an hour and a-half we arrived at Stalden. Here the valleys of the Saas and of St Nicolas separate; the latter, which goes to the right, led us to Zermatt. The Saaser Visp runs in the former valley, the Görner Visp in the latter. Between Visp and Stalden there is a fine view at the crossing of the river at Neubruck. A portion of the snowy range is seen between the two valleys of Saas and Zermatt.

Leaving Stalden we walked to St Nicolas (3583 French feet), which usually takes 2½ hours. In this part of the journey the Weisshorn is a conspicuous snowy mountain. St Nicolas is marked by its tin domes. There are terraced vineyards along the sides of the hills. The scenery was charming; high and precipitous hills were on either side; fir woods here and there, and spruces growing on the sides of the hills, where we could scarcely understand how they held their places. Snowy patches were also seen in different places.

Rested and lunched at St Nicolas. On our departure from this place rain and mist came on. We lost the fine scenery between St Nicolas, Randa (4160 feet), and Zermatt; and we failed to have a distant view of the Matterhorn. Some grand rocky scenery and deep gorges, remarkable waterfalls, and bridges across rocky chasms were seen on the way. We passed a chapel with a recess containing whitened skulls, covered by a grating in front. We reached Zermatt between 6 and 7 P.M., thoroughly drenched. As our baggage had not arrived, we were forced to go to bed for a time, and wait patiently for our habiliments. Nine of the party remained at the Mont Cervin Hotel, while the remaining twelve (three being left at Visp) were accommodated at the Monte Rosa Hotel, kept by one of the brothers Seiler.

During our trip this day the following plants were observed :—

Aquilegia alpina
Clematis Vitalba
Biscutella lævigata
Nasturtium palustre
Ononis Natrix
Astragalus Onobrychis
 Cicer
 dasyglottis
 leontinus
Medicago falcata
 denticulata
Trifolium fragiferum
Vicia Cracca
 villosa
Agrimonia Eupatorium
Rosa spiræifolia
Sanguisorba officinalis
Bupleurum falcatum
 graminifolium
Campanula barbata
 rhomboidalis
 pumila
Erigeron canadensis
Gentiana Pneumonanthe
Physalis Alkekengi
Hyoscyamus niger
Echinospermum Lappula
Digitalis grandiflora
Onosma echioides
Salvia viscosa
Hyssopus officinalis
Nepeta Cataria
Monotropa Hypopitys
Chenopodium album
 Botrys
 crassifolia
Scleranthus annuus
 perennis
Herminium Monorchis
Colchicum autumnale
Oplismenus Crus-galli
Stipa pennata
Lagurus ovatus
Lycopodium helveticum

Zermatt is about 4190 French feet above the level of the sea. The village is called in Piedmont *Praborgne ;* it is situated in a green hollow, with fir woods of *Pinus Cembra* and *P. sylvestris* around it, and with fine snowy summits in the neighbourhood.

Sunday, August 22.—This was a day memorable in the annals of the excursion. When we awoke in the morning we found the whole ground covered with newly-fallen snow to the depth of several inches. Not a spot of grass was to be seen; everything was covered with a white sheet of snow, which was a remarkable event at this season of the year. The sun broke out in the course of the morning, and the snow began to melt rapidly, so that the ground became very disagreeable.

The Matterhorn or Mont Cervin stood out in all its grandeur, rising to the height of about 14,000 feet, displaying its inaccessible cone covered with snow. It was perhaps the finest mountain we saw during our trip; we gazed on it with wonder and astonishment. The inhabitants of the village are Roman Catholics, and in spite of the snow they turned out in large numbers for early morning service in their chapel. Musical chimes morning and evening sounded sweetly. The dress of the women, particularly the square hat, ornamented gaily with various tinsel-like appendages, was peculiarly striking.

The curé of the parish is a good naturalist, and is often referred to by Mr Wills, in his work entitled *Wanderings on the High Alps*. He has made a collection of the plants of the district, and portfolios are sold containing the chief alpine species. Mr Barclay had made a list of those in the portfolios at the inn. We had English service in the dining-room of the hotel at half-past 10, the attendance being about fifty.

On Monday, 23d August, as the day was fine and the snow was melting, we ventured to ascend to the Riffel. Accordingly at 9 we started with a guide named Joseph zum Taugwald, who knew something about the plants of the district. On going up the valley, not far from Zermatt, there are marks of polishing and striation seen on some of the rocks. We made our way gradually through the wood, consisting partly of *Pinus Cembra*, and up the mountain to the Riffel hotel, kept by a brother of Seiler of Zermatt. On the rocks we collected *Gentiana nivalis* and *Oxytropis campestris*. The Riffel hotel is 3000 to 4000 feet above Zermatt. After arranging for *table d'hôte* at the Riffel in the evening, we proceeded with our guide towards the Görner-Grat, walking through deep snow and getting no plants. In some places the snow was a foot deep. We were much annoyed at this untoward event, for we had looked to this district as the best for alpine botanising.

The Görner-Grat and Hochthaligrat are lofty ridges which penetrate into the very heart of Monte Rosa. From them is seen a range of glaciers, precipices, and crags, the most gigantic and the most striking among the Alps, according to Wills.

In front was Monte Rosa, rising to the height of 15,165 English feet. The tops of Monte Rosa seen were Nord-end and Hochste-Spitze of Von Welden's map.* From the Görner-Grat, Monte Rosa appeared to be close, but it requires nine or ten hours to reach it. To the right was the precipitous Lyskamm and the Breithorn, ending in the little Mont Cervin (12,010 feet), and Col St Theodule. Behind was the Matterhorn, with its inaccessible obelisk rising to 13,850 French feet. Nearer were the twin peaks called Zwillinge or Castor and Pollux, and the magnetic Riffelberg (with its highest point called Stockhorn), which can be ascended by a curious and difficult path. Above the Riffelberg is a shaggy peak called the Riffelhorn, and between it and the Stockhorn is the Görner-Grat. Below us was the splendid *Görner-Gletscher*, called also the Monte Rosa or Zermatt glacier, which is said to be the longest in Switzerland. We next have the Findeln glacier, then the Furgge glacier, immediately under the precipice of the Matterhorn, and finally, the Zmutt glacier, by which Professor Forbes passed from Evolena to Zermatt. The Dent Blanche above Zermatt was another of the summits which attracted notice. The day was clear, the sun shone bright, and the reflection from the snow was intense. The pupils of our eyes were contracted to a fine point by the glare. This splendid view from the Görner-Grat has been engraved; but we were unable to procure copies of it. We saw the engraving at Zermatt and at Sion.

The summit of the Görner-Grat was reached by only fifteen of the party, whose names were with difficulty signed, owing to the effects of cold on the fingers. When thrusting our poles into the deep snow, a beautiful blue colour appeared even at a moderate depth of 6 or 8 inches. This blue colour has been conjectured to be that of pure water.

The effects of the sunlight reflected from the snow was very dazzling, and affected us all more or less, especially those whose faces and necks had not been protected by veils and green spectacles. While our feet were in the cold snow, the upper parts of our bodies were roasted by an unclouded sun, and the light from the snow was excessive. The greater number returned at once from the

* The best map of Switzerland is Leuthold's Post, Eisenbahn und Dampfschiffkarte der Schweiz, published at Zurich, engraved by Müllhaupt, the geographer.

Görner-Grat to the Riffel; while Messrs Buchan, A. Graham, myself, and guide, made an excursion to some rocks by the side of the glacier, where the snow had melted more fully. We gathered some excellent plants, and were satisfied that the snow had prevented us from reaping a rich harvest.

Plants collected at the Riffel and Zermatt.

Ranunculus pyrenæus
Alyssum alpestre
Arabis cærulea
Draba frigida
    polaris
Alsine recurva
Cerastium alpinum
Geranium aconitifolium
Oxytropis campestris
    cærulea
    cyanea
    montana
Phaca astragalina
    alpina
Anthyllis Vulneraria
Hippocrepis comosa
Epilobium Fleischeri
Galium rubrum
    Bocconi
Valeriana celtica
    montana
Achillea nana
Artemisia glacialis
    laciniata
Artemisia spicata
Arnica scorpioides
    glacialis
Antennaria alpina
    Leontopodium
Senecio uniflorus
    incanus
Gnaphalium pusillum
    carpathicum
Hieracium lanatum
    Pilosella var. robustum
Saussurea alpina
Campanula cenisia
    excisa
Gentiana nivalis
    glacialis
Eritrichium nanum
Veronica alpina
    saxatilis
    fruticulosa
Primula longiflora
Pinus sylvestris
    Cembra
Tofieldia borealis

About 6 P.M. the three persevering botanists reached the inn. The party had some difficulty in getting themselves seated at the *table d'hôte*, from want of room. The combined effects of the snow and the sun's rays were visible on all, and some of us suffered very severely. The skin of our faces became as red as a lobster, our eyes were bloodshot, so that we could scarcely see, and our lips, noses, and necks were very painful. These effects lasted, to a certain extent, for many days. The shining aspect of our red faces, after copious lubrications with butter, was a source of no small amusement even to the sufferers.

The evening was cold and misty, and ice and snow were at the very door of the hotel. We had intended to have had another day's botanising here, and to have visited the Furgge and Zmutt glaciers, but the effects of our adventures today were such as to make the party resolve to return to Zermatt. All were discouraged by the want of success in the way of plant gathering, and the smarting of faces, necks, and eyes, was not easily got over. Accordingly we proposed, after sleeping at the Riffel, to start for Zermatt. Mr Barclay noticed in the travellers' book the following entry:—" 25th July 1855.—At 1 P.M. this house was severely shaken by an earthquake." It was probably the same which caused such destruction near Visp.

On the morning of Tuesday, 24th August, I rose about half-past 4, with the view of seeing the sun rise. It was a cold morning, with ice all around; the sky was clear, and without a cloud. I went out of the inn with the additional covering of a blanket (without being charged extra, as at the Rigi). I stood alone on one of the summits near the inn, and was fortunate in seeing a most glorious sunrise; first a red colour tipping the very summit of the Matterhorn, then descending and reaching the Breithorn, the Dent Blanche or Hovenghan, and the other lofty summits, and finally the rays reaching the lower mountains, until, at half-past 6, the valley below was illuminated. It was a striking scene. The red tinge on the white snow was peculiarly beautiful, and the contrast between the lofty peaks bathed in light and the valley below still in darkness, was remarkable. I was amply rewarded for my long and cold waiting, without any one to commune with save Nature herself. Soon after 6 we commenced our descent to the Monte Rosa Hotel, at Zermatt, gathering a few plants on the way. Some of the party descended from the Riffel to Zermatt in an hour and a-half.

After breakfast we left Zermatt and walked down the valley, taking the opportunity of observing the splendid scenery which we had missed on our way up. The Matterhorn continued to be an object of admiration. Two horses carried the baggage.

The melting of snow had caused an increase in the streams, and in several instances the rude bridges required for the passage of the horses had been carried away. These rapid torrents often carry down debris and trees with them, and render the roads impassable. At one part of the journey the horses came to a stand-still, and it became necessary to repair the dilapidated bridge. This was accomplished by the party with the aid of the guides, under the direction of Dr Fayrer, whose experience in the crossing of rivers in India proved valuable. To the astonishment of the guides, a most effective bridge was constructed in a much better style than they had ever seen before. We were of course compelled to pay the guides for the lesson which we had given them.

St Nicolas was, as before, the rendezvous for lunch; and here we met Dr Burdon Sanderson, from London, a former botanical pupil, well known for his papers on Vegetable Embryology, who, with his wife, was making a tour in Switzerland. Continuing our walk, we reached Visp in the evening, after having been on foot for twelve hours, and accomplished about 34 miles. We took up our quarters at the Hotel de Soleil as formerly, and had some difficulty in teaching our host how to treat travellers. We arranged for our conveyances for next day after some stiff bargaining.

Wednesday, August 25.—At 9 our party of twenty-four started in four voitures of different kinds for Martigny. During the first part of our journey along the banks of the Rhone the weather was fine, and we had charming views of the landscape. *Herminium Monorchis* was gathered in large quantity. Sion was fixed upon as our resting-place for lunch. There we remained two hours. It is the chief town of the Valais, and has three castles—Majoria, Valeria, and Tourbillon, which are partly in ruins, and are very conspicuous objects from their situation on the top of a lofty rock. Near Sion there are large transported blocks, apparently showing the results of glaciers. Vines, maize, and buckwheat are grown in the fields.

The drive to Martigny was long; we had a sight of the town about eight miles off, at the extremity of a straight avenue of poplars. This made the journey tedious. Before we reached our destination, rain came on. We were accommodated at the Hotel Clerc, to which we had telegraphed for beds, and we arrived about a quarter before 7. In the evening our plants were put up and dispatched to Berne. The weather became boisterous; there were thunder, lightning, and rain during the whole night, and the wind increased much.

On the morning of Thursday, 26th August, the weather was so bad as to forbid our attempting to pass to Chamouni by the Tete Noire. Finding the weather did not improve, we left Martigny at half-past 10—some taking the omnibus and others walking. We passed the fall called Pisse-vache, and proceeded to the bridge of St Maurice, where we were detained by *Douaniers*, who examined our passports. On the way Mr Fraser gathered some good ferns, especially *Asplenium Halleri* and *Grammitis Ceterach*. We finally reached Bex, famous for its salt mines; proceeding from thence by rail to Villeneuve, we went on board the steamer on the Lake of Geneva, and started at half-past 12. The blue waters of the lake attracted our notice, and we had a good view of Byron's Chillon, and Rousseau's Clarens, as well as of the various towns and villages on the shores of the lake—Vevey, Lausanne, &c. The day was showery, and ever and anon we were compelled to shelter ourselves. Some of the brightest rainbows we ever contemplated were seen to-day. We landed at the quay at Geneva at 7 P.M., and finding that we could not get accommodation at the Hotel de la Couronne, we went to the Metropolitan Hotel, a large and new building, where there was ample room. At the *table d'hôte* at 8, the entrance of our party caused some sensation among the fashionable English who were seated at it, and who were at a loss what to make of us.

August 27.—The morning was occupied in clearing our baggage, getting passports *visé*, and having a photograph of the party taken by M. Poncy. Unfortunately the latter has not turned out well, and the printing of it has shown its defects. We missed the artists to whom we were recommended (Artaria and Carini), and our limited time compelled us to take the first we could light upon; M. Poncy happening to stay next door, we applied to him. Only twenty-two of the party were present, Messrs Bell and Sconce having by mistake failed to appear. Their photographs were separately taken. We visited the most important places in the town under the guidance of M. Emile Decandolle, son of Alphonse,—the Candollean Herbarium and Library, the Botanic Garden, the Public Library, the University, the Calvin schools, the statue of Rousseau, and the model of Mont Blanc by M. Sené. The junction of the Rhone and Arve was also visited by some. We had a fine view of Mont Blanc from the top of our hotel.

The herbarium of Decandolle naturally interested us. Its appearance was shabby when compared with the splendid herbarium of Hooker at Kew. We saw the mode in which the plants are labelled which are described in the Prodromus. It is an excellent working herbarium, which has done good service to science, although it has not much external show.

At 4.15 P.M. we left Geneva by train for Paris, and after a very uncomfortable and sleepless journey we reached Paris at 12 noon, next day (28th). We remained at Paris on Sunday, 29th, and on Monday, 30th, we visited the Jardin des Plantes and Museum of Natural History, and other objects of interest in the French metropolis. Leaving Paris at 7.30 P.M., we reached Calais about 2.30 A.M. of 31st August, Dover about 5, and London about 8. Two of the party (Fayrer and Hill) at once started for Edinburgh, and were home at 8 P.M., thus going from Paris to Edinburgh in 24½ hours.

As we left five of the party at Geneva, and seven at Paris, there were only twelve who came to London together. Of these, two went directly to Edinburgh, five visited the Crystal Palace, and five went to other parts of London. On the evening of 31st August, Turnbull, Logan, and myself left London by the train at 7.30 P.M., and reached Edinburgh at 7.30 A.M. on Wednesday, 1st September.

Thus was concluded a Continental trip which had lasted for twenty-six days, and during which the party had been enabled to see a good deal of the botany of Switzerland. The necessary expenses of the trip were about £20, although most of the party spent more than this sum. It was an experimental excursion, and was in many respects novel. It was instructive in many ways. In the first place, botanically, it gave us a view of a native alpine flora; in the second place, it taught us a lesson in the conducting of such expeditions, and proved to us that there is no difficulty in carrying on scientific excursions of this nature. A little experience has shown how much can be done without guides, and how useless these appendages are when we are botanizing on the hills. We have also learned that it is quite impossible for a botanical party to collect plants and to carry their baggage at the same time. Botanical-box, spade, field-book, and oil-coat are quite sufficient for all ordinary shoulders; and for the conveyance of other articles a botanist must trust to porters or horses. It is only when visiting glaciers or the snowy summits of lofty mountains that guides are required, but such localities are not productive in a botanical point of view.

M. Latrobe, in his *Alpen-stock*, gives the following view of the general aspect of the scene as we ascend the mountains of Switzerland:—

Feet above Sea.	
1000	Hamlets, lakes, vineyards, corn-lands, and villages.
1500	Many pines; pastures; forest trees.
2000	Pines; few forest trees; broken country.
2500	Many mineral springs.
3000	Glaciers mostly descend to this level from the flanks of the central chain of the Alps to the heads of the valleys.
4000	Pastures and innumerable chalets.
5000	Belt of pine forest; to this level the country is often covered with snow from storms in the height of summer.
5500	Rich pastures during height of summer; chalets.
6500	Much rock; highest pine forests; scattered pastures; and chalets.
7000 to 7500	Rocks, and patches of pasture.
8000 to 8500	Bare rocks.
9000	Patches of snow often remaining unmelted for years.
10,000	Snow never melts.

On the north side of the Alps the snow line is at 8200 feet above the level of the sea, while on the south side it rises to 9500. On Monte Rosa it sinks to 8000 feet in the east. The mean of the south side may be estimated at 8600 feet. A great portion of the Alps is covered with perpetual snow. From these great fields of snow glaciers pass into the ravines and valleys, enormous masses of ice sinking gradually downwards and melting there—their lower extremities marked by a barrier formed of stones and debris, from which flow streams of milky water. In some places the glaciers come down to 3000 feet above the sea, and thus lie on a level with corn-fields. The formation and the progress of these glaciers have been fully and satisfactorily explained by Professor Forbes, in the papers which he published in the *Edinburgh New Philo-*

sophical Journal, and which are now collected in an interesting volume on the *Theory of Glaciers*. His viscous theory has been thoroughly demonstrated. He has established that the middle and superficial parts of a glacier move faster than the sides and lower parts; and that the actual sliding of ice, as it gradually melts in contact with its solid bed and walls, amounts to but a very small part of its whole motion. Mr Wills says that Professor Forbes's hypothesis explains so consistently every fact in the history and phenomena of glaciers, as well in its minutest details as in its broadest features, as almost to have lost its speculative character, and taken its stand among geological certainties. It is thus enunciated:—"A glacier is an imperfect fluid or viscous body, and is urged down slopes of a certain inclination by the mutual pressure of its parts." *

Our party did not visit the maritime side of the Alps, and therefore we did not find oranges, myrtles, dwarf cactus, and dwarf palms on the plains; nor did we see the olive, which on the southern side reaches to the height of 1400 feet, along with *Quercus coccifera*, *Genista hispanica*, and the Aleppo pine (*Pinus halepensis*). We were, however, able to notice the gradations in the flora as we proceeded from the plains to the highest summit, and to observe the various regions described by botanical writers.

1. The region of the plains or lower hills, which is limited to about 1700 feet. Here we meet with the common Germanic flora.

2. The lower mountain region or zone of chestnuts, extending up to 2500 feet. Common cultivation extends this length; maize and vines are also found to a certain point.

3. Upper mountain region or zone of beech, extending on the south side from about 2500 to 4400 feet. This corresponds to Heer's *montane* region. This region has a climate analogous to Northern Germany; and most of the plants indigenous to it, as well as many others which belong properly to higher stations, but which descend and flourish at this elevation, can be grown without difficulty in our gardens. Here the winter lasts about six months, from November till May. It is the zone of the higher deciduous

* Wills' *Wanderings among the High Alps*, 2d edition, p. 365.

trees. The ash and the cherry occur here, as well as the oak and maple. Barley, oats, and rye are cultivated.

4. The sub-alpine region or zone reaches from 4400 to 5500 feet. In many places, on steep slopes, where the snow sooner melts away, the soil remains free from snow from the end of May till October; but in the shady and flat localities, only from the middle or end of June till October. Scotch fir (*Pinus sylvestris*), spruce fir (*Abies excelsa*), larch (*Larix europœa*), and Siberian pine (*Pinus Cembra*) occur, but are variable in their limit. Among sub-alpine forms may be recorded *Dryas octopetala*, *Saxifraga oppositifolia*, *Alchemilla alpina*, and *Gentiana verna*. Human habitations occur up to about 6000 feet occasionally in the central Alps.

5. The alpine region or zone of shrubs is considered to lie between 5500 and 7000 feet of supra-marine elevation. In many localities, and on declivities, the snow disappears from the end of June to October; and in shady places or level plains, especially towards the upper limits, the snow remains all the year round. Grassy pastures nearly disappear; the ground becomes stony, with patches of alpine shrubs, especially *Rhododendron ferrugineum*, along with juniper and alder (*Alnus viridis*), and dwarf gnarled pines.

6. The sub-nival region or zone extends from 7000 to 8500 feet. The soil is covered with eternal snow, except in places exposed to the full sun, and on declivities where the soil appears, from the middle or end of July till the middle of September. This zone is interposed between shrubby plants and the snow line. *Rhododendron*, *Vaccinium* and *Azalea* extend into this zone for a short way. We meet with species of *Saxifraga*, such as *S. androsacea*, *bryoides*, *biflora*, *cœsia*, *muscoides*; *Gentiana bavarica*, *nivalis*, and other species; *Androsace glacialis*, and others; species of *Primula*, *Aretia*, *Ranunculus*, *Draba*, *Hieracium*, *Erigeron*, *Oxytropis*, *Astragalus*, *Silene*, *Alsine*, *Arenaria*, *Cerastium*, *Cherleria*, *Pedicularis*, *Senecio*, *Chrysanthemum*, *Phyteuma*, *Salix*, *Poa*, *Sesleria*, and various *Carices*. *Ranunculaceœ*, *Cruciferœ*, *Caryophyllaceœ*, *Compositœ*, *Leguminosœ*, *Gentianaceœ*, *Saxifragaceœ*, and grasses and carices abound. *Umbelliferœ* are represented by such forms as *Gaya simplex* and *Meum Mutellina*. Some of the Gentians, Saxifrages, and Ranunculuses extend even to 10,000 or 10,700 feet. *Ra-*

nunculus glacialis was found by Saussure on the Col St Theodule at 10,461 feet, *Aretia helvetica* on the Col du Geant at 10,578 feet, and *Silene acaulis* on Mont Blanc at 10,680 feet. *Chrysanthemum alpinum* and *Phyteuma pauciflorum* have been observed on the Lys glacier on Monte Rosa at 11,352 feet.

7. The nival region covers the highest mountain-tops from 8500 feet upwards; and it is only in the month of August that a few steep and sunny places are ever free from snow.

Dr E. Regel, director of the Imperial Garden of St Petersburg, in his sketch of the Swiss alpine flora, and his outline of alpine plants, has made some interesting remarks, which I think worthy of record.*

"How powerful," he says, "is the attraction of mountain scenery to the inhabitant of low and flat countries! With what impatient delight the tourist visits the Swiss mountains; to repose there for a short while from the habitual occupation of every-day life,—to breathe the pure and cooling mountain air, which is so wonderfully invigorating, that we bear up easily against fatigues and hardships which, at a lower level, would soon overpower us,—and to imprint the mind with that peculiar beauty and grandeur of scenery which furnish to memory a source of the most agreeable and impressive recollections!

"Undoubtedly, the principal charm of a mountainous country is, above all, to be found in the various formations, and the gigantic proportions of the rocks and mountains themselves; but here, as everywhere in landscape scenery, the vegetation exercises a most important influence on the character of the landscape. Lower down, those fine forests, the fertile flowery meadows, and yonder abrupt towering walls of bare rock, or the swelling mountain slopes which border the valley; higher up, the gradually decreasing number of species of trees, and consequently a greater sameness in the character of the woodlands; those deep green Alp-pastures, which, in many parts of Switzerland, give such a charming character to the country: take them away, would not the whole scenery have lost its chief attractions?

* Garten Flora, translated in *Gardeners' Chronicle*, March 1857.

"We ascend still higher, the larger trees dwindle down to stunted bushes, the splendid roses of the Alps (*Rhododendron hirsutum* and *R. ferrugineum*) cover with shining red flowers whole mountain slopes; in the short grass at our feet flower the deep blue gentians, the pretty red primroses, the bluebell-shaped soldanella, the beautiful yellow and white kinds of anemone, the sky-blue alpine forget-me-not, the fine and interesting species of Pedicularis, &c. On the rocks and between detached masses of stones the Saxifragas spread their swelling cushions of vivid green; and Primulas, blue Phyteumas, Globularias, and many others, find in the smallest fissures of the rock a comfortable abode. Yet higher up leads our path, if path there be; the vegetation becomes more and more stunted and scantier as we go on; by our side and above us large tracts are covered with extensive snow-fields, never soiled by the footsteps of man; the mountain-tops, their bold outlines often broken by deep indentures, stand out against a clear cloudless sky, and the broad glacier rolls his waves, like a mighty river cascade suddenly frozen, over rocks and mountain slopes far down to the valley. The icy breeze from the frozen ocean of the high alpine region makes us shiver with cold even in the hottest days of summer; and yet wherever the snow has melted away, or often even piercing the icy cover, we meet the tiny inhabitants of these inhospitable regions spreading a flowery mantle over the ground, where a few short days before the winter still held its sway. The pretty *Ranunculus alpestris* and *glacialis*, *Geum reptans*, the Soldanellas, and different kinds of Saxifragas, are here at home, and give us a kind welcome amidst dark blocks of the naked rock, dazzling white fields of snow, and the deeper coloured masses of ice, with their fantastical forms and deep fissures. We venture to climb still higher, over snow-fields and glaciers,—we make a path with cautious steps, not afraid at the thought that a single false step might make us slip and perish, for often we are forced to find a path on the very brink of threatening precipices,—over yonder to that sunny slope, a spot free from snow, a rocky island in a frozen ocean, where on blocks and amongst loose masses of shattered stones, pretty Saxifragas, the moss-like Cherleria, small but beautiful Gentianas and Phyteumas grow,—where the *Aretia helvetica* forms small cushions, and where the *Androsace glacialis*, with rosy and white conspicuous flowers, grows in society with the azure blue *Eritrichium nanum*, two rare gems in the wreath with which the goddess Flora adorns the Alps; and a beautiful spot it is, inviting to rest from our fatiguing ascent,—on all sides surrounded by frowning rocks and glittering snow, by stern Nature in her grandest aspect. All around us reigns deep winter and dead silence, only at intervals broken by the thundering noise of an avalanche, sweeping down from the mountain peaks, which tower still far above our heads.

"If we feel humiliated by the impression of our own pigmy nature, and crushed by the overpowering grandeur of the surrounding scenery, the reviving sunshine and the smiling flower tell us a tale of a great but kind Providence, which seems to pervade the whole wonderful scene, and finds also an entrance to our hearts."

I am sure that the party feel satisfaction in looking back on this trip. The adventures we met with are indelibly fixed in our minds, and will be recalled to the end of life with pleasure. The companionship of those who are prosecuting with zeal and enthusiasm the same path of science is not the least delightful feature of such excursions. The various phases of character exhibited, the pleasing incidents that diversified the walks, the jokes that passed, and even the very mishaps or annoyances that occurred,—all become objects of interest, and unite the members of the party by ties of no ordinary kind. And the feelings thus excited are not of an evanescent or fleeting nature; they last during life, and are always recalled by the sight of the specimens which were collected. These apparently insignificant remnants of vegetation recal many a tale of adventure, and are associated with the delightful recollection of many a friend. It is not indeed a matter of surprise that those who have lived and walked for weeks together in an alpine ramble, who have met in sunshine and in tempest, who have climbed together the misty or snowy summits, or the icy walls of a glacier, and have lived on the same mountain dwelling at an elevation of many thousand feet, should have such scenes indelibly impressed on their memory. There is, moreover, something peculiarly attractive in the collecting of *alpine* plants.

Their comparative rarity, the localities in which they grow, and frequently their beautiful hues, conspire in shedding around them a halo of interest far exceeding that connected with lowland productions,—the alpine species of Gentian displaying their lovely blue corollas; the Myosotis of the mountain summit, whose tints far excel those of its namesake of the brook; the white and pink *Androsace glacialis*, and the stemless Silene, forming a bright carpet of the most attractive beauty; the alpine species of Astragalus and Oxytropis enlivening the turf with their pale and purple clusters of flowers; the Lychnis choosing the stony and dry knoll for the evolution of its pink petals; the Sonchus raising its stately stalk and azure head in spots which try the enthusiasm of the adventurous collector; the Saxifrages, with their white, yellow, and pink blossoms, clothing the sides of the streams; the Erigeron and Saussurea crowning the rocks with their pink and purple capitula; the Potentillas and Geums blending their yellow flowers with the white of the alpine Cerastiums and Silenes, and the bright blue of the alpine Veronicas; the Azalea, forming a covering of rich crimson; the rhododendron, with its spreading branches, covered with gorgeous blossoms; the yellow Hieracia, whose varied transition forms have furnished such a fertile source of dispute among botanists; the slender and delicate grasses, the carices, and the rushes which spring up on the moist alpine summits; the graceful ferns and tiny mosses, and the many-coloured lichens,—all these add such a charm to alpine botany as to throw a comparative shade over the vegetation of the plains. These feelings were fully experienced by us during our rambles. We enjoyed our herborizations while they lasted; we felt sorry when they were concluded; and we all longed to renew them on some future occasion.

LIST OF THE PLANTS COLLECTED BY MEMBERS OF THE PARTY.

Class I.—DICOTYLEDONES.

Subclass I.—THALAMIFLORÆ.

Ranunculaceæ.
Aconitum Lycoctonum, L.
Napellus, L.
paniculatum, Lam.
Actæa spicata, L.
Anemone alpina, L.
baldensis, L.
Hepatica, L.
Aquilegia alpina, L.
vulgaris, L.
Caltha palustris, L.
Clematis virginiana, L.
Vitalba, L.
Ranunculus aconitifolius, L.
acris, L. forma alpina
aquatilis, L.
Flammula, L.
glacialis, L.
montanus, Willd.
Philonotis, Ehr.
pyrenæus, L.
Thalictrum majus, Jacq.
minus, L.
Trollius europæus, L.
Berberidaceæ.
Berberis vulgaris, L.
Nymphæaceæ.
Nuphar lutea, Sm.
Nymphæa alba, L.
Papaveraceæ.
Chelidonium majus. L.
Fumariaceæ.
Corydalis claviculata, DC.
Fumaria officinalis, L.
Cruciferæ.
Alyssum calycinum, L.
Alyssum alpestre, L.
Arabis alpina, L.
arenosa, Scop.
bellidifolia, Jacq.
cærulea, Hænk.
Biscutella coronopifolia, L.
lævigata, L.
Bunias Erucago, L.
Camelina sativa, Crantz.
Cardamine hirsuta, L.
resedifolia, L.
Dentaria digitata, Lam.
Diplotaxis tenuifolia, DC.
Draba frigida, Saut.
Erysimum cheiranthoides, L.
ochroleucum, DC.
Iberis amara, Krautig.
Malcomia maritima, Br.
Myagrum saxatile, L.
Nasturtium officinale, Br.
palustre, DC.
Raphanus Landra, DC.
Sinapis alba, L.
Sisymbrium officinale, Scop.
pyrenaicum, L.
Sophia, L.
Thlaspi arvense, L.
sylvium, Gaud.
Resedaceæ.
Reseda lutea. L.
Phyteuma, L.
Cistaceæ.
Helianthemum obscurum, Pers.
vulgare, Gærtn.
Violaceæ
Viola Allionii, Pio.

Viola arenaria, DC.
biflora, L.
calcarata, L.
lutea, Sm.
mirabilis, L.
tricolor, L., β arvensis.

POLYGALACEÆ.

Polygala vulgaris, L. and vars.

TAMARICACEÆ.

Myricaria germanica, Desv.

CARYOPHYLLACEÆ.

Agrostemma Flos-Jovis, L.
Alsine rostrata, Koch.
Arenaria biflora, L.
ciliata, L.
fasciculata, Gouan.
laricifolia, L.
norvegica, Gunn.
recurva, All.
serpyllifolia, L.
verna, L.
Cerastium alpinum, L.
arvense, L.
campanulatum, Viv.
latifolium, L.
strictum, All.
trigynum, Vill.
triviale, Link.
Cherleria sedoides, L.
Dianthus actinopetalus, Fenzl.
atrorubens, All.
carthusianorum, L.
prolifer, L.
sylvestris, Wulf.
Gypsophila repens, L.
Saxifraga, L.
Lychnis alpina, L.
diurna, Sibth.
Flos-cuculi, L.
Möehringia muscosa, L.
Sagina apetala, L.
procumbens, L.
Saponaria ocymoides, L.
officinalis, L.
Vaccaria, L.
Silene acaulis, L.
inflata, Sm.
muscipula, L.
nocturna, L.
nutans, L.
Otites, Sm.
quadridentata, DC.
rupestris, L.
vallesia, L.
Stellaria graminea, L.
nemorum, L.

MALVACEÆ.

Althæa officinalis, L.
Malva rotundifolia, L.

HYPERICACEÆ.

Hypericum montanum, L.

ACERACEÆ.

Acer campestre, L.

GERANIACEÆ.

Erodium cicutarium, L'Her.
Geranium cinereum, Cav.
columbinum, L.
pratense, L.
pyrenaicum, L
robertianum, L.

LINACEÆ.

Linum angustifolium, Huds.
tenuifolium, L.
usitatissimum, L.

OXALIDACEÆ.

Oxalis corniculata, L.

BALSAMINACEÆ.

Impatiens noli-me-tangere, L.

SUBCLASS II.—CALYCIFLORÆ.

RHAMNACEÆ.

Rhamnus catharticus, L.

LEGUMINOSÆ.

Anthyllis Vulneraria, L.
var. rubriflora.
Astragalus Cicer, L.
dasyglottis, Fisch.
Astragalus depressus, L.
leontinus, Wulf.
Onobrychis, L.
Coronilla Emerus, L.
varia, L.
Genista germanica, L.
sagittalis, L.

Genista tinctoria, L.
Hippocrepis comosa, L.
Lotus major, Scop.
Medicago denticulata, Willd.
falcata, L.
sativa, L.
Melilotus Leucantha, Koch.
Onobrychis sativa, Lam.
Ononis arachnoides, Lap.
Natrix, Lam.
Oxytropis campestris, DC.
cyanea, Bieb.
Phaca alpina, Jacq.
astragalina, DC.
Tetragonolobus siliquosus, Roth.
Trifolium agrarium, L.
alpinum, L.
arvense, L.
badium, Schr.
cæspitosum, Reyn.
fragiferum, L.
medium, L.
montanum, L.
ochroleucum, L.
Vicia Cracca, L.
villosa, Roth.

ROSACEÆ.
Agrimonia Eupatorium, L.
Alchemilla alpina, L.
pentaphylla, L.
vulgaris, L.
Cotoneaster vulgaris, Lindl.
Dryas octopetala, L.
Geum montanum, L.
reptans, L.
Potentilla ambigua, Gaud.
argentea, L.
aurea, L.
cinerea, Chaix.
opaca, L.
Poterium Sanguisorba, L.
Prunus Cerasus, L.
Pyrus Aucuparia, L.
Rosa alpina, L.
Rubus cæsius, L.
Sanguisorba officinalis, L.
Sibbaldia procumbens, L.
Spiræa Aruncus, L.

LYTHRACEÆ.
Lythrum Salicaria, L.

ONAGRACEÆ.
Circæa Lutetiana, L.
Epilobium alpinum, L.
alsinifolium, Vill.
angustifolium, L.
Dodonæi, Vill.
Fleischeri, Hochst.
palustre, L.

CUCURBITACEÆ.
Bryonia dioica, L.

PORTULACACEÆ.
Montia fontana, L.

ILLECEBRACEÆ.
Herniaria alpina, Vill.
glabra, L.
Scleranthus annuus, L.
perennis, L.

CRASSULACEÆ.
Crassula rubens, L.
Sedum album, L.
atratum, L.
dasyphyllum, L.
reflexum, L.
Sempervivum arachnoideum, L.
montanum, L.
tectorum, L.

GROSSULARIACEÆ.
Ribes petræum, Jacq.

SAXIFRAGACEÆ.
Saxifraga aizoides, L.
Aizoon, Jacq.
androsacea, L.
aspera, L.
bryoides, L.
cæsia, L.
cuneifolia, L.
hypnoides, L.
oppositifolia, L.
rotundifolia, L.
stellaris, L.
umbrosa, L.

UMBELLIFERÆ.
Astrantia minor, L.
Athamanta cretensis, L.
Bupleurum caricifolium, Willd.
falcatum, L.
pyrenaicum, Gouan.
ranunculoides, L. var.
stellatum, L.
Daucus Carota, L.
Gaya simplex, Gaud.
Laserpitium hirsutum, Lam.
Siler, L.
Ligusticum actæifolium, Mx.

Meum Mutellina, Gærtn.
Myrrhis odorata, Scop.
Silaus pratensis, Bess.

CAPRIFOLIACEÆ.

Linnæa borealis, L.
Lonicera alpigena, L.

GALIACEÆ.

Asperula aristata, L.
cynanchica, L.
hirta, Ram.
taurina, L.
Galium Bocconi, Ten.
rubrum, L.
sylvestre, Pollich.
verum, L.

VALERIANACEÆ.

Valeriana celtica, L.
montana, L.
tripteris, L.

DIPSACACEÆ.

Asterocephalus Columbaria, Spr.
Scabiosa pyrenaica, All.

COMPOSITÆ.

Achillea atrata, L.
macrophylla, L.
Millefolium, L.
nana, L.
tomentosa, L.
Antennaria alpina, Gært.
dioica, Gært.
Leontopodium, Gært.
Anthemis montana, L.
Apargia autumnalis, Hoppe.
Arnica montana, L.
Aronicum scorpioides, DC.
glaciale.
Artemisia Absinthium, L.
campestris, L.
glacialis, L.
laciniata, Willd.
Mutellina, Vill.
spicata, Jacq.
Aster alpinus, L.
Amellus, L.
Bellidiastrum Michelii, Cass.
Cacalia alpina, L.
Carduus acaulis, L.
defloratus, L.
Carlina acaulis, L.
vulgaris, L.
Centaurea alba, L.
Jacea, L.
Centaurea montana, Lind.
paniculata, Lam.
Scabiosa, L.
Chrysanthemum alpinum, L.
coronopifolium, Vill.
Cichorium Intybus, L.
Cirsium oleraceum, Scop.
Crepis aurea, Cass.
bulbosa, Tausch.
setosa, Hall.
Doronicum Pardalianches, L.
Echinops sphærocephalus, L.
Erigeron acris, L.
alpinus, L.
canadensis, L.
uniflorus, L.
Villarsii, Bellard.
Eupatorium cannabinum, L.
Filago arvensis, L.
Gnaphalium arenarium, L.
norvegicum, Gunn.
pusillum, Hænke.
sylvaticum, L.
Hieracium angustifolium, Hop.
Bauhini, Sch.
blattarioides, L.
dentatum, Hoppe.
grandiflorum, All.
Halleri, Sch.
montanum, Jacq.
obscurum, Reich.
Pilosella, L.
piloselloides, Vill.
præaltum, Koch.
prenanthoides, Vill.
rigidum, Hartm.
staticifolium, Vill.
Hypochæris maculata, L.
Inula germanica, L.
Lactuca perennis, L.
Scariola, L.
virosa, L.
Leontodon Taraxacum, L.
Prenanthes muralis, L.
purpurea, L.
Saussurea alpina, DC.
Senecio erucifolius, L.
Fuchsii, Gmel.
incanus, L.
uniflorus, All.
Solidago Virgaurea, L.
Tussilago alpina, L.

CAMPANULACEÆ.
Campanula barbata, L.
cæspitosa, Scop.
excisa, Sch.
linifolia, Jacq.
persicifolia, L.
pusilla, Hænke.
rapunculoides, L.
rhomboidalis, L.
rotundifolia, L.
Scheuchzeri, Vill.
speciosa, Pourr.
Campanula Trachelium, L.
Jasione montana, L.
Phyteuma betonicifolium, Vill.
hemisphæricum, L.
humile, Sch.
orbiculare, L.
pauciflorum, L.
spicatum, L.

VACCINIACEÆ.
Vaccinium uliginosum, L.
Vitis-idæa, L.

SUBCLASS III.—COROLLIFLORÆ.

ERICACEÆ.
Arbutus Uva-ursi, L.
Azalea procumbens, L.
Calluna vulgaris, Salisb.
Erica carnea, L.
Rhododendron ferrugineum, L.

PYROLACEÆ.
Monotropa Hypopitys, L.
Pyrola secunda, L.

OLEACEÆ.
Fraxinus excelsior, L.

ASCLEPIADACEÆ.
Cynanchum Vincetoxicum, Br.

GENTIANACEÆ.
Erythræa Centaurium, Pers.
Gentiana acaulis, L.
alpina, Vill.
asclepiadea, L.
bavarica, L.
brachyphylla, Vill.
campestris, L.
ciliata, L.
glacialis, Vill.
nivalis, L.
obtusifolia, Willd.
Pneumonanthe, L.
punctata, L.
purpurea, L.
tenella, Rottböll.
verna, L.

CONVOLVULACEÆ.
Convolvulus arvensis, L.
Sepium, L.
Cuscuta europæa, L.

BORAGINACEÆ.
Cynoglossum officinale, L.
Cynoglossum pictum, Aiton.
Echinospermum Lappula, Lehm.
Echium vulgare, L.
Eritrichium nanum, Schrad.
Myosotis alpestris, Schmidt.

SOLANACEÆ.
Physalis Alkekengi, L.
Solanum Dulcamara, L.
nigrum, L.

ATROPACEÆ.
Hyoscyamus niger, L.

OROBANCHACEÆ.
Orobanche cærulea, Vill.

SCROPHULARIACEÆ.
Anarrhinum bellidifolium, Desf.
Bartsia alpina, L.
Digitalis grandiflora, Lam.
lutea, L.
Euphrasia lutea, L.
minima, Schleich.
Odontites, L.
salisburgensis, Funk.
Linaria alpina, Mill.
Cymbalaria, W.
genistifolia, Mill.
minor, L.
vulgaris, Mill.
Melampyrum cristatum, L.
sylvaticum, L.
Pedicularis recutita, L.
rostrata, L.
Rhinanthus Crista-galli, L.
major, Ehrb.
Verbascum nigrum, L.
Thapsus, Sch.
Veronica alpina, L.

Veronica bellidioides, L.
saxatilis, Jacq.
serpyllifolia, L.
var. humifusa.
spicata, L.
urticifolia, L.

LABIATÆ.
Ajuga genevensis, L.
Calamintha alpina, Lam.
Galeopsis Ladanum, L.
Hyssopus officinalis, L.
Lamium maculatum, L.
Leonurus Cardiaca, L.
Lycopus europæus, L.
Mentha sylvestris, L.
Nepeta Cataria, L.
Origanum vulgare, L.
Prunella grandiflora, Jacq.
hyssopifolia, L.
Salvia glutinosa, L.
pratensis, L.
Sideritis scordioides, L.
Sideritis spinosa, Lam.
Teucrium Chamædrys, L.
montanum, L.
cordium, L.
Thymus alpinus, L.

VERBENACEÆ.
Verbena officinalis, L.

PRIMULACEÆ.
Androsace bryoides, DC.
carnea, L.
Chamæjasme, Host.
obtusifolia, All.
pennina, Gaud.
Aretia tomentosa, Sch.
Primula farinosa, L.
latifolia, Lapeyr.
viscosa, All.
Soldanella alpina, L.

PLUMBAGINACEÆ.
Statice pubescens, DC.

PLANTAGINACEÆ.
Plantago alpina, L.

SUBCLASS IV.—MONOCHLAMYDEÆ.

CHENOPODIACEÆ.
Chenopodium album, L.
Botrys, L.
crassifolium, Schrad.

POLYGONACEÆ.
Oxyria reniformis, Hook.
Polygonum Fagopyrum, L.
viviparum, L.
Rumex alpinus, L.
acetosella, L.

ELÆAGNACEÆ.
Hippophae rhamnoides, L.

SANTALACEÆ.
Thesium alpinum, L.

EUPHORBIACEÆ.
Euphorbia Cyparissias, L.
platyphylla, L.
segetalis, L.
Mercurialis annua, L.

URTICACEÆ.
Humulus Lupulus, L.

SALICACEÆ.
Salix arenaria, L.
herbacea, L.
pyrenaica, Gouan.
reticulata, L.
retusa, L.

BETULACEÆ.
Betula alba, L.

CORYLACEÆ.
Fagus sylvatica, L.
Quercus Robur, Sm.

PLATANACEÆ.
Platanus orientalis, L.; cult.

CONIFERÆ.
Abies excelsa, DC.
Juniperus communis, L.
Sabina, L.
Larix europæa, DC.
Pinus Cembra, L.
sylvestris, L.
var. montana.

Class II.—MONOCOTYLEDONES.

Subclass I.—DICTYOGENÆ.

Trilliaceæ.
Paris quadrifolia, L.

Subclass II.—PETALOIDEÆ or FLORIDÆ.

Orchidaceæ.
Epipactis latifolia, All.
rubra, Sw.
Epipogium aphyllum, Sw.
Goodyera repens, Br.
Habenaria albida, Br.
viridis, Br.
Herminium Monorchis, Br.
Listera ovata, Br.
Ophrys alpina, L.
Orchis nigra, Sw.
odoratissima, L.
Liliaceæ.
Allium fallax, Don.
Schœnoprasum, L.
Anthericum ramosum, L.
Convallaria bifolia, L.
Lloydia serotina, Salisb.
Melanthaceæ.
Colchicum alpinum, DC.
autumnale, L.
Tofieldia palustris, DC.
glacialis, Gaud.
Veratrum album, L.
Juncaceæ.
Juncus alpinus, Vill.
bufonius, L.
filiformis, L.
Jacquini, L.
trifidus, L.
Luzula albida, DC.
campestris, DC.
lutea, DC.
nivea, DC.
pediformis, DC.
spadicea, DC.
spicata, DC.
Alismaceæ.
Sagittaria sagittifolia, L.
Butomaceæ.
Butomus umbellatus, L.

Subclass III.—GLUMIFERÆ.

Cyperaceæ.
Carex atrata, L.
brachystachys, Schrank.
capillaris, L.
chordorhiza, Ehrh.
ciliata, Willd.
curta, Good.
curvula, All.
decipiens, Gay.
ferruginea, Scop.
firma, Host.
fœtida, All.
frigida, All.
irrigua, Hoppe.
lagopina, Wahl.
nigra, All.
ovalis, Gaud.
remota, L.
Carex rigida, Gaud.
sylvatica, Huds.
tenuis, Host.
vulgaris, Fr.
Elyna spicata, Schrad.
Eriophorum angustifolium, Ro.
capitatum, L.
Scirpus alpinus, Schl.
Bœothryon, Ehrh.
cæspitosus, L.
Gramineæ.
Agrostis alpina, Scop.
rupestris, All.
setacea, Curt.
stolonifera, L.
Aira alpina, L.
Arundo Calamagrostis, L.
Avena Scheuchzeri, All.

Avena sempervirens, Vill.
tenuis, Mœnch.
Brachypodium pinnatum, Beau.
Bromus arvensis, L.
secalinus, L.
tectorum, L.
Cynodon Dactylon, Pers.
Festuca heterophylla, Lam.
Lemanni, Lej.
ovina, L.
var. vivipara.
pumila, Vill.
sylvatica, Vill.
tenella, Willd.
Lagurus ovatus, L.
Melica ciliata, L.
Molinia cærulea, Mœnch.
Oplismenus Crus-galli, Kunth.
Panicum ciliare, Retz.
Panicum miliaceum, L.
Phleum alpinum, L.
asperum, Vill.
Böehmeri, Wibel.
commutatum, Gaud.
Michelii, All.
Poa alpina, L. var. vivipara.
Balfourii, Parn.
cenisia, All.
laxa, Hænke.
nemoralis, L.
Sesleria cærulea, Ard.
disticha, Pers.
Setaria glauca, Beauv.
verticillata, Beauv.
viridis, Beauv.
Stipa capillata, L.
Trisetum distichophyllum, Bea.
Zea Mais, L ; cultivated.

Class III.—ACOTYLEDONES.

Filices.
Allosorus crispus, Bernh.
Asplenium Halleri, Br.
lanceolatum, Huds.
septentrionale, Hull.
viride, Huds.
Botrychium Lunaria, Sw.
Ceterach officinarum, Willd.
Cystopteris fragilis, Bernh.
Lastrea dilatata, Presl.
Polypodium calcareum, Sm.
Polystichum aculeatum, Roth.
Lonchitis, Roth.
Pseudathyrium alpestre, Bab.
Scolopendrium vulgare, Sw.
Lycopodiaceæ.
Lycopodium annotinum, L.
helveticum, L.
selaginoides, L.
Musci.
Aulacomnion androgynum, Sch.
Bartramia pomiformis, Hedw.
Bryum Wahlenbergii, Sch.
Dicranum scoparium, Hedw.
Funaria hygrometrica, Hedw.
Gymnostomum curvirostrum, H.
Hedwigia ciliata, Hedw.
Hypnum Crista-castrensis, L.
cupressiforme, L.
tenellum, Dicks.
Hypnum triquetrum, L.
Leskea subrufa, Wils.
Leucodon sciuroides, Sch.
Mnium serratum, Brid.
Neckera crispa, Hedw.
Pogonatum alpinum, Brid.
urnigerum, Brid.
Polytrichum commune, L.
sexangulare, Hop.
Racomitrium aciculare, Brid.
canescens, Brid.
Sphagnum cymbifolium, Ehrh.
Tortula ruralis, Hedw.
tortuosa, W. and M.
Zygodon Mougeotii, B. and S.
Lichenes.
Alectoria jubata, Ach.
Borrera furfuracea, Ach.
Cetraria islandica, Ach.
nivalis, Ach.
juniperina, Ach.
Cladonia rangiferina, Hoffm.
Evernia vulpina, Ach.
Parmelia caperata, Ach.
conspersa, Ach.
saxatilis, Ach.
Peltidea polydactyla, Ach.
Scyphophorus deformis, Hook.
Stereocaulon paschale, Ach.

13th January 1859.—Professor BALFOUR, V.P., in the Chair.

The following Candidates were balloted for and duly elected as Resident Fellows:—

F. LOCKWOOD LOGAN, Esq., 14 Saxe-Coburg Place.
HENRY B. RADFORD, Esq., 18 Moray Place.
JOHN M. HUNTER, Esq., 25 Albany Street.

The following donations were presented to the Society's Library from the University of Christiania:—

Om skovene i deres Forhold til Naturaloeconomien, of J. B. Barth.

Physikalske Meddelelser, ved Adam Arndtsen.

Quelques Observations de Morphologie Vegetale, par J. M. Norman.

Dr Balfour announced the following donations made to the Museum at the Botanic Garden:—

From Messrs P. Lawson and Son—Cone of *Araucaria imbricata*, from Peru.

From Dr Douglas Maclagan—War Clubs, from New Caledonia, and Marriage Dress, made of inner bark of a tree.

From the Earl of Shannon—Cone of *Picea Webbiana*, and fruit of *Cupressus Goveniana*, *C. lusitanica*, and *Laurus nobilis*, all ripened at Castle Martyr, near Cork.

From Andrew Murray, Esq.—Cones and leaves of *Abies bracteata*, and the resin yielded by the tree.

The following communications were read:—

I. *Notes upon Californian Trees.* Part I. By ANDREW MURRAY, F.R.S.E.

My brother, Mr William Murray of San Francisco, having, at various times, in sending home seeds of trees and plants from California, accompanied them with remarks either of his own or of others upon the plants themselves, and sometimes with figures of the more striking, I have thought it might be interesting, and possibly useful to the public, were I occasionally to throw some of these remarks together for publication, along with such of the figures as may be considered sufficiently interesting to deserve a place in the Transactions of the Society. They will necessarily be without order or arrangement, and are not intended for anything more than a record or memorandum of such points of interest regarding the plants as came before him or his friends.

Abies bracteata, Don. Plates I and II.

Having been for some time desirous to obtain seeds and cones of this singularly beautiful pine, I interested my brother in the subject; and although his other avocations prevented his undertaking the expedition himself, he caused two different expeditions to be made to procure it, one in 1856, and the other last season.

The first of these expeditions was conducted by his old fellow-traveller and co-explorer Mr Beardsley; the latter by Mr William Peebles, a gentleman who, in addition to his other qualifications for the task, appears to possess much talent as an artist, for it is to his pencil that we owe the graphic view of this tree as seen on its native mountains.

Before extracting one or two passages from their notes, I should perhaps first remind the Society of what was previously known regarding it.

The tree was first discovered by Dr Coulter, who spent ten years of his life in exploring the wilds of California and Mexico, at a time when they were still undisturbed by the hordes of gold-seekers who have since turned much of the country into vulgar ground. He discovered many new trees and plants, some of which (and among them *A. bracteata*) were described by Mr Don in the "Linnean Transactions," vol. xvii. (1835). Mr Don there says, "This curious and interesting species of fir was discovered by Dr Coulter on the sea side of the mountain range of Santa Lucia, about 1000 feet lower down than *Pinus Coulteri*. The trunk rises to the height of about 120 feet, is very slender, not exceeding two feet in circumference, and as straight as an arrow. The upper third of the tree is clothed with branches, giving it the appearance of an elongated pyramid. The branches are spreading, the lower ones are decumbent." I quote these remarks of Mr

Don, because there are some slight discrepancies (nothing material, but still discrepancies) between his account and those given by Hartweg and Beardsley, to be presently adverted to. He goes on,—" The bracts are long and recurved, and but little changed from the ordinary leaves, which give the cones a singular appearance. The seeds are remarkable for a peculiarity in their structure, in having the nucleus exposed at the inner angle of the seed through a considerable opening in the outer testa, as if the junction of the two sides had been prevented by the rapid enlargement of the nucleus." I may remark, that the same peculiarity is to be found in the seeds of *Abies grandis*, *A. nobilis*, and the allied species. Mr Don adds, that it is only the middle branches which bear cones, a circumstance which reminds me of a similar remark made by my brother, on one of his former expeditions, regarding *Pinus tuberculata*, on which he plucked very ancient cones within reach of the ground, growing on the main stem of a great tree. The next botanist who saw this fine tree was Hartweg, who was sent out by the London Horticultural Society in search of plants and seeds in 1847. He describes his various expeditions in reports sent to the London Horticultural Society, which were published from time to time in the Journal of that Society. In vol. iii., p. 225 (1848), he gives the following account of his attempt to obtain seeds of *A. bracteata*. " On September the 20th I again left Monterey for the southern parts, which, on account of the disturbed state of last year, I could not visit before. As guide, I engaged the services of a man who had accompanied me on my last excursion to Santa Cruz, and who, from his profession of a hunter, was well acquainted with the intricate mountain-paths of the district I intended to visit. On the day of our starting we reached the Mission of La Solidad, an ill-constructed, half-ruined building, situate in the Salinas Valley, and encamped towards evening on the banks of the Salinas River within a short distance of the Mission. By sunrise the following morning we were again on horseback, and leaving the main road on the right, we entered a mountain defile leading to the Mission of San Antonio. . . . . From San Antonio a range of mountains extends along the coast, attaining a great elevation, which, though apparently barren, as seen from the Mission, I was assured, on the western flank towards the sea, is covered by large pines." Mr Hartweg, after reaching the mountain range, goes on to say—" descending the western flank of the great mountain range, I found at last the long-wished for *Abies bracteata* occupying exclusively ravines. This remarkable fir attains the height of 50 feet" (the reader will remember that Dr Coulter stated it at 120 feet, and he will presently find that Beardsley states it at 130 feet), " with a stem from 12 to 15 feet in diameter,"—(this must be a mistake for 12 to 15 inches, Dr Coulter say that the largest were only 2 feet in circumference, instead of 15 in diameter, which would give 45 in circumference)—" one-third of which is clear of branches, and the remainder forms an elongated tapering pyramid, of which the upper part for 3 feet is productive of cones." These must have been bad specimens, for Mr Beardsley's account describes them as branched to the ground, and Mr Peebles' drawing, although it represents one or two devoid of branches at the base, represents others feathered nearly to the ground. " Having cut down some trees, I found to my regret that the cones were but half-grown, and had been frost-bitten. In more sheltered situations towards the sea-shore, the same happened to be the case; and I was thus precluded from introducing this remarkable fir into Europe."

The next attempt to obtain seed of it was that made by Mr Beardsley in 1856—(Jeffrey was not so far south)—and I cannot do better than quote that part of his notes which relates to this tree. He made his attempt in the middle and latter part of October:—" After finishing my collections in this vicinity (Monterey), I set out for the Santa Lucia mountains below the mission of San Antonio; our equipage from Monterey consisted of a waggon drawn by two horses, three loose animals, to ride and pack into the mountains, one Dutchman, one greaser, one rifle, two revolvers, two bowie knives, camping utensils, &c., and provisions for twelve days" (a preparation which indicates that, however much the rest of California is crowded, this part is still in its primitive wildness). " We reached the Mission the third day; here we left our waggon, and proceeded on horseback into the mountains, in search of *Abies bracteata*, which we found on the second day, on the western slope of the range, about 30 miles from the Mission, and about 10 miles from the sea-coast, by the worst trail that I ever travelled in this or any other country. After passing the *divide*, and descending to the west, I fell in with the tree, occupying the mountain sides as well as the ravines, and not 'exclusively the ravines,' as described by Hartweg. I was greatly disappointed in finding the cones too ripe to be able to obtain a supply of seed. I tried cutting the top off, but a few strokes of the hatchet shattered the cones in pieces, and scattered the seeds to the winds. The only plan was to climb to a most dangerous height and pick off the few cones which could be reached. They went to pieces in my hand the moment they were touched. The cones only occupy a few feet of the top, hence the difficulty and danger of obtaining them. I have never seen any description that does justice to this most beautiful of all the firs; it rises to the height of 130 feet, straight as a line, the trunk tapering regularly from the ground to the top; clothed with branches, which are slim and graceful, down to the ground; the outlines of the branches taper almost as regularly as the trunk, giving the appearance of an 'elongated pyramid,' as Hartweg describes it; but I would rather call it a tall spire with a pyramidal base of two-thirds of the lower part of the tree; the pencil of the artist could not give it a more regular shape than it appears in nature. I saw no tree deprived of its lower branches, except in thickets where it was impossible for them to grow; there was none, with the above exceptions, that I could not step from the ground on to its branches. Not the least remarkable thing is, that these branches bear fine foliage down to the ground, and the branchlets often touch the ground. I have found it occupying exclusively the calcareous districts abounding with ledges of white, veined, and gray marble. We encamped for the night on the point of a ridge, the only place to be found level, and large enough to make down our beds; in the evening, it commenced raining, and increased into a regular driving storm. We passed the most horrible night that ever fell to my lot to experience; we were totally unprovided, as there was no appearance of a storm when we lay down a short time after dark. We had provided wood only to cook with, and we were obliged to get it with great labour, and at the risk of breaking our necks, to keep from freezing. With great difficulty we kept our fire up until morning. The mountains here are as steep as the laws of gravity will admit, and in a state of disintegration ; rocks from the ledges above were detached by the rains, and came tumbling down past us, making a fearful crashing among the trees, increasing in speed until they landed among the rocks at the bottom of the ravine below us, with a noise which sent its reverberations up among the hills like peals of thunder. The impenetrable darkness of the night, the howl of the tempest, the crashing of falling rocks, together with the severity of the cold rain, almost snow, made the night truly awful. We saw a large grizzly bear just before dark, and plenty of fresh tracks everywhere, which added nothing to the enjoyments of the night. Day-light came at last, and with it a clear sky, which I hailed with more gratitude, I think, than I ever did in my life,—thankful that I was alive.

"I had intended to have spent a portion of the day in collecting what few seeds I could; but the storm had beaten them off, so that all attempts in this vicinity were useless. After breakfast, we packed up and took the back track. After passing the first ridge, I descended into a deep gulch where there were a few trees, and found the seeds all gone. I descended again on the north side, and found one small tree that had a few shattered cones left, and obtained about a handful. I attempted to cut off the top, but the first few strokes of the hatchet knocked them all off, and I was obliged to give it up for the season. We reached Monterey after an absence of nine days. We had killed on the trip, four deer, three antelopes, one hare, one wild cat, and seen two grizzly bears."

This account by Mr Beardsley gives an important hint to cultivators in this country. The tree being confined to a calcareous soil, would indicate that it would be well adapted to our chalk districts, which, for another reason, may be more suitable to it than our Scottish hills, namely, from their better climate. From its locality south of San Francisco, and Dr Coulter's remark that it grows 1000 feet lower on the mountains than *P. Coulteri*, it is probably less hardy than the general run of Californian pines. Still Hartweg's finding the cones frost-bitten, and Beardsley nearly getting frost-bitten himself, would seem to indicate that it grows in a climate not free from a considerable degree of cold.

Next year (1857) Mr Lobb, the collector, paid a visit to the spot, but was scarcely more successful than Mr Beardsley. He found that the seeds were, like those of *P. nobilis*, subject to the attacks of an insect in their green state, from which, of course, no precaution in the way of gathering, drying, or packing, can protect them.

Last year Mr Peebles' expedition has produced little more than Mr Lobb's. Notwithstanding that he was a month earlier than Beardsley, he was still too late.

He returned on the 17th of September He found that the cones were so ripe that the trees could not be cut (which was the usual method adopted in procuring cones from the pines in former expeditions) without scattering the cones to the winds, so that all he got were obtained by climbing the trees and carefully picking the cones. This difficulty in reaching the spot at the right time is explained by a remark of Hartweg's in regard to other plants. "Being now aware of the rapidity of Californian vegetation, I lost no time in collecting such seeds as were worth taking, and returned to my headquarters by the beginning of May. Most kinds had during the fortnight after I first saw them in flower ripened their seeds." For the benefit of any future expedition, I may mention that a man of the name of Miers accompanied both Lobb and Peebles as guide, and he knows the station perfectly. It is exceedingly unlikely, however, that any fresh expedition will be tried until the country is more opened up. The expense, danger, chance of bad seed, and small returns, will deter any one from trying it as a mercantile speculation, and there is little in the district to induce an explorer to try such difficult ground which has been already examined.

Mr Peebles mentions that the padres of the Mission use the resin of the tree for incense. My brother sent me a little of it, which I have tried, and find the odour pleasantly terebinthine.

He also sent me a beautiful photograph of the cone taken by Mr G. Johnston, one of the principal photographic artists in

San Francisco, which suggests a convenient and rapid mode of procuring information as to species from scientific head-quarters, without the expense and delay of sending bulky specimens, which may possibly be of no value.

The cone does not appear to have been properly figured in any very accessible work. I think, therefore, it will be an acceptable offering to the Society to give the annexed figure, which I owe to the accurate pencil of Dr Greville.

Torreya Myristica, Hooker (Californian Nutmeg). Plate III.

This interesting genus was first correctly described and put upon its present basis by Dr Walker Arnott in the "Annals of Natural History" (1st series), vol. I., 1838. There are two Californian species: one, the *T. taxifolia*, or stinking cedar, is common both to the east and west sides of North America; the other, the *T. Myristica* or Californian nutmeg, is confined to the western sides of the Rocky Mountains. It receives its vernacular appellation, not from its spicy qualities, nor from possessing any of the intrinsic properties of the nutmeg, but from its cone bearing a very close external resemblance to that fruit, more especially in the ruminated appearance of its seed. Although known to my brother several years before, it was only first sent home by Lobb in 1857, and described by Hooker in the "Botanical Magazine," No. 4780. The fruit and leaves are there figured, but not the tree itself; and as the form and aspect of the tree is of interest on account of its relationship to the yew and pine families, I have thought it desirable to give the annexed figure of it, taken by Mr Peebles. It grows to a height of 30 or 40 feet, and it will be seen that it bears considerable resemblance in habit to an old larch.

II. *Professor* Balfour *read the following communications:*—

1. *List of Plants found at Tayport, Fife*, in September 1858. By Professor Lawson, Kingston, C.W.—The following species were observed on the ballast heaps at the harbour of Tayport:—*Lepidium ruderale*, *Papaver Argemone*, *P. Rhœas*, *P. dubium*, *Fumaria calycina*, *Linum usitatissimum*, *Camelina sativa*, *Spergula arvensis*, var. *major*, *Cannabis*

sativa, *Melilotus arvensis*, *M. vulgaris*, *Erigeron canadensis*, *Setaria verticillata*, *Phalaris canariensis*, *Panicum* sp. ? (not in flower), *Triticum sativum* (degenerated forms). *Melilotus arvensis* also occurs in a pasture field south from Tayport. *Medicago sativa* is abundant on Speirshill, where also the following indigenous species occur :—*Geranium sanguineum*, *Dianthus deltoides*, *Chrysanthemum segetum*. On the sea-shore, *Pyrethrum maritimum* (the true plant) occurs, along with *Atriplex Babingtoni*, *Polygonum Raii*, and other sea-side species ; several species of Chenopodium, growing on the ballast heaps, seemed to deserve an attentive examination. The dredged mud afforded good specimens of many of the shells of the adjoining river, which are otherwise not easily obtained at ordinary tides. Larvæ of the Death's Head Moth were not uncommon among garden potatoes in the neighbourhood.

2. *Extracts from Dr Lawson's Account of his Voyage to America.*—" Kingston, C.W., 16th October 1858.—I am happy to say that we have come safely through all the troubles of sea and land, and are now comfortably settled down at Kingston. We left Liverpool on the 9th of September, per screw-steamer ' North Briton,' and after a rather stormy passage, with strong head winds all the way, we eventually arrived at Quebec on the 21st of September. On Friday, 17th September, in lat. 52 deg. 30 min. N., long. 53 deg. 40 min. W., we met with fine icebergs, several of them of very large size—magnificent pieces of sculpture, whiter than the finest Carrara marble, and of most grotesque forms, floating in silent majesty on the bosom of the waters. I had read many descriptions, and seen many pictures of icebergs, but must say that I was totally unprepared for objects of such grandeur. The immense size of the iceberg, its well-balanced proportions, and usually graceful form, the perfect purity of its dazzling whiteness, when seen in the sunshine, its immobility while every wave around is in motion, lashing its sides in vain; these and many more are features which cannot be realized through any description. The first one which I saw presented, when first seen, a striking resemblance (but in truly gigantic proportions) to the well known piece of sculpture, ' Eve at the Fountain;' presently, as the vessel passed on, the iceberg gradually

became metamorphosed into an old ruin,—a ruin of marble halls; again the scene changed, new creations arising like enchanted palaces, and passing away like the fancies of a day-dream. One berg reminded me of the island of Inchkeith: another small and distant one was precisely of the form of the Bass Rock. It was the tamest of the whole; but, if you imagine the Bass Rock, done of the natural size, in the purest marble, highly polished, and basking in a noon-day sun, it will give some idea of its aspect. We experienced cold throughout the voyage, as the vessel kept far north, entering the Gulf of St Lawrence through the Straits of Belleisle. This course afforded us a good view of the Labrador coast, and of Lower Canada, and I may here observe that those parts, from their rocky mountainous character, are evidently richer, in a botanical point of view, than the upper province, which is generally flat and better adapted for agriculture. We went from Quebec to Montreal per river steamer, thence per rail to Kingston.

Since arriving I have been with Dr Williamson to Toronto and the Falls of Niagara; at the former we were much interested in the Agricultural Exhibition (Upper Canadian), which is a great improvement upon those of former years. There was much stir and much interest evinced, and the products were highly creditable; immense quantities of Cucurbitaceæ for feeding purposes, excellent Indian corn and root crops, fruits (open air grapes, apples, plums, &c. &c). Flowers were generally inferior. In the arts department many admirable specimens of machinery, locomotives, implements, &c.; and good cattle and sheep; horses not so numerous. In Canada generally the horses seem to be very light, so that two are required for the work that one would do at home; I think it is a breed originally introduced by the French, but there were some fine specimens shown of improved breeds.

"At Niagara I made a collection of plants. There the Compositæ are extremely luxuriant; mosses, mostly barren from the excessive moisture. I hope next 'fall' (1859) to send you a box of plants, as then I shall have had time (if health be spared) to explore some interesting districts. Those I have picked up in the neighbourhood of Kingston are chiefly weeds; in this neighbourhood the Trenton limestone (lower silurian) is the only rock visible, and it lies in perfectly horizontal strata, so much so, that it forms a natural pavement for the houses built upon it. The country is therefore quite flat, and I do not anticipate a rich land flora in the immediate neighbourhood; but the lake may afford some good plants and mollusca.

"Insects are very numerous at present, especially Orthoptera, Neuroptera, and Lepidoptera; of the latter I have picked up a few specimens, including the Camberwell Beauty (*Vanessa antiopa*), and the magnificent *Danais Archippus*, which, although chiefly of southern distribution, and regarded as producing only one brood, appearing in July, I captured this forenoon (16th Oct.) I have no doubt I shall find Coleoptera plentiful when I have time to look for them, and shall send Mr Murray a few boxes next autumn. I shall also endeavour to get a few birds for Sir William Jardine.

"Judging from the changes that have taken place in the feathered inhabitants, even since we came, there are evidently many migratory species. The humming birds (said to be common here in summer) have disappeared, so also a wren; and now we have an immigration of 'robin red breasts,' larger than blackbirds.

"The lake fish, of which I had read glowing accounts in Scotland, are, so far as we have seen, not to be compared to the commonest fish in Scotland; even the salmon is soft and pale, so different in its whole aspect from the Scotch one, that I should have fancied it to be a different fish, had not Sir William Jardine come to the conclusion that it is the same species."

III. *On the Growth of the Bamboo Cane in the New Palm-House at the Royal Botanic Garden.* Communicated by Mr M'Nab.

In this notice Mr M'Nab gave a detailed account of the growth of the bamboo, taken every third day until the plant attained the height of 15 feet, with the mean temperature of the external air during each successive three days from 3d July to 14th August 1858. The average temperature of the internal air during the period of growth ranged from 65 degrees to 70 degrees.

Date.	Mean Temperature open air.	Growth during 3 days.
July 3 to 6	54 deg.	1½ inches.
6 ... 9	46 „	2½ „
9 ... 12	43 „	3¾ „
12 ... 15	48 „	7 „
15 ... 18	50 „	9½ „
18 ... 21	45 „	10¾ „
21 ... 24	44 „	13¾ „
24 ... 27	51 „	17 „
27 ... 30	54 „	18½ „
30 ... 2 Aug.	52 „	19¾ „
Aug. 2 ... 5	47 „	17½ „
5 ... 8	47 „	18½ „
8 ... 11	43 „	19½ „
11 ... 14	45 „	20½ „

From the 14th of August to the 24th of September, the extra height reached was 25 feet, being an average of 2 feet for every three days. On the 24th of September, the extreme height of the shoot was 40 feet, the growth of 81 days. The plant was shifted into its present tub during the spring of 1858. The soil used was turf loam, about 4 inches of bruised bones covered the drainage previous to the plant being retubbed.

IV. *Measurement of certain Coniferous Trees, taken at St Fort, Fife*, by George Patton, Esq., Advocate. Communicated by Mr M'Nab.

Cryptomeria Japonica (in cone)—height, 21 feet; circumference of stem, 14½ inches. *Taxodium sempervirens*—height, 13½ feet; circumference of stem, 10 inches. *Abies cephalonica*—height, 14½ feet; circumference of stem, 20 inches.

V. *On the Economical uses of the Bamboo.* By Alex. Hunter, M.D., F.R.C.S.E., Madras School of Industrial Arts.

The Bamboo (*Bambusa arundinacea*), the largest known plant of the family of the gramineæ or grasses, grows luxuriantly in India, China, and other tropical countries. There are from eighteen to twenty species of bamboo already known and described, seven of these are common in India, four in Ceylon, and six in Cochin China, but it is doubtful if they are all distinct, as the plant is known to present very different characters according to the soil, climate, and exposure. Of the common *B. arundinacea* there are three varieties. In the wild state it springs up in the jungles in small circular patches, presenting all the appearance and habits of a grass, but growing with great rapidity, and shooting out a few long, bare, reed-like stems, the first of which are strong, single, and pointed. These are soon followed by more delicate, branched, and gracefully drooping stems. The former are usually considered the male bamboos. They are solid at first, and shoot up to a considerable height before bearing leaves or lateral shoots. The thin, delicate and drooping stems are usually considered to be the female bamboo, but this point is not yet precisely determined. The number of solid bamboos is very small in proportion to the hollow, and the latter are more branched and slightly angular in their growth, there being a deflection at each joint, with at first a strong spine starting from the axil of a large leaf or stipule, which is persistent until the spine enlarges into a lateral branch. In the joints of what is called the female bamboo there is often found a white, hard substance called *tabasheer*, composed of seventy parts of silicic acid, and thirty of potass. This is used by the Hindus as a medicine, and is supposed to be possessed of tonic, cardiac, and anthelmintic properties. It is much used amongst the Gentoos of the Northern Circars as a tonic, and in internal bruises. The bamboo varies prodigiously in size in proportion to the supply of water and the richness of the soil. In dry, hilly localities it grows only to 8 or 10 feet, while in moist jungles, and in swamps, particularly on the banks of sluggish rivers, it attains the height of 90 to 100 feet, growing sometimes as much as 18 inches in twenty-four hours. The largest bamboos are probably those found in Burmah, where they occasionally grow to 10 inches in diameter, each joint being from 20 to 24 inches in length.

The plant is often cultivated in clumps, and to form ornamental archways for avenues and gardens; also as a hedge, being bent over and interwoven so as to combine the qualities of both a hedge and a paling. It does not answer the purpose well, however, except in damp localities, as it grows irregularly and in clusters.

There is probably no other plant with which we are acquainted that is put to so many and such opposite and diversified uses. It is occasionally planted so thickly as to form a dense impenetrable belt or wall of vegetation, to protect crops or gardens from the depredations of large animals, like the elephant, elk, and bison. The leaves are tender and delicate when young; they are much eaten by herbivorous animals, and are considered cooling and diuretic for horses. The seeds are also used in the same way, and are administered as a decoction in fevers of cattle. An emulsion is also made from them, and applied locally to bruises and sprains in horses. The young, thin shoots of the female or hollow plant are used for making arrows; those of the male or solid plant are largely exported to Europe, for making the tops of fishing-rods, riding-sticks, and walking-canes. Large bamboos are used as pointers and as fishing-rods. The pointed lateral shoots, which are the rudiments of the branches, are used, when young, as pins with which the leaves of the Banyan, Peepul, and other species of Ficus, are fastened together to form plates, which are much used by some castes of Hindus. The temporary plate, which is cool and clean in appearance, is thrown away after the meal, and forms a prize for monkeys or crows. When the bamboo grows a little thicker, the stems are used for a great variety of purposes, as props, palings, posts, and supports for roofing. They are also split longitudinally into halves, quarters, or smaller sections, and are extensively used for roofing, flooring, and wall-mats for light doors, window-shades, rolling and folding blinds. A water-colour sketch exhibits a native house having the rafters and props, the door, and part of the roof, made of bamboo, covered with a thatching of coarse straw, and supported by mud walls; in the distance is a clump of bamboos growing luxuriantly, and at one end of the house a circular umbrella of bamboo, the short stalk or handle of which was represented thrust under the thatching, to keep the umbrella out of the way during the summer months, as it is not a folding one like ours. Other illustrations exhibit houses built entirely of bamboo, the walls and roof being of coarse matting, and the posts and rafters of strong bamboo; such houses, I need hardly say, are only suited for warm climates, and are neither very durable, nor water or wind proof. In the heavy showers of the monsoons they leak considerably, and in gales they are apt to be blown to pieces. They are more picturesque than the ordinary mud houses of India, and when new they cost from five to eight rupees, or ten to sixteen shillings of our money. They last about three years in dry localities, but require yearly repairs in damp situations.

Among the more important uses of the bamboo is its employment in the manufacture of a fine quality of paper in China. I am indebted to Dr Crommelin of the Bengal medical establishment, for specimens of fine printing bamboo paper, and also for larger and coarser varieties extensively used in papering walls and lining boxes. The following is the process of preparing the paper:—The young shoots of the bamboo, when about the thickness of the thumb, are cut into lengths of 5 or 6 feet, and the hard silicious outer part peeled off in thin strips for making fine table mats, light baskets, and boxes of various kinds. The peeled bamboos, while still green, are beaten with heavy pieces of wood to split them a little; they are then tied up in bundles, and placed in pits full of lime water, in which they are left to steep for a fortnight or three weeks; after which they are bruised into pulp under heavy stampers, and mixed with a further quantity of fresh quicklime and water which serves to bleach the pulp. The mass is then coarsely strained and mixed with a large quantity of water, which is repeatedly changed, so as to wash out all the lime. It is again well pounded and put into vats, from which it is lifted on frames supporting a kind of stretcher of finely-split bamboo, on which the pulp in thin films is lifted. Many parts of the process are very similar to those followed in India and in the manufactories in Europe, where drawing-papers are made by hand. If the paper is to be sized for writing upon, a decoction of the roots of a leguminous plant resembling liquorice, or an Astralagus, is added to the pulp in the vat. Sketches and engravings made upon the paper in the Madras School of Industrial Arts show that it is well suited for printing purposes. This paper may be contrasted with another kind made from the refuse of the silk factories in China. The latter is smoother, and less pulpy than the bamboo paper, and is chiefly used as writing paper. I have not heard the details of the process for making paper from silk refuse, but I believe there are other materials, as cotton, employed in making the pulp. Another manufacture from the bamboo made by the Chinese is a kind of soft cloth, which appears to combine some of the properties of paper and silk. Specimens are seen in the Museum of the Edinburgh Botanic Garden. They have much the same feel and appearance as the paper, but are more tenacious, and may perhaps owe their strength to a small admixture of silk refuse. This bamboo cloth is much used for painting upon, and for covering screens and fans.

The bamboo is put to a number of other uses by the Chinese. The tender shoots are peeled and cut into strips, then woven into round balls resembling basket-work, and made into pickles, or preserved in syrup, to form one of the ingredients of the celebrated preserve called chou-chou. The thin strips which are peeled off the young plant are woven into light, elegant baskets, or a neat kind of ornamental table mat, used in India to put under hot-water plates and dishes. Some of the delicate Chinese bamboo baskets, mats, and window-blinds, are elegant and light in manufacture, showing considerable dexterity in weaving, and taste in the application of simple means to accomplish useful ends. Ornamental table-mats of a different kind are made by some of the semi-barbarous tribes near Vizagapatam, in the Kimmedy country, on the northern borders of the Madras Presidency; these are the districts in which, till lately, the Meriah sacrifices of children took place yearly on certain feasts, to propitiate the deity supposed to preside over agriculture. This barbarous rite has fortunately been put a stop to by the British government, and we are indebted in a great measure to Mr Knox, the intelligent collector of the district, for extending and improving the manufacture of these table-mats. When examined carefully, and turned to the light, you will see that it is not the fine quality of the weaving that attracts the eye, but that advantage has been taken of the silky gloss of the outer silicious surface of the young bamboo to produce a simple, delicate, and tasteful manufacture, which would probably be more extensively used if it were better known. The cost of these mats is about twenty rupees, or L.2 for a large set. They must not be confounded with the table-mats of China or of India, made of thin split rattan, which are not nearly so tasteful. Specimens of the latter are seen in the Museum at the Botanic Garden. The bamboo window-blinds, chicks, or tent-purdahs of India are by no means equal in taste to those made from the bamboo in China, though they are equally serviceable.

Another most tasteful and delicate manufacture from the bamboo is the lackered boxes and cups of Burmah. I am indebted to the kindness of Captain Tripe, the government photographer of Madras, for very fine specimens of these, which are superior in taste to the ordinary Burmese boxes and cups;* also for the description of the manufacture of this Burmese bamboo lackered-ware, which is interesting as illustrating the use of shell-lac, a substance which is most difficult to manipulate, from its hardness, and the rapidity with which it solidifies after being melted. The bamboo frame-work of which these cups and boxes are made is prepared in a very delicate way, by cutting thin long strips off the outer surface of the young, fresh bamboo; these are passed through fine holes in a steel plate to bring them all to one size, and of the thickness of packthread or fine wire, according to the size of the article desired. The cups, boxes, or baskets are then woven into the desired shapes or sizes, in the same way as basket-work is made. The articles are then put upon a rude kind of turning-lathe, and made to revolve rapidly, while a ball composed of shell-lac and bees-wax, coloured as required for the ground-work, is firmly pressed upon the basket-work. The heat produced by the rapid revolution melts the ball of shell-lac and wax, which fills up the interstices of the basket-work. When cool, the whole forms a solid, but light and pliant frame-work, which is either turned smooth and polished on the lathe, with a rag dipped in oil, or coated with another colour before being turned smooth.

* The use of the bamboo in building, forming scaffolding, and decorations, has also been well illustrated by a series of photographs collected by Captain Tripe when on an embassy to the Court of Ava.

On comparing samples of this ware, you will see that there are great differences in the quality both of the basket frame-work and of the decoration. In the finest kinds, which are evidently got up with great care, and are expensive, the different colours, and the surface of the bamboo weaving, shine through each other, and produce a very pleasing effect. Another variety of lackered bamboo basket-work is made in Burmah much in the same way as already described, except that a coating of Thetsi, an elastic waterproof varnish, is applied over the lac and wax, or sometimes along with it. This varnish has one very curious property, which is, that it will not dry except in a damp locality. It is usually applied to large and coarse articles,—as shields, pillows, baskets, and bowls for eating or drinking out of; the latter, from their lightness, flexibility, and strength, are more suited for marching than our brittle earthen, or heavy stone-ware.

I could fill and illustrate a large volume were I to enter into a description of all the uses of the bamboo. I must for the present content myself with enumerating simply some of the most important of them, trusting to be able to continue the subject hereafter, or to lay it before the public in some other shape.

The whole bamboo is used for a great variety of purposes, according to its size,—as for posts, props, poles of tents, tall frames for pigeons to light upon; sign-posts, with swinging-lamps to denote toddy or drink-shops, or with small toy figures, windmills, bells, &c., to denote trades carried on in the adjacent houses; poles for carrying water, luggage, palankeens or dhoolies for the sick; for floating-rafts, for light scaffolding, which can be erected quickly, and run up to great heights; pecottahs over wells for raising water; swinging-poles at feasts; small light bullock-carts, larger travelling covered carts and ruts, in which images are dragged about at religious ceremonies; raised watch-houses for guarding crops; ladder and fire escapes; fishing-rods; poles for pushing along boats; spear-shafts; pointers, garden-seats, and chairs; frames for supporting plants; walking-sticks, punishing or bastinado-rods; water-pipes; floats for lines and nets; blow-pipes and distilling-tubes; poles with basket-work frames for gathering fruit; hookah and hubblebubble pipes, bows and arrows. The joints, when cut into lengths, are also used for a variety of purposes,—as large or small bottles, ewers, jars, pots, oil or sugar vessels, and for a very ingenious mode of decorating floors,* by pricking a pattern through the bamboo, filling the joint with powdered chalk, and tapping it gently with a stick while rolling along the floor, immediately after the latter has been wet with rice water.

The joints are also used for holding letters or documents of value, for transmitting small articles or papers secretly or by post, for musical instruments, handles for tools, a great variety of blowing, spinning, jumping, and whirligig toys; blow-pipes for gold and silver smiths' work, and by the Burmese for a most ingenious method of producing fire by compressed air. (The instrument is described by Dr J. Fayrer, of the Bengal Medical Establishment, in the Asiatic Society's Proceedings.)

The split bamboo is put to nearly as many uses as the whole. When cut in halves it is used for thatching, for lath, and making the framework of partition-walls, upon which bamboo mats are fastened; for pellet bows, basket boats, cowrie or cavady coolie, and water-carriers' poles; framework, and hoops of different kinds; baskets, bird-cages, pegs and nails for fastening planks, and carved wood-work to pagodas in Burmah; net-work cases to protect bottles and water-goglets; tongs, compasses, surgical splints, decks of boats, penholders, fishing-nets, and traps to catch fish and small game; also as pointed stakes in tiger-traps; coarse and fine matting of all kinds for roofs, floors, windows, and packing purposes; and lastly, two of the few uses for which it is exported, are for bonnet-frames and hoops for ladies' dresses.

I have thus noticed the various and multiplied uses to which the bamboo is applied by nations whom we are inclined to call semi-barbarous. I question much if in more civilized countries any one substance can be found that has been so variously and skilfully turned to account. We may

* This was fully described and illustrated by me at the Meeting of the Royal Scottish Society of Arts, on the 13th December 1858, and a great variety of Hindu patterns shown. The process seems to have suggested to our manufacturers the ideas of cylinder printing, and taking out colours in fabrics by the process of discharge. See Reports of the Royal Scottish Society of Arts.

learn from this two or three useful lessons:—(1.) Thank God, who supplies to each country or race of mankind the necessaries and luxuries of life, implants in man also the power to use them very differently; barbarous and half-civilized nations often excelling others in ingenuity and natural taste; (2.) That in the bamboo we have a plant which might be much more extensively used in our arts, manufactures, and commerce; and (3.) That if the nations of the East can teach us so much in one department of practical knowledge, it is our duty to try to give them in exchange some of the blessings which we have derived from our Christian civilisation; and should attempts, like the present, to bring to notice some of the arts, manufactures, and raw products of India and China be productive of benefit to our manufactures and commerce, let us take care that when we borrow from other nations hints that may improve our manufactures, we give them in return something that will elevate, improve, and enlighten their understandings, as well as raise them in the scale of civilisation. We already owe to India the ideas for some of our best and most lucrative manufactures; and it is the duty of our merchants and manufacturers to make some return.

VI. *On the Economical Uses of the Roots of Coniferous Trees.* By Mr M'Nab.

The donations of Mrs Millar, prepared from the roots of the *Abies nigra*, received from the Hudson's Bay territory, and presented at the last meeting of the Botanical Society; also the donations of Mr Jeffrey, prepared from the *Abies Menziesii*, from the Oregon territory, and presented December 1854, suggest the idea that something might be done in this country by a more extensive cultivation of these trees. Both species delight in open brown peat soil. Perhaps the finest specimens in Great Britain of the *Abies Menziesii* are to be seen on Keillar Moor, Perthshire, where it is growing vigorously in deep brown peat. This species differs from most of the other conifers, in being easily propagated by cuttings, which, if stuck into the spongy peat, root and form trees. The *Abies nigra*, like *A. Menziesii* also rejoices in peat soil. I have not as yet been able to ascertain the state of the roots of these trees when grown in peat, but I have no hesitation in saying, that from the appearance of the roots now exhibited (grown in loam and clay) they must run freely amongst open brown spongy peat. Judging from the strength and durability of the articles now shown, I would venture to suggest that the roots of these as well as other coniferous trees, might, if found suitable, afford employment to the labouring population in the upland districts of Scotland, by preparing these roots for baskets, hats, and other useful articles, and thus turn to a profitable use, soils at present wholly unproductive. The object of the foregoing remarks is to induce as much as possible the turning to account the roots of the various coniferæ (Scotch fir, spruce, and larch), annually cut down for railway sleepers, and other economic purposes. The roots of these trees are either allowed to rot in the ground, or if grubbed up, burned to get them out of the way. When we see the uses to which coniferous roots are put by the American Indians, we are entitled to conclude that something may yet be done with them in this country.

A notice was read from the Society for Encouraging Arts, Manufactures, &c., of a prize of £100 for an Essay on the applications of the Marine Algæ and their products as food or medicine.

Several interesting species of Gentiana, including *G. cernua*, were contributed by Mr Isaac Anderson. They had been sent by Professor Jameson of Quito. Mr Anderson, in his note accompanying the specimens, says, "I beg to send dried specimens of three gentians sent to me by Dr Jameson of Quito, and gathered by him on Antisana, to which he had made an excursion on the 2d of November last. The tallest, *G. cernua* of Humboldt, was gathered at the place where that great naturalist found it, at 13,000 to 14,000 feet of elevation. The next in size, about one and a-half inch high, is described as scarlet-flowered, and also found at 14,000 feet. The smallest, with largest flower, is described as purple-flowered. This is the one about an inch high, flower included."

10*th February* 1859.—Andrew Murray, President, in the Chair.

The following Candidates were balloted for, and duly elected as Resident Fellows:—

Frederick Fawssett, Esq., 26 Dundas Street.
Robert Reid, Esq., 10 Salisbury Street.

The following donations to the Society's Library and Herbarium were announced:—

Proceedings of Philosophical Society of Glasgow, vol. iv. part 1, from the Society.

British Plants, from A. G. More, Esq., Bembridge, Isle of Wight.

Professor Balfour stated that he had received, from Dr Lindley, specimens of the seeds of a hybrid between the Pea and Lentil. This hybrid has been produced by Dr Rauch of Bambery. "It bears long pods, and is very productive. The taste of its seeds is very agreeable. The colour of the seeds is like that of the best ripened early frame pea, a little heightened, so as to verge upon apricot. In form the seeds are compressed like a lentil, not spherical like a pea. In size they are generally about twice as large as that of a fine lentil, or even somewhat bigger, but they are by no means alike in magnitude." Specimens of the seeds were exhibited.

The following donations were presented to the Museum at the Botanic Garden:—

Dr Balfour, Stick made from *Xanthoxylon Clava Herculis*, a North American plant.

Miss Graham, per Dr A. H. Balfour, specimens of fruit of *Tacsonia mollissima*, grown in a greenhouse at West Duddingston; the flavour of this fruit is said to be pleasant.

Andrew Murray, Esq., Californian cones, including *Pinus Coulteri*, *Cupressus macrocarpa*, and *C. lusitanica*, fruit of *Torreya grandis* with branches and wood, branches and wood of *Abies bracteata*.

Dr Lockhart of Shanghae, section of Formosa Tree-fern, and specimens of Rice-paper. Dr Lockhart, in his note accompanying the specimens, says,—"I have much pleasure in sending you a piece of the Formosa Tree-fern I promised you, also specimens of the Rice-paper plant; one piece with the bark on in its natural state, three pieces with the bark removed, and a few sheets of the paper itself; it is cut direct from the pith, with a broad, heavy, sharp knife, slightly damped with water, and then flattened by pressure."

Dr James Young presented, from the Rev. Zerub Baillie, a specimen of a species of *Lycopodium*, collected by him at Old Calabar.

The following communications were read:—

I. *On Approximate Measurements of the Axial Appendages of Plants.* By Mr WILLIAM MITCHELL.

Any one who takes an interest in botanical studies, if at the same time of a mathematical turn, can scarcely fail to wish for some method, the application of which would give analytical expressions for those laws which determine the symmetric forms, the graceful curves, and varied contour of leaf and flower and fruit, so conspicuously displayed throughout the wide range of the vegetable kingdom. Unhappily, however, the more closely the subject is considered, the more hopeless does the realization of this wish appear; for amidst curves of double curvature, often altering their flexure under every change of temperature, or bending beneath the slightest touch, amidst curvilineal angles and doubtfully-defined points, our nicest mensuration seems utterly at fault.

Yet plants must have a geometry, though we should never be able to reach its transcendental heights, nor expound its intricate formulas. But though foiled for the present in this direction, might not something be attempted to obtain derivative laws, so as to exhibit the relations of approximate values? The importance of mean results in meteorology, astronomy, statistics, and other departments of science, is well known; and could we introduce them into botany with equal advantage, a desirable end might be gained.

The idea has often presented itself to my mind while rambling among the blooming beauties of the vegetable world, during intervals of leisure; but after various expedients with subsequent trials and failures, I have got no further than a rough method of measurement of the axial appendages of plants, which this paper is intended to explain, merely as a tentative process which may to a limited extent be ultimately found useful.

There are many leaves, sepals, and petals of plants, which may be gently pressed on a plane surface, without very greatly distorting the natural form, and an accurate outline traced. Having obtained an outline by this, or any other way, I next choose a convenient point within it, and after certain measurements about to be described, find an equation of the form,—

$$\begin{aligned} R = A &+ B \sin(\theta + C) \\ &+ B' \sin(2\theta + C') \\ &+ B'' \sin(3\theta + C'') \ \&c.; \end{aligned} \qquad (1.)$$

which is an adaptation to our present purpose of a formula often employed by meteorologists, and which will be found well explained in the article Meteorology in the 8th edition of the "Encyclopædia Britannica." From the point selected as the origin of measurement I draw radii vectores to the outline, corresponding to equal arcs, into which a circle described round the pole or point in question is divided. On each side of each of these primary radii, other radii are drawn in the same way, and at equal distances, and each measured by a scale of equal parts. Then the length of each principal radius, added to that of each of the secondary drawn on each side of it, and the sum divided by the number of the whole, gives a mean radius corresponding to each primary division of the circle. Let the total number of mean radii be called N, and each in succession denoted by $r_1, r_2, r_3 \ldots r_n$, the corresponding arcs may be represented by $\theta, 2\theta, 3\theta \ldots n\theta$, and their cosines and sines by $c_1, c_2, c_3 \ldots c_n$; $s_1, s_2, s_3 \ldots s_n$, then by the method of least squares we can easily find the values of the quantities A, B, C, B′, C′, &c., in equation (1.) thus:—

$$A = \frac{1}{N}(r_1 + r_2 + r_3 \ldots r_n),$$

and by taking

$$a_1 = \frac{2}{N}(c_1 r_1 + c_2 r_2 + c_3 r_3 \ldots c_n r_n),$$

$$a_2 = \frac{2}{N}(c_2 r_1 + c_4 r_2 + c_6 r_3 \ldots c_{2n} r_n), \text{ \&c.}$$

$$b_1 = \frac{2}{N}(s_1 r_1 + s_2 r_2 + s_3 r_3 \ldots s_n r_n),$$

$$b_2 = \frac{2}{N}(s_2 r_1 + s_4 r_2 + s_6 r_3 \ldots s_{2n} r_n), \text{ \&c.,}$$

we find

$$B = \sqrt{a_1^2 + b_1^2}; \ \tan C = \frac{a}{b_1}$$

$$B' = \sqrt{a_2^2 + b_2^2}; \ \tan C' = \frac{a_2}{b_2}, \text{ \&c.}$$

If the origin of measurement be taken on any part of the axis, except the centre of the leaf, sepal, or petal, we shall have simply, when the formula is reduced,—

$$\begin{aligned} 6\,B &= \sqrt{3}\,(r_1 - r_5) + (r_2 - r_4) - r_6 + r_3 \\ 6\,B' &= r_1 - r_2 - r_4 + r_5. \end{aligned} \qquad (2.)$$

for 12 divisions of the circle, or $\theta = 30°$, and C, C′ = 90° or 270°, according as B, B′, come out positive or negative; A will be found as before, namely, $A = \frac{1}{12}(r_1 + r_2 + r_3 \ldots r_{12})$ in this case.

In this way I have roughly measured a number of leaves, placing the pole in the axis, at ¼th the length of the midrib from the base, and using a scale of $\frac{1}{20}$th of an inch; but as each radius was taken only as the mean of three, and the measurement made merely to satisfy myself as to the practicability of the method, a few of the results need only be given here by way of illustration.

Laurel,	$R = 34{\cdot}6 + 18 \sin(\theta + 90^\circ)$
Dahlia,	$R = 38{\cdot}4 + 24 \sin(\theta + 90)$
Strawberry,	$R = 15 + 10 \sin(\theta + 90)$
Beech,	$R = 29 + 15 \sin(\theta + 90)$
Ivy,	$R = 40 + 16 \sin(\theta + 90)$
Common Dock,	$R = 24 + 8 \sin(\theta + 90)$
Common Sorrel,	$R = 21 + 6 \sin(\theta + 90)$

These polar equations are not carried further than the first variable term, but as the series is very convergent, one or two variable terms might be a sufficient approximation in the case of most plants capable of being so measured. The formula will apply to the outline of any part of a plant presenting a closed curve, and involves only a very simple numerical operation.

It might be applied also to such unfavourable cases as those of the leaves of *Plantago lanceolata*, *Leontodon taraxacum*, and the still more elongated leaves of grasses, &c.; but then the point at the base is too obscure for giving the measure of a proportional part of the axis, in order to compare the resulting formulas with those of other leaves, so readily as in the former cases.

In conclusion, permit me to remark, that if we had an extensive series of accurate measurements, in the way thus indicated, we would be able to compare both the average variation in form of the axial appendages of any plant, and also that of different plants, by which we might meet with numerical relations, tending to throw light on vegetable morphology, and otherwise advance the interests of the attractive science of botany.

Note.—This note is appended in order to give a numerical example by the measurement of a leaf of the Ivy, the pole being $\frac{1}{4}$ the mid-rib from the base, and 12 mean radii, each the mean of 3, employed. The scale of measures is $\frac{1}{20}$th of an inch.

In the figure, page 235, P is the pole; and the actual measures of P*a*, P*c*, P*b*, P*d*, &c., are 48, 43, 46, 61, 52, 47, 43, 40, 27, 20, 17, 18, 17, 20, 27, 40, 43, 47, 52, 61, 46, 43, 48, 55.

$$r_1 = \frac{1}{3}(\mathrm{P}a + \mathrm{P}c + \mathrm{P}b) = \frac{1}{3}(48 + 43 + 46) = 45{\cdot}56.$$

$$r_2 = \frac{1}{3}(\mathrm{P}b + \mathrm{P}d + \mathrm{P}e) = \frac{1}{3}(46 + 61 + 52) = 53{\cdot}00, \text{ \&c.}$$

Hence, $r_1, r_2, r_3, \ldots r_{12} = 45{\cdot}56,\ 53,\ 47{\cdot}\dot{3},\ 36{\cdot}\dot{6},\ 21{\cdot}\dot{3},\ 18{\cdot}\dot{3},\ 21{\cdot}\dot{3},\ 36{\cdot}\dot{6},\ 47{\cdot}\dot{3},\ 53,\ 45{\cdot}5\dot{6},\ 50{\cdot}\dot{3}$

Then by (2) we have

$$A = \frac{1}{12}(r_1 + r_2 + r_3 \ldots r_{12}) = 39{\cdot}75.$$

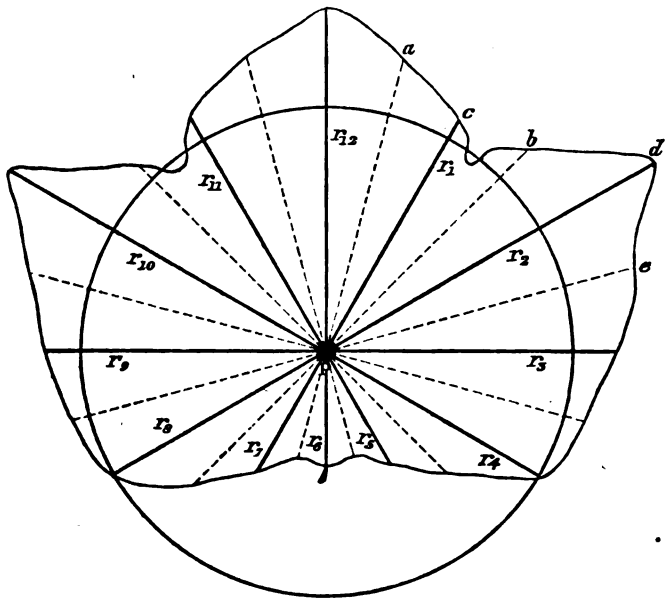
$$6\,B = 1{\cdot}732\,(45{\cdot}56 - 21{\cdot}33) + (53 - 36{\cdot}66) - 18{\cdot}33 + 53 = 92{\cdot}976, \therefore B = 15{\cdot}496$$

$6\ B = 45{\cdot}56 - 53 - 36{\cdot}66 + 21{\cdot}33 = -22{\cdot}77$, and hence $B' = -3{\cdot}461$.

$C = 90°$, and $C' = 270°$, therefore

$$R = 39{\cdot}75 + 15{\cdot}496 \sin(\theta + 90°) + 3{\cdot}461 \sin(2\theta + 270°).$$

Leaf of the Ivy.



$$R = 39{\cdot}75 + 15.496 \text{ Sin } (\theta + 90°) + 3{\cdot}461 \text{ Sin } (2\theta + 270°)$$

II. *Botanical Notes of a Visit to Cannes* (Dep. Var.), *France, in the Spring of* 1858. By Mr R. M. Stark.

Mr Stark left for Cannes in the beginning of April. He gave an account of the progress of vegetation as he journeyed southwards. He described generally the nature of the vegetation of the rising grounds in the immediate vicinity of the town of Cannes, of the more level and cultivated district surrounding it, and that of the sandy sea-shore which forms the Bay of Napouli, in which it is situated. The higher grounds, besides exhibiting most of the timber and fruit trees common to temperate Europe, produce in rich abundance several species of fir, only found in the mildest districts of the south. The Cork and evergreen Oak, Arbutus, Laurustinus, Myrtle, Fig, Vine, Pomegranate, &c., flourish in luxuriance, besides many interesting perennial and annual herbs, some of which are rare, and others well known in gardens. The *Cytinus Hypocistis*, a parasite, growing on the roots of the Cistus, was particularly noticed. The mode of growth and propagation of this plant seems to demand further investigation from botanical physiologists. On the level and more cultivated ground there are many interesting herbaceous plants (a great proportion of which were annual). In the fields the cultivation of Geranium, Violets, Rose, Jasmine, &c., used so extensively for the manufacture of perfumes, is very characteristic of this corner of France. On the sea-shore some rare plants were found. In addition to dried specimens of the land plants collected by him, Mr S. also exhibited portions of a curious marine plant, *Caulinia oceanica*, allied to Zostera. The specimens consisted (1) of the dead stems, with the basis of the ribbon-like leaves attached, which forms immense banks on some portions of the Mediterranean coast; and (2) of hairy balls, formed of comminuted fragments of the leaves and stems of the same plant, which assume this form by adhering together as they are blown along the sandy shore by the winds.

III. *Letter from Dr Thomas Anderson, Calcutta.* Communicated by Dr Balfour.

Dr Anderson, in his letter to Dr Balfour, dated Fort William, 8th December 1858, says:—"Dr Thomson of the Botanic Garden and I have just returned from a botanical trip to a little-known mountainous country 300 miles north of Calcutta; we brought back large collections of very interesting plants; among them are some new species; one of them I send the seeds of; it is an undescribed Begonia. It flowers in the rains, and grows in the crevices of rocks at and above 4000 feet elevation on the mountain Parasnath, and is a beautiful species. The temperature of the height at which it grows is about 78 deg. in the rains. It has a tuberous perennial root. It will be described in our catalogue of the plants of the district. We also got two handsome new Osbeckias, and a very interesting African form, Alectra, new to India, and not described by Bentham. I hope you got a parcel of Lucknow plants I sent you. I shall send home the catalogue, as I merely sent home the numbers on the specimens. I have a large collection, and plenty duplicates of High Himalayan and Tibetan plants, which I gathered in 1857."

IV. *Report on the Conservation of Forests in India.* By Dr Cleghorn. Communicated by Professor Balfour.

Dr Cleghorn says:—"During the past year I proceeded on my first tour of inspection, traversed Mysore, and visited the depôts at the mouths of nearly all the rivers on the Malabar coast, examining the greater part of the western ghauts with a view to ascertain the exact state of the Government forests, their extent and capabilities. I travelled through the most wooded portions, along the chain of ghauts, ascending and descending by the mountain passes, from the Bombay frontier down to Ponany. I afterwards went across the Anamallay Hills, and round the slopes of the Neilgherry Hills; I also made a circuit of the Wynad, and twice visited the Conolly plantations at Nellumboor, being altogether eight months absent from the Presidency. In the beginning of the century an immense almost unbroken forest covered the western ghauts, from near the water's edge to the most elevated ridges left to nature, thinly peopled, abounding in wild animals, and all the higher portions, without exception, covered with timber; and now the passing traveller, looking down from the higher peaks of Coorg or Malabar, conceives that an inexhaustible forest lies below him; but as he descends the ghauts, he finds that the best timber has been cut away, and that the wood-contractor is felling in more remote localities. I speak especially of Teak, Blackwood, and Poon spars, which are every year becoming more scarce in accessible situations. The practice in this country has been the converse of that in Europe, where the soft wood is thinned out and the hard wood left; here the valuable kinds are removed and the scrub left. By one of these authorities, burning the jungles was recommended as a sanitary measure, and to diminish the number of wild animals; but circumstances have much changed. Now the axe of the coffee-planter and of the coomree-cultivator has made extensive and often wanton havoc, devastating a large portion of the area of the primeval forest. The trees are classified according to size—1st class, 6 feet in girth; 2d class, 4½ feet; 3d class, 3 feet and upwards; 4th class, under 3 feet, seedlings.

TEAK (*Tectona grandis*).—This invaluable wood has received the special attention of the department, and, I may say, has occupied at least two-thirds of my own time during the past year. Along the whole length of the Malabar coast from Goa to Cochin, there is now very little of this wood in a ripe state on Government land below the ghauts, and there are only three localities above the ghauts where I found Teak in abundance, and of good size—viz., 1st, The Anamallay Forest, in Coimbatore; 2d, Wynad and Haggadevincottah (partly in dispute between Mysore and Malabar); 3d, Goond Tableau, North Canara, near Dandellie. The Anamallay Forests have been the subject of annual Reports to Government since 1848, when their importance was first declared by Captain F. C. Cotton (*Madras Journal*). The forests of Wynad and Haggadevincottah Teak, on the borders of Mysore and Malabar, are of great value, and stand second in importance. The average price of Teak at the quarterly auctions held at Mysore has been almost exactly the same as at Anamallay, about one rupee per cubic foot. The Canara Teak is of much smaller scantling generally than that of Wynad. It has the advantage of water-carriage to the coast, not possessed by the two last; but it has for some years been chiefly obtained for naval purposes from the banks of the Kalla Nuddee, where it emerges from the Soopah Hills, and the supply has gradually been sent down from more distant localities, as in Malabar, where the Teak is now cut by the Teroopaud of Nellumboor, just under the Neilgherry Peak. The Goond Forest is the chief remaining reserve in Canara. I saw here several thousand trees on an elevated plateau with precipitous sides. The trees are well grown and ripe, conserved by their inaccessible position, which has been rarely visited by Europeans.

Poon spars (*Sterculia fœtida*) are becoming very scarce, and consequently are perhaps more valuable than Teak; young ones, especially such as are in accessible places, are most carefully preserved.

Blackwood (*Dalbergia sissoides*).—This valuable wood has risen much in price. Indents were received during the year, both from Madras and Bombay gun-carriage manufactories, each for 5000 cubic feet. There is not much Blackwood remaining in the Anamallay Forest, but there is a considerable quantity in the escheated forest of Chennat Nair, and it is abundant in the Wynad and Coorg.

Sappan Wood (*Cæsalpinia Sappan*).—This important dye-wood has engaged my attention. It appears to grow with great luxuriance in South Malabar, and is cultivated rather extensively by the Moplahs, who plant a number of the seeds at the birth of a daughter. The trees require fourteen or fifteen years to come to maturity, and then become her dowry. I saw more on the banks of the Nellumboor river than anywhere else; why it should be there in particular is not obvious, as Malabar is generally uniform in its character. A better system of cutting and cultivating the Sappan is desirable, and the dye-wood is damaged, I believe, by being allowed to float in salt water.

The *Sandal-Wood Tree* (*Santalum album*) in Mysore, Canara, Coimbatore, Salem, and a little in North Arcot, has received much attention. It would appear that the spontaneous growth of this tree has increased to a considerable extent.

The "*Gutta Percha Tree* of the Western Coast," so called (*Isonandra* sp ?) has been traced from Coorg to Trevandrum. All the reliable information procurable has been condensed into a memorandum, and a large sample has been transmitted to England for report as to its suitability for telegraphic and other purposes.

Catechu (*Acacia Catechu*).—The enhanced value of cutt has caused an unusual destruction of the tree.

Kino.—Two thousand trees of the Kino tree (*Pterocarpus Marsupium*) were seen along the roads through the Wynad, notched, for the extraction of Kino, which is taken to the coast, where it meets with a ready market, and is exported in wooden boxes to Bombay.

Bamboos.—Immense quantities of fine bamboos are floated down the various rivers of the western coast. They constitute one of the riches of the provinces. They are ordinarily 60 feet long, and 5 inches in diameter near the root. These are readily purchased standing at five rupees per 1000, and small ones at three and a-half rupees per 1000. Millions are annually cut in the forests, and taken away by water in rafts, or by land in hackeries. From their great buoyancy they are much used for floating the heavier woods, as Mutte (*Terminalia tomentosa*) and Biti (*Dalbergia arborea*), and piles of them are lashed to the sides of the paltimars going to Bombay. The larger ones are selected as out-riggers for ferry-boats, or studding-sail booms for small crafts. In addition to the vast export by sea, it is estimated that two lacs are taken from the Soopah talook eastward. The Malabar bamboo is much smaller than that of Pegu (*Bambusa gigantea*), which is eight inches in diameter.

Mode of Floating Timber.—It is curious to see the clever management of the floaters, who are a distinct class of persons. Rafts are of all sizes, usually longer than broad, and the logs bound together by the stringy bark of various trees, and stout branches passing through the drag-holes at right angles to the log. In the centre of the raft a small hut is generally made of thatch, or bamboo laths, covered with Palmyra leaves; in this the floaters are sheltered at night. It is not usually considered advisable to float logs when the river is at the fullest, as the raft is apt to go over the bank and be stranded. Numerous logs may be seen high and dry all along the sides, and the following year the flood lifts them. At night floats are brought to under deep banks, in deep water, they are then tied to the trunk of some adjoining tree. Occasionally the banks fall in, and serious accidents occur.

Coffee.—The successful cultivation of the coffee plant is extending remarkably, and applications for grants of forest lands pour in upon the revenue authorities. In the Sisipara Perambady and Sumpagoe passes vast clearings are being made. In the Coonoor Ghaut six large plantations may be seen, and there are very large and numerous holdings, above thirty, in the Wynad, which from year to year will increase. The plant has succeeded admirably in Mysore, and there are patches of cultivation in Madura, in and even North

Canara. I may observe that in granting forest land, it seems to me that while the destruction of forest (Teak, Ebony, and Poon spar excepted) for *bona fide* cultivation may be considered legitimate, yet the preservation of the fringe along the crest of mountain ridges is of special importance in a climatic point of view, and this should never be given over to the axe. As these mountain crests are not suitable for the growth of coffee, the restriction cannot be complained of.

Tea.—I think it right to bring to the notice of Government the thriving condition of a tea plantation near Coonoor, belonging to Henry Mann, Esq., who has devoted much attention to it, and has spared no expense. This is a very interesting experiment. The best varieties of the shrub were imported from China in 1854, the seeds having been given to Mr Mann by Mr Fortune on his return from the tea-growing districts. There are now about 2000 vigorous plants, and to ensure success it seems only necessary to procure a supply of workmen to teach the manipulation and separation of the leaves. I have issued a general instruction to the forest assistants in a circular, and I try to persuade each to keep a small arranged herbarium of flowers and fruit-bearing specimens of all forest trees and their varieties, with notes. By inviting them to do this, I trust some will become at least observers, if not botanists. I am preparing a manual of Indian botany, which it is hoped may be a useful guide to the botanical riches of the Presidency.

Mr Murray exhibited some recent cones from California.

10th March 1859.—Andrew Murray, President, in the Chair.

The following Candidate was balloted for and duly elected a Resident Fellow :—

Thomas Cayzor, Esq.

The following Donations to the Society's Library were laid on the table :—

From M. Charles Martins, Montpellier, the following publications, of which he was the author :—

Promenade Botanique le long des côtes de l'Asie Mineure, de la Syrie, et de l'Egypte.

Experiences sur la vitalité des grains flottant a la surface de la mer.

Geographie Botanique et ses progrés.

Index Seminum Horti Monspeliensis, Anno 1858.

Especes Exotiques Naturalisées spontanement dans le Jardin des Plantes de Montpellier.

Rapport sur le Jardin des Plantes et le Conservatoire Botanique de Montpellier.

Sur le Froid exceptionnel qui a regné a Montpellier dans le courant de Janvier 1855.

Transactions of the Malvern Naturalists' Field Club.—From the Club.

Transactions of the Tyneside Naturalists' Club, Vol. IV., Part 1.—From the Club.

Mr J. M. Syme presented specimens of British Plants to the Society's herbarium.

Professor Balfour announced that a large and valuable series of Indian Plants, collected by the late Colonel Madden, H.E.I.C.S., had been generously presented to the Herbarium of the University by Mrs Madden, along with preserved specimens of *Caladium pumilum*, *Tillæa pentandra*, and *Nardostachys Jatamansi* (Spikenard) from Simla; also, the fruit of *Melia Azedarach*. He stated, also, that Mr J. J. Martin, surgeon, R.N., had presented specimens of *Sargassum bacciferum* (Gulf weed); and Dr Lowe, Lynn, fruit of a *Hakea*, sent by Mr Thomas Bains from South Head, Sydney.

Professor Balfour alluded to the death of one of the foreign hon. members of the Society, Carl Adolph Agardh, Professor of Botany and Rural Economy in the University of Lund, Sweden, and Protestant Bishop of Carlstadt:—

Carl Adolph Agardh, Professor of Botany and Rural Economy in the University of Lund, Sweden, was born at Bastud in Harland, 23d January 1785, and he died 28th January 1859. He prosecuted his studies at the University of Lund, which he entered in 1799, and devoted his attention in a special manner to natural history and mathematics. In 1807 he taught mathematics in the University. His favourite science, however, was botany. After a visit to Olaf Swartz at Stockholm, he entered upon the study of the Algæ, and in this department he acquired a well-merited reputation. He travelled on the Continent, and on his return to Lund was nominated Demonstrator of Botany. In 1812 he became Professor of Botany in the University. He now laboured assiduously at the classification of the Algæ. In his "Synopsis Algarum Scandinaviæ" he developed his system of arrangement. He subsequently published his "Species Algarum," "Icones Algarum," and lastly, his "Systema Algarum," which appeared in 1827. He published also works on the physiology and morphology of plants, as well as on systematic botany. He became a member of the Swedish Parliament in 1817, and zealously advocated all measures which tended to the public welfare. In 1816 he took orders, and in 1837 was consecrated Bishop of Carlstadt. He was much interested in education, and in the improvement of schools. He strongly urged the propriety of introducing modern science, and especially botany, into elementary education.

He did much to promote science in Sweden, and his death is a national loss. A Swedish correspondent, writing to Dr Hooker, says, "He was a singular man, in some respects a first-rate genius, but a very peculiar one. As a youth he studied mathematics, and wrote some dissertations on that subject; then hearing that botany was a very difficult science, he determined to show the little world of Lund that in a very few months he could master the science. There are probably few subjects of human knowledge on which he has not ventured to write. He was ever genial, with light, sparkling wit and good humour."

Professor Balfour exhibited a specimen of *Cephalanthera ensifolia*, collected by Mr A. Buchan, near Comrie, not far from the Devil's Cauldron.

The following Communications were read:—

I. *On the Structure of* Lemania fluviatilis. By Dr W. J. Thomson. Plate IV., A.

While recently employed in examining the minute anatomy of *Lemania fluviatilis*, I was struck by some points of structure which are not described in any work on the Algæ, and some of which are quite at variance with the descriptions and plates contained in Hassall's British Freshwater Algæ, which plates are copied from Kutzing's Phycologia Generalis. The position of this genus, in a general classification of the Algæ, has hitherto been very unsatisfactory, but I believe that the points of structure about to be described will entitle it to a comparatively high and definite position among the Melanospermæ. The genus Lemania, as instituted by Bory, is characterized as having the frond attached, coriaceous, ramose, cellular; outer cells small, polygonal, and firmly adherent; interior larger, more lax, spherical, and empty. Now, this description, so far as it goes, is perfectly correct; but if a frond be allowed to macerate in water for some time, so as to destroy its colour, and render it more transparent, and then be slightly torn up with needles, and viewed with a magnifying power of 200 diameters, it will be seen to contain an axis consisting of a single articulated tube, which runs throughout the whole length of the frond, and bearing at each of the whorls of warts peculiar processes, to be afterwards described in connection with the organs of fructification. If the tips of the branches of the young and growing plants, as well as the warts, while the spores are coming to maturity, be examined by the same power, they will be seen to be covered with minute articulated hyaline filaments, analogous to those which cover the young branches of *Desmarestia aculeata*, and some other marine Algæ. But it is in connection with the organs of fructification that the most remarkable structure presents itself; the fructification is described thus:—"Sporules moniliform, fasciculate, naked, arising from the inner vesicles, and occupying the interior of the frond." Now, this is entirely erroneous. At each of the dilatations on the frond of the Lemania are from two to four wart-like tubercles; within each of these is found a bundle of branched moniliform filaments, which ultimately break up into spores. But these branches are not attached to the large internal cells, but to the central axis, by means of 2 to 4 elongated radiating cells, one to each tubercle, which are articulated to the axis by means of a round head (like that of the human humerus), the other end being expanded to a greater degree to receive the bundles of spore-bearing filaments. The upper extremity of the cells of the axis below that to which the radiating cells are attached is also much dilated, so as to be at least three times the diameter of the lower end of the cell, articulated to it superiorly. From the above characters it will be at once seen that this genus has a very strong title to be classed in the natural order of *Sporochnaceæ*, in which it seems to occupy a position intermediate between *Arthrocladia* and *Sporochnus*, resembling the former in its articulated tubular axis, and in the arrangement of its spores in moniliform series, while it forms a transition by its consolidated knobs of filaments to the stalked receptacles of Sporochnus. In the articulated filaments which crown its growing apices and tubercles, it also corresponds with all the other genera of this order.

II. *Descriptions of some new species and varieties of* Naviculæ, *&c., observed in Californian Guano.* By R. K. Greville, LL.D., F.R.S.E., &c. (Plate V.)

Among the *Naviculæ* I have observed in Californian Guano are several of a very perplexing appearance; especially those belonging to the group of which *N. Lyra* may be considered the representative. Some of these forms strikingly illustrate the exceeding difficulty of determining what characters really go to constitute a species among these minute and variable plants. But it is amusing to notice the difference of opinion which still exists on the question of species. Professor J. G. Agardh, after quoting some eminent naturalists, thus briefly recapitulates:—"Ex his, quæ breviter attulimus, satis, credo, apparet, tres nostræ ætatis vel excellentissimos naturæ investigatores in illa, quam proposuimus, quæstione dijudicanda, inter se dissentire. Schleidenius sola individua, Lindley species, Friesius species et genera a natura vult constituta, majores omnes ordines ab arte inventos esse."*

We have unquestionably much to learn regarding the value of characters presented by the Diatomaceæ. In the present state of our knowledge, it would appear that scarcely any one character taken by itself is to be relied on; and that even a combination of characters which may be sufficient for the determination of species in one genus, may be unsatisfactory in another; and where groups or sections happen to be what is called exceedingly natural, the difficulty is greatly increased. Indeed, it often becomes a question, whether it is best to leave a doubtful variety to embarrass the diagnosis, or to separate it under a provisional character. No law can be laid down on this subject which shall practically be a clear and unerring guide. Among the Diatomaceæ, the process of self-division, by means of which any deviation from the normal condition of a species becomes stereotyped and perpetuated with inconceivable rapidity, complicates the idea of a species

* Theoria Systematis Plantarum, &c., 1858, a learned and valuable work.

to an extent unknown among the higher orders of vegetables. For example, let A represent a species of Diatom. By some unknown cause, one of its progeny, B, becomes so changed as to constitute a well-marked variety. Another of its progeny, C, undergoes a different but equally decided change; and possibly the same thing may occur in others. Now, these varieties or aberrations from the typical condition may be propagated, according to the late Professor Smith's calculation, at the rate of a thousand millions in a single month. Then, as there is no reason why B and C should not also have an indefinite number of nonconformist children, all removed in one character or another a *second stage* from the type, and producing duplicates by thousands of millions, it is manifestly impossible to say where the confusion is to end. But this is not all. By the process of conjugation, what Mr Thwaites calls "Sporangial frustules" are produced, which are very much larger than the ordinary size of the parents, and these, it is presumed, multiply equally freely by self-division, and are equally liable, from accidental causes, to have their deviations from the normal state perpetuated. Such is the theory; and to arrive at anything like fixed specific distinctions would seem to be almost a hopeless endeavour. Nevertheless, by correcting processes unknown to us, we cannot doubt that the typical characters of real species are preserved. There must be a limit to the influence of the disturbing causes above mentioned; for order and individuality are conspicuous in the marvellous works of the Great and All-wise Creator.

NAVICULA, Bory.

N. irrorata, n. sp., Grev. Valve oblong, suddenly contracted at the obtuse and produced extremities; striæ slender, conspicuously moniliform, interrupted, forming a broad band parallel with the margin, and a very narrow and irregular one next the median line; the linear blank spaces disappearing before reaching the ends. Length ·0055″ to ·0070″; breadth ·0020″ to ·0024″; striæ 15 in ·001″. (Pl. V., fig. 1.)

In Californian Guano.

A remarkable species, having considerable affinity with *N. prætexta* (Ehr.), figured in Professor Gregory's Paper on the Diatomaceæ of the Clyde (Trans. Roy. Soc. Edin., vol.

21). The striæ in *N. irrorata* are slender, and, under a sufficiently magnifying power, are found to be composed of distinct oval granules, about 15 in ·001″. The marginal band of striæ constitutes about a third of the entire breadth of the valve; the inner edge of the band forming a straight line until near the extremities, where it curves inwards. Opposite the nodule several of the striæ are finer and more crowded. Next the median line they are curiously irregular, influencing to a corresponding extent the contour of the blank spaces. At the nodule these striæ consist of three or four granules; at the distance of about a third of the space between the nodule and the extremity, the granules are rather suddenly reduced to one; then after a similar interval, they are increased to two, until they nearly reach the produced ends, which are filled up with granules more or less closely and irregularly disposed.

N. polysticta, n. sp., Grev. Valve elliptical, obtuse; striæ forming a narrow external band, moniliform, passing into distinct punctiform granules, which are scattered over the whole vacant area of the valve. Length, ·0024″; breadth, ·0011″; striæ, 25 in ·001″. (Pl. V., fig. 2.)

In Californian Guano.

A minute but apparently well-marked species, allied to the preceding and to *N. prætexta.* The outline is purely elliptical; the marginal band of striæ less than the fourth part of the width of the entire valve. The space thus left unoccupied by true striæ is filled up by irregularly scattered puncta.

N. Lyra, Ehr., var. *recta*, Grev. Valve elliptical, obtuse; blank spaces contracted at the nodule, but otherwise parallel throughout their length with the median line, from which they are separated by a very narrow band. Length, ·0084″; breadth, ·0026″; striæ, 24 in ·001″. (Pl. V., fig. 3.)

In Californian Guano.

I offer this truly splendid *Navicula* as a variety of the protean *N. Lyra*, the precise characters of which species we are not, I apprehend, even yet in a position to define. I have only seen two examples of the extraordinary size I have represented, which may be sporangial frustules, but have noticed many approaching towards it, all more or less elliptical or slightly produced at the ends, and distinguished by the straight narrow blank spaces.

N. approximata, n. sp., Grev. Valve oblong, obtuse, produced at the ends; striæ interrupted; the linear acuminated blank spaces separated from the median line by an extremely narrow band, straight opposite the nodule, somewhat converging towards the extremities. Length about ·0044″; breadth about ·0018″; striæ, 17 in ·001″. (Pl. V., fig. 4.)

In Californian Guano.

Although belonging to the same group, and allied to *N. Lyra*, this seems to be really distinct. I have examined many frustules, and they uniformly agree in the total absence of any contraction of the blank spaces opposite the nodule. On the contrary, there is frequently a tendency to become slightly convex at that part, as is seen in the figure I have given. From *N. Hennedyi* it differs in the form, in the linear blank spaces being closely parallel with the median line, and in the much larger proportion of blank space round the nodule in consequence of the greater shortness of the extremely narrow bands of striæ next the median line. The striæ are also less numerous than in both *N. Lyra* and *N. Hennedyi*.

N. Californica, n. sp., Grev. Valve broadly elliptical, obtuse, the sides somewhat angular; striæ moniliform, interrupted, constituting a narrow marginal band, and a very narrow row on each side the median line, the larger portion of the valve being blank space. Length, ·0044″; breadth, ·0027″; marginal striæ, 20 in ·001″. (Pl. V., fig. 5.)

In Californian and South African Guano.

A very fine and apparently well-marked species. A larger series of specimens might exhibit the same tendency to variation in outline that is so frequent in the section of *Naviculæ* furnished with interrupted striæ. In an individual from South African Guano now before me, the frustule is somewhat narrower, but in other respects precisely the same, even to the sides of the valve, which, being straight for a short space in the middle, produces an angular appearance. The singularly large proportion of blank space at once arrests the eye, and in contrast with it the exceedingly narrow row or band of striæ close to the median line. It may be remarked that these striæ, which are usually assumed to be the continuation of the marginal striæ, interrupted only by the intervening blank space, in this case take an unexpected direction. The marginal striæ throughout their whole length are arranged so as to form lines (were they continued) concentric with the extremities; but near the ends, the short striæ next the median life, instead of being pointed so as to meet the others concentrically, are directed so as to form an acute angle with them, and actually do so where the two sets of striæ meet.

N. nummularia, n. sp., Grev. Valve suborbicular; striæ moniliform, interrupted by two narrow linear blank spaces, which contract opposite the nodule, and then curve outwards and converge and meet at the terminal nodules. Length, ·0012″ to ·0018″; breadth, ·0010″ to ·0015″; striæ about 24 in ·001″. (Pl. V., fig. 6.)

In Californian Guano.

A curious little species belonging to the *N. Lyra* group, with the striæ highly concentric with the extremities. The blank spaces have a considerable resemblance to those of *N. forcipata.* Were it not for these blank spaces the frustules might easily be referred to *Cocconeis.* This may prove to be an extreme form of some other species.

N. gemmata, n. sp., Grev. Valve linear oblong, obtuse, the sides straight or slightly concave; striæ moniliform, interrupted, reaching half-way to the median line, with a single row of puncta intermediate between the striæ and the line. Length about ·0058″; breadth about ·0016″; striæ, 10 in ·001″. (Pl. V., fig. 7.)

In Californian Guano.

An exceedingly brilliant and beautiful diatom, well distinguished by the distant striæ, which form a band parallel with the side of the valve, and gradually narrowing at the ends. Two rows of puncta (one on each side) are situated half-way between the striæ and the median line, which diminish in size as they approach the nodule and the extremities. The affinity of *N. gemmata* is with *N. Crabro* and its allies.

Stauroneis, Ehr.

S. apiculata, n. sp., Grev. Valve elliptical oval, obtusely apiculate; stauros linear, reaching half-way from the median line to the margin. Length, ·0020″; breadth, ·0010″; striæ fine, 34 in ·001″. (Pl. V., fig. 8.)

In Californian Guano.

A graceful, but inconspicuous object, not liable to be confounded with any other species known to me.

Explanation of Plate.

Fig. 1. Navicula irrorata; 2. N. polysticta; 3. N. Lyra, *var.* recta; 4. N. approximata; 5. N. Californica; 6. N. nummularia; 7. N. gemmata; 8. Stauroneis apiculata.

III. *On the Manner of Growth of* Dracæna Draco *in its Natural Habitat, as Illustrating some Disputed Points in Vegetable Physiology.* By Professor C. PIAZZI SMYTH. (Plate VI.)

Having recently mentioned to my friend, Professor Balfour, some ideas which had occurred to me from attention to the general aspects of *Dracæna Draco*, when growing in its native climate, and manifesting certain peculiarities on a scale of very striking magnitude, he informed me that similar views had been already arrived at by the physiological researches of several eminent botanists. Their opinions, however, not having yet been proved to the satisfaction of all their brethren, and being of late even pointedly opposed by some great names, the question he thought was still quite an open one, and the acquisition of more facts very desirable.

In illustration, he both referred me to his own important "Class-Book," where the names and opinions of authorities on both sides are abundantly given; and subsequently directed my attention to the "L'Institut" for February 9, 1859; on account of its full report of a Commission of the Academy, consisting of MM. Brongniart, Moquin-Tandon, and Payer, appointed to sit in judgment on a paper by M. Hetet, Professor of Botany in the Naval Medical College of Toulon: the paper being descriptive of a series of excellent practical experiments instituted by him on a variety of plants in the Botanical Garden, in order to satisfy his mind as to the radicular theories of Petit-Thouars and Gaudichaud.

The Commission just named recalls, in its eloquent and powerfully written report, the "vivacity" wherewith those theories were received on their first announcement at the Institute; the favour which they gradually won, and then at length their adoption; until the researches of Mirbel and Trecul in France, with Mohl's in Germany, gave rise to directly opposite opinions; and in Parisian circles, after abundant discussion and severe contest, were finally considered to stand for the law of nature.

M. Hetet, however, buried in the provinces, was still a disciple of Gaudichaud, and is severely handled by the reporters for not having been cognisant, when beginning his experiments, that a similar series had already been instituted by M. Trecul, and, above all, published by the Academy three years before. Nevertheless the Commission itself appears to pass over several published works without mention; and one wonders why. For although the neglected authors may not be always exactly academical, yet some of them have had opportunities, in the course of foreign travel, of studying in distant primeval forests the leading features of vegetable growth on a scale, as to size and time, otherwise perfectly unapproachable; and in that way to come to a knowledge of facts, which, in a practical and inductive science, must be of most important aid in drawing true theoretical conclusions.

Compared with such observation of nature, the hot-house plants of metropolitan botanists can be little more than the index of nature's mighty volume, and are therefore totally unable to supply the *whole* information required; and even though their living tissues be cut and carved upon in numerous experiments, the circumstances are all so thoroughly exceptional, that the results can hardly be less so too. Indeed, it is not a little remarkable to find that those generally who have seen the plants growing in their own natural habitats, hold to one set of opinions, and those who have not, to another.

Which of the two are right, if either of them fully, posterity is alone entitled to say; but we may probably be allowed to venture the suggestion, that if, in the inability of every one being able to travel, those who do, were to publish more frequently, as well as more fully, what they have observed, there would be greater uniformity of botanical ideas and better theories amongst all classes of men. The difficulty will, of course, be felt by many, as it is by myself, of not being scientific botanists; but if we do not pretend to that position, and merely confine ourselves to stating undoubted facts which we have met with frequently in nature, but not seen well described in books, if at all, leaving to others to assign their place and their value in the theoretical fabric of science, we are surely entitled to hope that our attempts will not be regarded as altogether useless.

With such a purpose then, and the desire of adding somewhat, though in ever so small a way, to the stock of exotic information and observation already in the hands of the learned, I will attempt to detail what I have lately had special opportunity of witnessing, as to some of the characteristics of growth in *Dracæna Draco* when flourishing, as indeed it only can flourish, under the very peculiar meteorologic conditions of its native island of Teneriffe.*

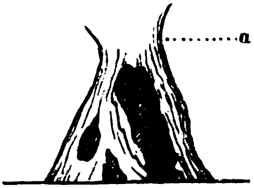
Let us commence, then, with that celebrated historical example the great Dragon-tree of Orotava, according to Baron Humboldt 5000 or 6000 years old; according to Sir John Herschel, "supposed to be the oldest tree in the world;" and according to French naturalists of the catastrophic school in geology, "so old as to have witnessed some of the last revolutions which the surface of our planet underwent prior to the advent of man;" or to speak in the most moderate terms and in words which no one will venture to contradict, the oldest specimen of this species of tree that has yet been brought to the knowledge of man.

After considerable study of the tree, and careful examination of all the photographs which were taken of it in 1856, as well as comparison with other trees of the same species in Teneriffe, and with reminiscences during many years of allied kinds in the equally luminous atmosphere and high radiation influences of the N.W. of the Cape colony, I am inclined to describe its characteristic figure, when freed from the effects of accident and violence to be,—

1*st*, Trunk, pyramidal, hollow, vertically, and widely fissured; deeply corrugated longitudinally, corrugations dividing as they descend. (See Fig. 1, approximate only.)

2*d*, Branches rising upwards at an acute angle; forking and reforking at slightly increasing angles, and entirely naked of leaves except at the extremities of each long, stout, snake-like arm. (Fig. 2.)

Fig. 1.



3*d*, The leaves form at the end of each branch a short head of stiff, upward - radiating, sedge - shaped leaves, and appear in the photographs, on days so windy that other trees were all blurred, both their leaves and branches, like

* See Admiralty Report on "Teneriffe Astronomical Experiment of 1856."

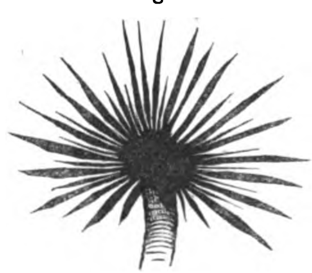
military star-ornaments formed of bayonets, or straight sword-blades, well defined and sharp. (Fig. 3.)

Fig. 2.

4*th*, The ultimate branches, or from the leaves down to the first forking, are thick and sturdy, remarkably smooth; or, if marked, only by transverse wrinkles, the base of old foot-stalks; but at the forking there hang a few half-dry radicles (much like those seen on the sugar-cane in the palm-house at the Edinburgh Botanic Garden), and below that point begin longitudinal corrugations, which are carried on through all the lower branchings down to the trunk, where they join the similar corrugations already described. (Fig. 2, approximate.)

Let us next consider the stages through which the tree must have passed in the process of acquiring these characteristics; such an inquiry being rendered easy by the photographs which I now produce (some of them being already published in my small work, "Teneriffe, an Astronomer's Experiment").

Fig. 3.



About five years after its production from seed, a *Dracæna* must be like our fig. 3, if we suppose the level of the ground where the stalk terminates. Twenty years later it has still the same head, the same thickness, but so much more length of stem as to have reached the level of the contraction in the pyramidal trunk of the old tree. (See "*a*" in fig. 1). Then begin the changes in the *Dracæna's* endogenous and palm-like nature. It flowers (or is said to flower, for I have not seen that), branches spring out, and the stem below thickens and corrugates longitudinally. These branches, at intervals of many years, are again said to flower, and again they divide, always becoming corrugated longitudinally below the fork; and the central stem, or trunk, still increasing in diameter, especially towards its base; where at length ragged apertures appear, showing the interior to be hollow.

The simple explanation of all these appearances, as it occurred to me on the ground, was, that when the twenty-year old tree flowers and produces branches, these are essentially young trees, or viviparous offspring, as sometimes seen, but less successful in result, with the American aloe; and endued with a certain parasitical power, which enables them to strike root as freely into their parent's bark, and through it to work their way down to the ground, as their parent did into the earth itself. The soft succulent nature of the *Dracæna's* stem, with its power of reforming an external bark, may much conduce to this result; the end of which is, that the parent, completely enclosed by the inosculating roots of its parasitical offspring, dies and decays away in the interior, leaving the family of young trees supported up in the air by the hollow-cylinder of their own coalescing roots; just as, *mutatis mutandis*, a small *Pandanus* in the Botanic Garden, with its original stem severed and cut away, is supported up in the air, entirely and most visibly by aërial roots previously sent down from the branches.

At every fresh branching of the *Dracæna* then, we may conclude one family of the tree to have died, and to be replaced by another generation growing on the summits of the preceding ones, and sending down their roots through the bark of all the others and the original stem, to the ground.

In the *Pandanus*, or in the *Banian*, where the descending aërial roots come out from stem or branches as visible, separate, stick-like forms, and even in the acrogenous tree-ferns, where the similar roots, though closely embracing the stem, are as distinct from it and each other as ivy branches from the side of a house to which they cling, there is no uncertainty in the mind of any one. With the *Dragon-tree*, however, the similar case that obtains is not so immediately apparent; but on attentive examination of all the circumstances of the classic Orotava specimen, (whose illustrations are so intensified by their long ages of duration), such as the actual rootlets at the base of the last branchings, the longitudinal corrugations beginning below them, the tendency of the trunk both to separate and split up into forms with vertical rounded edges, as well as to expand its circle below (as roots do when trying to keep pace with the expansion of branches above), and finally, the remarkable filling up and rounding off of the lower angle of branch and stem with increase of age—all these circumstances tend to indicate the apparent trunk to be merely a collection of descending roots; varied, however, from other trunks, in the manner in which nature so loves to vary, that it forms at last another distinct step, as much beyond the *Tree-fern* as that is beyond the *Pandanus* in the scale of approach in the external figure of their stems to the stem of a standard dicotyledonous tree.

Hence we have, in the so-called trunk and branches of *Dracæna Draco* (monocotyledonous), the radicular and vertical formation theory of Petit Thouars and Gaudichaud, producing a horizontal growth or increase, without any necessity for referring to the horizontal theory of Duhamel, Mirbel, and Trecul. There is not, indeed, much appearance of Gaudichaud's extreme notion of the whole stem being made up of phytons placed one over the other, and of roots descending from every leaf-base; on the contrary, we see a marked confinement of the roots to the lower end of the stem, and of the leaves—the fresh ones at least—to the upper end; in so far rather confirming Mirbel's view of there being no early connection between the leaves and roots of a *Date-palm*.

The tissue, however, capable of giving off roots, may extend the whole way between the green leaves and the roots; and though generally in a dormant condition, may be called into activity by such experiments as those of M. Hetet's on a Yucca at Toulon, or more simply by the operation of planting a stem cut off in its middle—*i.e.*, half-way between roots and leaves. This experiment I have actually tried, though not intentionally; for, having brought home in 1856 a broken branch of *Dracæna Draco*, and presented it to the late Lord Murray, he confided it to the care of Mr M'Nab at the Botanic Garden, under whose skilful cultivation it not only lived, but produced new leaves during more than a year; and although since very much decayed, it is not yet quite dead, after two and a half years' severance from its parent tree; and on examination has been found to have formed several roots.

So, far, then, on the strength, chiefly, of what I have observed myself. But how does that accord with the testimony of other and older observers. Amongst them, as every one knows, there is an engraving of the celebrated tree of Orotava, deemed for more than half a century of unimpeachable accuracy, and extensively copied in our own as well as other countries—viz., the view in the "Atlas Pittoresque" of Baron Von Humboldt. How does that plate agree with the principles maintained in this paper? Very imperfectly, I am sorry to say, for there is hardly anything there given of those features which I have described as essentially characteristic; and in a new edition of MacGillivray's abstract of the great traveller's works, published in this city in 1857, or after I had brought home my photographs, and exhibited them in public in 1856 and 1857, the editors have preferred to abide by the Aberdeen professor's copy from Humboldt in the first edition, although it deviates further still from the real tree, as well as from my accounts and measures.

Let not this, however, immediately decide the question, for Humboldt's written description differs considerably from the drawing he has published; and this, though going by his name, was not executed by himself, nor by any one who had ever seen the object in question, but by a Parisian artist employed to copy a sketch of M. Ozone's, a companion of De Borda, who had visited Teneriffe about twenty years before Humboldt, and made the original drawing from nature. Now this original, according to a copy recently obtained by my father (Admiral Smyth) from the French Hydrographic Office, started with a large amount of prejudice in favour of European types of trees, which was increased by Humboldt's artist, M. Marchais, and unconsciously carried further still by MacGillivray. So that over and above the size being enlarged to at least double the real measure, the trunk is made solid in place of hollow, cylindrical instead of pyramidal, and is unmarked, together with its branches, by the longitudinal corrugations; the abortive radicles nowhere appear; and the foliage is altered from its really scanty terminal tufts to the rich umbrageous appearance of a many-leaved *dicotyledonous* tree, such as an oak or an elm.

On comparing this drawing with my Teneriffe photographs, the editors of the MacGillivray edition must surely have assumed that I had put up the camera before an altogether erroneous tree; though it is rather surprising that botanical theory should not have taught them, as well as the public, the impossibility of the long approved representation in their woodcut being correct, for its deviations from nature and *Dracæna* growth are so very glaring. Amongst better botanists, however, some suspicions had here and there begun to be entertained; and I am happy to record that, before I went out to Teneriffe, Professor Balfour, when having a class diagram painted from Humboldt's tree, instructed his artist how to modify the foliage so as to make it true to what he knew a *Dracæna* must more nearly be. More lately, too, Dr Greville, in another class diagram which rises to the scenic effect of an artistical picture, as well as in a plate for a proposed publication—whose appearance is immensely to be desired for the new illumination it will throw on certain forms of natural beauty —"The Scenery of Plants," has profited largely from theoretical deductions, assisted by the photographs above mentioned; and has, without any immediate communication with me, considerably approximated, or rather attained, independently to the principles I have been endeavouring to establish.

A more extraneous proof, however, is found in the fine lithographs of Barker-Webb, and Berthelot's large work on the Canaries, published about twenty years ago in Paris, and presenting us with several portraits of Dragon-trees of various sizes, taken direct from nature.

Indeed, I might rest the case here, had not a more remarkable, as well as unexpected, confirmation still appeared in Germany this very year, where Dr Herman Schacht, a name well known to botanical science, has published an interesting work on the plants of Madeira and Teneriffe. This latter island he visited in 1857, or but a few months after I was there; though, too, he saw the same residents with whom I had had the pleasure of conversing in Santa Cruz and Orotava, and though he has published a year and a half after the exposition of my papers before the Royal Society of London, and a year after the appearance of my popular book on Teneriffe with its stereo-photographical illustrations, yet as he does not seem to have heard anything either of myself or my labours, his testimony may be regarded in so far, as perfectly independent and unexceptional.

How, then, does Dr Schacht represent the Great Dragon Tree of Orotava, for of course in a botanical work on Teneriffe it is figured, and, indeed, made a great deal of, forming, as it does, the decoration of the outside of the volume, as well as one of the plates?

The answer is, that Dr Schacht shows the pyramidal form of the trunk as markedly as I could desire; he also represents its hollowness; the long uprearing of its branches, longitudinally corrugated (one of them) below, capped at their extremities by tufts of sedge-shaped leaves, and with something like indications of the abortive rootlets at the latest forkings.

All this is very satisfactory, indeed it could hardly be more so, thus far; but beyond it there is a certain drawback which cannot be overlooked—a something like that "not pleasant result in the after-taste," which the Doctor describes as existing in the soft, succulent fruit-flesh of the vermilion-"red glistening berries of the Dracæna," and which demands notice all the more because the great mass of the book is so sterling and trustworthy. We see there, indeed, the able botanist of the modern school most evidently, in his descriptions and drawings of sections of stems, leaf-buds, flowers, seed-vessels, &c.; while his skill in the mechanical handling of the pencil is fully equalled by his rare knowledge of some of the recondite laws of *composition* in form, and light, and shade, in landscape pictures. His language, too, is eloquent; but unfortunately what he has observed with his own eyes (in such case always with eminent ability and charming earnestness), is often blended on, apparently without distinction, to what he has heard from nameless informants, making his book very dangerous ground for his reader to tread without the exercise of extreme caution, and sometimes of minute criticism.

His description, already mentioned, of the fruit of the Dragon-tree is one of these cases; for he has not only *not* seen it himself, but says that the *Dracæna* generally blossoms so rarely that many natives of Teneriffe have never seen either flower or fruit, and that the old Dragon-tree has not flowered for many years. This is a strange *pendant* to Humboldt's account in his "Personal Narrative," p. 118 of the original French edition, viz., that the old tree produces flowers and fruit *every year;* but as the great Prussian was only once in Teneriffe, and then only for four days, he could not have made the statement upon his own observation.

Putting this question, however, for the present on one side, for some future author with more time at his disposal, and larger local experience, to clear up, we are inclined to express some surprise at Dr Schacht not having measured the trunk of the tree, and being content, instead, to give a communicated result many years old, and very discrepant from what now obtains. In the absence, too, of any positive information from himself, we may even venture to infer that his drawing of the tree was not from the life. This is indicated by certain internal evidences; such as, 1*st*, The disproportion between the size of, or space filled by, branches and trunk (viz. two to three in his drawings, five to two in a photograph from the same point of view), for it is an error such as so good a botanist and draughtsman as himself would never have committed with the real object before him; and,

2*d*, He himself drawing from nature would not have represented the withered rootlets or the branches like tufts of well-shaped leaves, nor would he have misinterpreted the sky seen through the hollow of the tree. But as these faults do appear in his plate, the conclusion follows that he must have copied, modifying as he went on, some one else's imperfect and ill-understood design; not a photograph certainly, or fault No. 1 would not have been incurred, though 2 and 3 might have been; and I even think to have seen in Orotava a large water-colour painting by a resident lady artist, which must have been the prototype of Dr Schacht's published wood-cut.

We may further remark, if, for sake of trying to clear up the tangled difficulties into which our subject has been thrown by want of precision in previous authors, we may be allowed a little license in friendly and well-intentioned criticism, that this woodcut of the Doctor's, equally with Ozone's sketch, can never have been intended by its scientific author for a portrait of the vegetable patriarch actually as it stands, or as it stood before him; for all surrounding trees and shrubs are utterly eliminated, especially a large laurel in actual contact with the tree. And whereas in the line of copies that have descended from Ozone's drawing, we see the accumulating effect of prejudice in favour of European types of plants; so in Dr Schacht we have the curiously diverse prejudices of the hot-house, and the style of plants which grow therein.

The effects of this misapplied knowledge of exotics is chiefly seen in the two young *Dragon-trees*, situated on either side of Dr Schacht's old one, in strange resemblance to Dr Greville's drawing; strange, because there are none such in the neighbourhood of the real tree, and they must therefore have been introduced first by Dr Greville and then by Dr Schacht to illustrate phases of *Dracæna* growth. But how has the latter prevented the natural characteristics? The branches of his young tree "that has three times flowered" are not *Dracæna* branches at all, but are modelled on the disjointed lobe-shaped leaves of the cactus; and they are mounted up so high in the air on a tall *Dracæna* stem, that they would inevitably soon be broken off by the trade-wind, so constant in those latitudes. Mechanically as well as æsthetically, these branches are distressing to look at, for they are not at all adapted to their terrestrial existence; and such an error is all the more inexcusable to be committed on this tree, whose symmetry in its limb-shaped branches is something perfectly captivating, as well on artistic grounds as on the admirable evidence of all wise design which they abundantly exhibit.

On barren lava rock, and other untoward sites, a young *Dragon-tree* might be contorted in a variety of ways; but such a specimen is no more to be taken as typical of *Dracæna Draco* growth, than a hunchback cripple of the Caucasian race. To ascertain the pure type, unalloyed by any adventitious circumstances, is a worthy problem to occupy some future traveller, and is only to be arrived at by collecting and collating numerous examples. An approach to it, however, may be seen in Plate, No. 16 of my "Teneriffe," where the orange trees and Indian corn in the foreground answer for the fertility of the soil; and where the *Dracænas* rise stately in curves of matchless sweep, and lift their white and delicately rounded, yet strong-limbed arms to the sky, in sculpturesque forms of beauty unknown amongst all other trees of the present day.

Strangely then, indeed, has Dr Schacht erred in his figure of the young branched *Dracæna*, and equally has he with the unbranched one; for while such an ungainly bulbous-topped pole as its stem is extremely improbable to have been produced in Teneriffe, the flattened head of depending leaves is quite impossible to have been met with there, though something of the sort may be found not unfrequently in sickly specimens growing with feebleness in our too dark and damp hothouses at home.

One general and inevitable result of these examinations and comparisons is evidently, the importance of a passing traveller in a foreign land, employing photography whenever a drawing is wanted, if the subject admits at all of being so treated; and coincidently with that, the peculiar advantage for scientific men at home, of being enabled on a disputed point to refer from conflicting artists to any sort of photograph, even one of very indifferent execution, rather than to another artist still.

Under these circumstances I have great pleasure in being enabled to append to this account a "photoglyph" kindly prepared, at Professor Balfour's request, by Mr Fox Talbot himself, from one of my Teneriffe photographs of 1856. (Plate VI.) It represents two young Dragon-trees, of fair normal figure; and may enable the reader to realize much that I have attempted to say of the charming contour of their limbs, and of their general physiognomy, so strikingly different to the trees of our own part of the world.

Dr Fayrer exhibited a hyacinth which had flowered in an inverted position, with the root at the top of a glass bottle, and the flower in the water. He described the mode of growing such specimens as follows:—"When the bulbs begin to shoot, place the root head downwards in a hyacinth-glass full of water, only letting the root touch the water, place the glass in a dark closet until the leaves get two inches long, and then place them in a sunny place to flower.

The flower will be of the same colour in the water as if grown at the top of it. The flowers are the same time in growing in the water as they would be if placed either on the surface or in earth. The water must not be changed; simply fill up the glass as the water diminishes. The bulbs should be placed in water in November. There is also a very curious way of growing hyacinths. It is by placing two bulbs of the same colour together, root to root, the under one in water; place wet moss round both bulbs so as to conceal entirely the upper one; they will flower at the same time—the one in the water, the other at the top. I have often seen them so grown in Switzerland; the moist moss is quite sufficient to nourish the bulbs."

Mr Sadler stated that he examined the stomata of the leaves of the hyacinth grown under water, and found them in no way differing—either in form or number—from those in the leaves of hyacinths grown in the open air.

14th April 1859.—Andrew Murray, President, in the Chair.

The following Candidate was balloted for and duly elected:—

James G. Reid, Esq.

Professor Balfour announced the following donations to the Museum at the Botanic Garden:—

From Sir William Jardine, Bart.—Transverse and longitudinal sections of the stem of *Alnus Canadensis*, grown at Jardine Hall.

Dr Cleghorn, Madras—Pods of *Dolichos* and of *Bignonia*, stem of *Bauhinia scandens* and *Mahonia Leschenaultii*, &c.

J. B. Booth, Esq.—Cones of *Abies Mertensiana*, *Pinus grandis*, *P. Menziesii*, and specimens with fruit of *Thuja gigantea*.

Ralph Carr, Esq.—Transverse section of the Douglas Pine (*Abies Douglasii*).

Messrs P. Lawson and Son—Cones of *Abies Williamsoni*.

Mr William Milne—Fruit and leaf of *Banksia grandis*, fruit of *Banksia occidentalis*, and of another species from King George's Sound; resin of *Dammara obtusa* from the New Hebrides; Cowdie or Kaurie resin of *Dammara Australis*, from Auckland, New Zealand.

The following Communications were read:—

I. *On some of the Plants used for Food by the Feejee Islanders.* By Mr William Milne, late Botanical Collector in Captain Denham's Expedition to the South Seas.

The inhabitants of the Feejee Islands subsist mainly on the fruits of the earth. The principal articles of food are yams, taro, breadfruit, and bananas. Of yams there are upwards of fifty varieties in the islands. These grow sometimes to an enormous size, being occasionally 50 lbs. to 80 lbs. in weight; their general average, however, is from 2 lbs. to 8 lbs. They will keep for eight or ten months after being dug. The planting season extends from June to September, and the yams reach maturity in March, and are dug in April. On the west coast of Naviti Levu two crops are secured—one in November, and another in March. The natives prepare the ground for cultivation by cutting down the natural vegetation, allowing it to dry, then burning it, and using the ashes as manure. They dig the ground with sticks about six feet long, sharpened at the end. The smallest yams are used for planting, and sometimes the large ones are cut up like potatoes, and the pieces planted separately. When the yams begin to sprout, sticks and reeds are placed in the earth, and a rude frame is formed on which the twining stems of the yams can support themselves. When the yams are ripe they are dug up and stored like potatoes. They are cooked either by boiling, baking, or roasting. The boiling is conducted in pottery-ware of native manufacture, and is superintended by the women; baking is the work of the men. A large hole from 9 to 18 feet in circumference, and 2 to 3 feet deep, forms the oven. This is filled with firewood, on which stones are laid. When these are thoroughly heated the oven is cleaned out, the stones being placed at the bottom and covered with leaves; the walls of the pit are lined with the same material; the yams, after being scraped, are laid on the stones and covered with several layers of leaves; and, finally, the oven is covered with a mound of earth. The yam, as well as other food, is served on wooden trays, which are covered with leaves. Another article of Feejeean food is the *Ndalo* or *Taro*, the root or rhizome of *Colocasia macrorhiza.* The principal crops are raised from November to April. The average weight of the root is 2 lbs. There are two varieties, called land ndalo and water ndalo; the latter is that which is most generally grown. It requires irrigation, and valleys are selected for its cultivation through which a stream of water flows. The stalks and leaves of the plant are acrid, but in the young state they are used after preparation as articles of diet, either like spinach or in soup. The root is employed for making the mindrai or native bread. It contains much starch. The banana yields abundance of fruit from November till March. There are numerous varieties of it. The plant takes twelve months to arrive at maturity and bear fruit. The unripe bananas are boiled and baked, and the ripe ones are used as dessert. Sometimes they are made into puddings or bread. The *Musa Cavendishii*, or Chinese banana, has been introduced, and it bears abundance of fruit. The breadfruit tree (*Artocarpus incisa*) is another vegetable production of the Feejee Islands; it grows in abundance on the coast. The sweet potato or *Kumera* (*Convolvulus Batatas*) is also cultivated, and some other species of convolvulus. The *Kawai*, or sweet yam, is another edible root. The root of the Ki, or *Dracæna terminalis*, also yields food. It weighs from 10 lbs. to 40 lbs. Sugar-cane is eaten by the natives. The coco-nut is also employed as an article of diet, especially in times of scarcity. Among other fruits of these islands are *Tarawan*, a kind of plum; *Kavika*, or the Malay apple (*Eugenia Malaccensis*); and the *Ivi*, a kind of hog-plum (*Spondias dulcis*). The rhizome of *Tacca pinnatifida* yields a large quantity of starch, and is used as food after the acrid matter of the root has been removed by washing. The root or rhizome is grated, and, after being steeped, is made into a kind of jelly, which is sweetened with the juice of the sugar-cane. From October to December there is sometimes a scarcity of food. The chief causes of want of food are improvidence on the part of the natives, war, and occasional failure of crops. Native bread is prepared from the taro, banana, kawai, breadfruit, and Tahitian chestnut. The roots and unripe fruit are scraped and bruised in pits thickly lined with banana leaves. These are covered over and left to ferment. The bread thus prepared may be kept for a long time. The material is taken out of the pit when wanted and made into cakes, which are wrapped in leaves, and then either boiled or baked. In general it may be said that the food of the Feejeeans during January consists of ndalo or taro and bananas; February, ndalo; March to September, yams and ndalo; October, breadfruit; November and December, ndalo and bananas. A great improvement has taken place in the habits of the natives since the introduction of Christianity.

II. *Extracts from Correspondence between Dr Skene and Linnæus and John Ellis, about the year* 1765. Contributed by Mr Thomson of Banchory, and communicated by Professor Balfour.

Letter from Linnæus *to* Dr David Skene, *21st January* 1766.

(Original sealed with coat of arms bearing twigs of *Linnæa borealis*, as ornaments outside shield.)

Lætor magnopere quod tu, tamquam lucens Sidus, ortus sis in boreali Britannia, ubi nullum præter te curiosum novi.

Ad dubia a te, vir Clarissime, mota de natura zoophytorum non lubenter respondeo; lego cum oblectamento aliorum sententias nec eas refello; dico tantum quæ mihi visa sunt; forte non semper tutissima; nec alios obstringo in meam sententiam.

Quænam est differentia inter vegetabilia et animalia? Anne sedes vitæ in medullari substantia? An plantæ sensû omni destituantur non dixi; nervos destitui, quibus motum voluntarium perficiunt, credo.

Fuci radicantur quasi in lapidibus, sed nutrimentum hauriunt non basi, sed per poros totius corporis. Isides et Gorgoniæ caulescunt ramis; hi rami, transversim dissecti, ostendunt corticem, ligneam (aut in quibusdam corneam substantiam ut in nonnullis) substantiam, annulis concentricis, annuis, et intra hanc substantiam medullarem.

Tænia inter utrunque articulum includit animalculum propria cute vestitum.

Sertulariæ videntur Tæniæ fixæ, in quibus infimi articuli, antea animati exaruere in substantiam fruticuli. Anne poteris cum tua sententia conciliare Ellisii. Tab. V. *a*, *b*. Tab. VIII, Tab. IX. *n*. 17. Tab. XII. *n*. 19, 18. Tab. XIII. *a*. Tab. XVIII. *a*. Tab. XX. *a*, *b*. Tab. XXVII. *n*. 1.

Embryo humanus haurit succum ex placenta uterina ex utero matris et etiam ore, ut pullus in ovo gallino. Flosculos in zoophytis esse animatos, a motu spontaneo, et quod centro cibum ingerant, dubium esse nequit; quod hi flosculi in variis transeant in capsulas seminiferas, ut in plantis, docent plurima mea specimina ut in Ellisii, Tab. VII. b.

Sed his sepositis a te lubenter auderem tuam propriam de Spongia sententiam; in aqua dulci obtinui pulchram speciem globis cæruleis, quæ nulla ratione fabricant Spongiam.

Si me aliquibus Sertulariis rarioribus aliisve bene non graveris, ea servabo in tui memoriam; cum nave dirigantur Stockholmiam, deponenda in Telonio vectigali, ubi merces exonerantur apud earum rerum inspectorum Malmgren. Si vero mi literis tuis honorare velis, inscribantur Societati Regiæ Scientiarum Upsaliæ cujus societatis literas omnes ego aperio. Coluber tuus indigenus Angliæ 163–77, cum Gronoviano n. 26 perplaceret; potuit enim Gronovii eundem esse cum meo C. lineato, quem et ipse possideo et in musco regio attente vidi et examinavi, nec potest esse eundem.

Nec minus perplaceret descriptio Aranei tui spinis mobilibus, quem non vidi; si descriptionem velis mittere, oro quod brevi mittas, cum nunc sudet 12mo editio Systematis in qua typhographus pervenit ad Anseres,– His vale et vive sospes tui Clarissimi nominis.

Cultor
CAR^{v} LINNE, Equ. aur.

Upsaliæ 1766, ud. 21 Januarii.

Letters from MR ELLIS *to* DR SKENE.

GRAY'S INN, *April* 25, 1765.

SIR,—I received your favour of the 17th of April, inclosing a specimen of your *Sertularia muricata.* It is entirely new to me, and shall certainly have a place in the second volume. I wish you could meet with a specimen more complete, that we might see the denticles; by a broken part of the stem, to which some of them adhere, they appear to be alternately placed. You inquire of me what Linnæus thinks or has written about these beings; for answer, I am persuaded he as yet knows nothing of the matter, for which reason I have told Dr Solander that we must sit down and arrange them properly for him, and distinguish between those parts called by Ray denticles, and what I understand by vesicles, which are properly the ovaries of these animals, the denticles being only the mouths by which they feed. The roots, as they appear, are only the first state of these animals while they are in that creeping form (which I have seen alive as the young animals fall from the vesicles); these fix themselves securely to some fucus, shell, or rock, and, from their radical state, they are empowered by nature to throw out several erect stems furnished with denticles, out of each of which a sucker or polype-like head appears to furnish nourishment for the future growth of the adult age; when this is advanced to a proper size, or perhaps age, the prolific state comes on, and then we find in regular rows (sometimes) the vesicles protruded; at other times I have seen them very irregularly placed, as in the case of your *Sertularia,* which seems to have met with some injury by the violent agitation of the waves. I agree with you that Linnæus does not understand English, and his understanding or not understanding a letter from England depends on his interpreter.

I have lately had a very obliging letter from him, desiring me to give him all the information I can from the kingdom of Neptune, for that he is now publishing his "*Regnum Animale.*" I shall take what pains I can to set him right in things that regard myself, and am in hopes I shall alter his present system of zoophytes for the better. I have this evening received from Mr P. Collinson a very extraordinary sea production; 'tis in the shape of a crucible, hollow within. He told me it was a sea fungus from Norway; 'tis about thirteen inches high, ten inches and a half over the top by nine inches. The inward substance of it is like the crumb-of-bread-sponge, composed of an infinite number of masses of transparent minute spiculæ, with many irregular tubular passages through them ; but all these minute tubular meanders terminate on the surface, which is composed of a cretaceous substance not unlike the *Corallina opuntioles* of Jamaica, and full of minute holes. The more I look into nature, the more I am puzzled; here is now an animal production between a sponge and the corallines.

I thank you heartily for the *Fucus piper.* I had it before in abundance. I collected it at the back of the Isle of Wight, and at Hastings, in Sussex, the last summer ; but your *Baderlocks* I have never seen. It is particularly described in Caspar Bauhin's *Prodromus*, where it is called *Baderlocks.* His description exactly agrees with yours. I would not advise your sending it by sea ; after a ship, it would not answer by any means. If you can get me a small specimen that is nearly the figure of the common large ones, let it be well washed in fresh water and then dried between linen cloths, and afterwards put into a book till it is dry enough to fold up in a letter not exceeding two ounces. When you have afterwards an opportunity to send me some dried specimens by ship from Aberdeen, I shall be glad of them.

Let your specimen of the *Baderlocks* be inclosed to P. C. Webb, and I shall receive it very safely.

Dr Solander has all this day been busy at the museum, showing the Duke of Athol and his family the museum, but is to come and spend a day in order to answer your very proper objections to Linnæus's *Zoophytes.* I shall then look for some specimens of *Sertularias* to send you, which you may expect in a post or two at farthest, as I have got a frank for that purpose. Pray try to get all the varieties you can, and send them inclosed to Mr Webb. I hope our correspondence will turn out to our mutual benefit.

I shall inquire in the city of the traders to your parts for a method of conveying larger bodies than the post can carry.—I am, Sir, your obliged humble servant, JOHN ELLIS.

GRAY'S INN, *Dec.* 31, 1768.

DEAR SIR,—Your kind letter of the 17th inst. has given me great pleasure. I think you have treated Dr Pallas as he deserves, and exposed his quibbles in a masterly manner.

This, certainly, is the proper manner of reasoning with a philosopher who aims rather at perplexing than clearing up the point in dispute. You have beat him out of his subterfuge of QUASI, and reduced his reasoning to an absurdity. I have inclosed you a small piece of the horny part of a Gorgonia, divided lengthways, that you may see the course of the medulla. If you get a small young branch of a lime or elm tree, and cut it in the same manner, you'll soon be convinced of the difference of the medulla in one and the other.

If you make any further observations on his book, I hope you'll be so good as to communicate them to me.

I think you may make out a very good letter on the subject to be communicated to the Royal Society here, directed to me, as observations on Dr

Pallas's "*Elenchus Zoophytorum*," which, I think, would do you honour; and if any figures are wanted, I shall take care to get them done. These hints of yours will likewise help me greatly in my introduction.

I don't know whether you have seen the last vol. of our Transactions; but it was those two letters of mine on this subject that procured me the medal.

I am sorry (as you observe) to see Linnæus still continue his distinction between *Lithophyta* and *Zoophyta*. I never made any, and have wrote to him often on the subject. But, as you observe, I should be sorry that anybody should treat him with severity as Pallas has done.

Pallas has a party in our Society; but believe me, they are greatly mortified at seeing his blunders exposed in my last papers, and will be more so if you send me a letter on the subject, containing the hints you have already sent, and what more you can collect in revising his work.

I shall send you all the characters of the genera of the zoophytes for your observations on them. I will do the best I can; but I am too sensible of my own inabilities in going through a work that requires good health and the vigour of youth, instead of the attempts of one that is past the grand climacteric.

If you want to be more particularly informed in any of the genera of zoophytes, I will explain the matter to you as well as I can. My best wishes attend you.—Dear Sir, your much obliged, obedient, and humble servant. JOHN ELLIS.

III. *Notice of* Ferula (Narthex) Assafœtida (*the Assafœtida plant at present in flower in the Botanic Garden*). By Professor BALFOUR.

This season another of the Assafœtida plants in the Botanic Garden, raised from seeds sent home by Sir John M'Neill and Dr Falconer, has produced a flowering stem.

The specimen was planted out in front of the houses in the Garden about five years ago. It began to show symptoms of developing a flowering stem at the end of February and beginning of March; none of the large radical leaves were produced, but the flowering axis shot up at once from the underground stem. At the time when this took place none of the other specimens in the open ground of the Garden had shown any leaves. Warned by the untimely fate of the plant last year, which was suddenly destroyed by an intense frost on 13th April, when the thermometer fell to 22°, Mr M'Nab secured the present specimen from injury by getting a glazed wooden frame, about 8 feet high, erected around it, and connecting it with the adjoining stove, so that a moderate degree of heat might be supplied in the event of intense frost occurring during night. In this way the plant has been completely protected from the effects both of very high winds and of cold. It has progressed vigorously and rapidly. On the 13th of April its height was 7 feet 8 inches. This height had been reached in about forty-five days. The last 30 inches of growth were accomplished in eleven days—*i. e.*, from 2d to 13th April. The first anther expanded at 11 A.M. on 7th April, and in the course of that day the anthers appeared by hundreds. The plant has flowered well, and promises to bear fruit. At present there are 45 compound umbels on it, some of which are 5 or 6 inches across. The lower leaves on the axis have the characteristic pæony-like form, but they are by no means so large as those produced as radical leaves by the non-flowering plants. These leaves have compound *laminæ* 13 or 14 inches long, borne on evident rounded petioles, which at the base have short sheaths nearly surrounding the whole stem. The four lowest leaves do not bear umbels in the axil; all the rest do. In proceeding upwards the laminæ diminish in size, while the sheathing part of the petiole, or the pericladium, increases—the laminæ becoming 3½ or 4 inches long, the sheaths 7 to 9 inches by 8 inches in breadth. The laminæ in the upper leaves disappear, and the sheathing petiole alone is produced. Finally, near the top the sheaths are reduced to abortive membranous scales about 1 inch in length, and at last they disappear entirely when we reach the umbels at the summit. From the axil of the sheathing petiole umbels are developed, those produced from the sheaths, from the 7th to the 20th in ascending the stem, being the largest. The peduncles of these compound umbels are 10–12 inches long, and the radii from 2–2½ inches, bearing perfect flowers. There are several sterile umbels showing stamens only, and no appearance of fruit. These are borne on long stalks, and have a more or less globular appearance. Small bractlets are seen on the peduncles of the general umbels, chiefly at the base of the abortive ones. These bractlets do not occur among the upper umbels. The odour of the flowers when expanded is of a sweetish honey-like nature, resembling that of *Galium verum*. From the whole plant, especially when bruised, there exhales a strong assafœtida odour. It yields a milky juice which, when allowed to flow, concretes in clear tears on the stem, and has a very strong fœtid and enduring odour. The umbels come off from the axis alternately, but towards the middle and upper part of the axis they have a somewhat verticillate aspect. Another plant which was transplanted last spring, and is now in the open ground behind the pits, has just shown symptoms of flowering. It has begun to send up five flowering stems. The plant of last year which flowered, but was destroyed by frost before it fruited, died down, but the stem has sent out small lateral leaves within the last few days. It has not therefore died away after flowering, as is said to be the case in general. This occurrence may have depended on its being killed last year before it had gone through all its phases of flowering and fruiting.

The following note was read from A. G. Speirs, Esq. of Culcreuch:—"The enclosed I took off a *Cryptomeria Lobbii;* they appear to be attempts to form cones, and I have not heard of that tree seeding in this country. I presume the *C. Goveniana* has borne seeds with you, as it has done so several years here. The cones on my *Cedrus Deodara* fell off with frost in November last; none of my pines have suffered last winter; even the *Pinus Royliana*, which began to grow last autumn, is still pushing its new growth."

Dr Balfour noticed the flowering of *Rhododendron Falconeri* in Professor Syme's garden at Millbank. The plant has produced 28 flowers, which are of a white colour, and are beautifully marked with a purple spot inside.

Mr J. B. Booth exhibited specimens of a *Thuja*, which he had received from British Columbia, under the name of *Thuja gigantea*, but supposed to be the true *Thuja Menziesii* of Douglas. The specimens were taken from a tree 200 feet in height, and from 4 to 6 feet in diameter.

Mr Murray exhibited specimens of *Spraguea umbellata* from California.

Mr M'Nab laid on the table specimens of the common hawthorn (*Cratægus oxyacantha*) having the leaves of 1858 still green upon it, as well as the mature leaves of 1859, with blossoms fully developed. He likewise laid on the table specimens of *Cratægus heterophylla* in full leaf, with flower buds far advanced. The branches also contained a considerable quantity of the ripe fruit of last season.

12*th May* 1859.—Professor BALFOUR, Vice-President, in the Chair.

The following donations to the Museum were announced:—

From Mr M'Nab—Portraits of Allan Cunningham and Daniel Ellis. These were directed to be framed and hung up with the other botanical portraits belonging to the Society.

Dr Harvey—Portion of a tree, in the hollow trunk of which a sermon was preached to thirty persons; also roots of a tree which were produced at a considerable height from the ground inside its hollow stem.

The following letter to Dr Balfour, from Mr Isaac Anderson, was read:—

" MARYFIELD, EDINBURGH, *May* 12, 1859.

" MY DEAR SIR,—As you expressed a desire to know the real facts as to the destruction of the city of Quito—reported in the newspapers to have been almost entire—and how it affected our excellent friend, Professor Jameson, of the University there, I have great pleasure in sending the Doctor's letter to me, dated the 23d March, the day after the earthquake, from which you will be glad to hear that not only is he unscathed in person, but also little injured in his property. And as he mentions that comparatively *few lives were lost*, the newspaper account of 5000 of the inhabitants having been killed must be a myth. From Doctor Jameson, however, saying that this earthquake has been the most severe he ever experienced, it must have indeed been an appalling one; for he has resided now thirty years continuously in that volcanic region, where these things are of frequent occurrence.

" You will observe that I am still receiving seeds of alpines, &c., from that interesting locality, some of which I will have great pleasure in sending for the inspection of the members of the Botanical Society, as they come into flower. With this I send a Berberis, set with flowers, but not yet opened. I also send a Vaccinium with some of the spikes thickly set with pretty roseate blooms. It grows at 10,000 to 11,000 feet of elevation on the Andes, and bears eatable fruit.

" What, perhaps, will be most interesting to your Society will be such alpines as the Gentian, Swertia, Silene, Castilleja, Potentilla, Œnothera, Gaultheria, &c., of which I have had various species sent me, now coming forward.—I am, very faithfully yours,

" ISAAC ANDERSON."

The following is an extract from Professor Jameson's letter above referred to, dated 23d March 1859:—

"Since yesterday morning we have been dreadfully alarmed by a violent shock of an earthquake, which has overthrown and ruined many of the public buildings, and damaged more or less *all* the houses of private individuals. The churches have suffered most, but fortunately *few* lives were lost. The earthquake (the most severe I ever experienced) commenced yesterday morning at half-past eight, and lasted about a minute. I had just reached my house, and had barely time to station myself in the centre of the courtyard. The movement of the ground resembled a succession of waves, and I found it impossible to remove from the spot I occupied. My house has suffered no further damage than several cracks in the walls, and having the tiles that covered it completely jumbled together, and a number of them thrown down and broken. I am at this moment occupied in superintending repairs. Many of the inhabitants have left the city, and are living in the suburbs. We are still ignorant of what may have occurred in the other towns and villages. In addition to our calamities, the port of Guayaquil is still closely blockaded by the Peruvian squadron."

There was presented from Robert Daw, Esq., Plymouth, a specimen of coniferous wood, with the following note:—"A ship from Puget Sound, lying to the north of Vancouver's Island, having not long since put into this port, for Liverpool, with timber, I have been able to procure some small pieces from a log of 200 *annual rings*. It appears to me to be peculiar, and similar to some which Dr Lawson, if I recollect right, procured from a Californian box." The wood displays in a beautiful manner punctated tissue with spiral fibres.

The following Communications were read:—

I. *Notes on a Visit to Algeria.* By George S. Lawson, Esq.

After a tour through France and Italy, I was agreeably surprised with the appearance of Algiers—beautifully situated and prettily built, the white houses imparting a gaiety to it under the darkest cloud, and making it brilliant as polished marble beneath the rays of an almost tropical sun. Luxuriant vegetation meets you on every side when you leave the city walls, and you may imagine yourself in the tropics from the agaves and cactuses which line the roads—the flowering stems of the former being from 20 to 30 feet high. About three miles from the city you come upon the Jardin d'Essai, close to which is the Café Hammah, or café of the plantain trees, where your cup of coffee and pipe are completely *à l'Arab*, and by no means the less enjoyable; the garden is supported by the government, and indeed receives the name of "Pépinière centrale du gouvernement," from its forming a nursery for the cultivation and the supply of plants suited to the country; and it is a wise provision of the government which has a similar institution, on a smaller scale, in nearly every town. I saw an interesting experiment when there, in rearing the cochenille on the *Opuntia cochenillifera;* it was a little protected but perfectly successful. Cotton proved a good introduction, so much so that a building was constructed and fitted up in the ground for its preparation; indigo, also sugar-cane, and the *Sorgum saccharatum*, were quite naturalized. The chief supplies kept for distribution are oranges, olives, apricots, mulberries, pears, almonds, and a few kinds of grapes. If I remember right there were 40 varieties of oranges. Returning from the Jardin d'Essai by the sea, you are surprised to find the date palms by the shore, and growing well, though I do not think they ever ripen fruit there. Of the provinces which constitute Algeria, Algeria proper may be called the most fertile. I did not visit Oran, but made a small excursion to the plain of Metidja and gorge of Chiffa, lying south-westerly from Algiers. A rich calcareous soil, in the environs, supports a most luxuriant forage of leguminous plants, such as *Ornithopus*, *Hedysarum coronarium* and *capitatum*, *Astragalus*, *Medicagos*, and *Scorpiurus*. Once the summit of the chain of hills on which the town is built, which I believe gets the name of the Massiff range, is reached, a view the most enchanting bursts suddenly upon you. A plain 50 miles long and 30 broad forms, from its uniform flatness, one grand billiard-table before you; encircled by the Atlas and Massiff ranges, darting up perpendicularly from the base; and here and there over the plain in the distance, little green patches occur: oases in what you may call a desert, for it is remarkable that the antitheses, barrenness and fertility, are side by side; the former, however, arising solely from a want of drainage and cultivation, and from no inherent paucity of rich elements. Besides a little maize, which is consumed when green, wheat and barley are nearly the only cereals cultivated. *Triticum* *durum* is the favourite with the Arabs, and from it they make their cuscoussoo, which is a coarse kind of flour made by bruising the wheat, which is baked with milk into little round pellets, spices being sometimes added. It is kept for several months sometimes in this condition, and, when wished for consumption, they are fried with butter or fat. The *Hordeum hexastichon* is the variety of barley chiefly grown, but it is only given to horses,—oats I do not believe are known at all. Sowing time is from November to January, the barley harvest coming in May, and the wheat in June. The Arabs in reaping clip only the ears, and leave the straw to be eaten by the cattle, or more frequently to be burnt, the ashes forming manure for the succeeding crop. It was evening before I descended the Massiff range, and it will be long ere I forget the glorious sunset I then witnessed: the whole plain was one mass of gold, the water was in a blaze, and the lofty palms, in clumps, with their reflections, stood erect, and seemed to enjoy the scene with myself; while the deep blue haze in the distant mountains—deeper under an unclouded sky of peculiar brightness—presented a picture difficult to be realized by the most skilful brush, and impossible to be exaggerated. On my way towards Blidah I halted at Bouffarick, a little village from which, as a centre, nineteen small farms radiate. Blidah (another village) possesses orange groves surpassing those of the Governor of Malta; and the fragrance of the trees is at times so powerful as to be almost suffocating. I picked up in the plain some Mignonette, French and African Marigold, several kinds of Orchis (*O. mascula*, *pyramidalis*, and *latifolia*), *Papilionaceæ*, &c. Nearly two-thirds of the plain is monopolized by the dwarf-palm (*Chamærops humilis*),* and though no favourite with the farmer, from its creeping stems and roots having such a firm hold of the soil, it is almost indispensable to the wandering Arab, who makes ropes, sacks, and mattings from its leaves, while the heart and buds form the only food he can rely on in the spring of the year. The most valuable production of this palm, however, is a substance made of its fibres, and which gets the name of "crin

* Dr Greville mentioned at the meeting, that a variety, *Ch. elatior*, was to be seen near Algiers; and I am inclined to think that those clumps I have referred to in the description of the plain were composed of that variety, which I thought at the time were the date-palm.

végétal." It is so very fine that it resembles horse-hair so much, when dyed black, that it can hardly be distinguished from it. I may mention that one of our most eminent paper-makers in this city is now in the habit of importing it as a basis for his manufacture.*

II. *Botanical Intelligence.* By Professor Balfour.

1. *Biographical Sketch of Baron Von Humboldt, one of the Foreign Honorary Members of the Society.*

Frederick Henry Alexander, Baron Von Humboldt, the most learned man of the present age, was born at Berlin on 14th September 1760, and died on 7th May 1859. He lost his father when he was ten years old; his mother was a cousin of the Princess Blucher. From 1787 to 1789 he studied at the Universities of Frankfort-on-the-Oder and Göttingen, when, among others, he had for his teachers Gottlieb Heyne and Blumenbach. During his holidays he made geological excursions in the Harz and on the banks of the Rhine, and wrote a work on the Basalts of the Rhine, which was the first of his publications. He early displayed a taste for travelling. On this subject he says:—"Brought up in a country which has no direct communication with the colonies of the two Indies, an inhabitant of the mountains, removed from the coasts, I felt the progressive development in me of a real passion for the sea and for long voyages. A taste for herborization, the study of geology, a rapid tour made in Holland in spring 1790, in England and in France with a celebrated man, George Forster, who had the good fortune to accompany Captain Cook in his second voyage round the world, contributed to give a determined direction to the plans for travelling which I had formed at the age of 18. It was no longer the desire of agitation and of a wandering life,—it was that of coming into immediate contact with wild nature, majestic and varied in its productions; it was the hope of finding some facts useful to the sciences which made me constantly sigh for an opportunity of visiting those beautiful regions situated in the torrid zone. My circumstances not permitting me to execute then the projects which occupied my mind, I had leisure during six years to prepare myself for the observations which I hoped to make on the new continent."

After his return from his excursion with Forster, Humboldt, destined at first for financial occupations, passed some months in the school of Busch and Ebeling at Hamburg. From June 1791, however, he attended the lectures of the celebrated Werner in the School of Mines at Freiberg, where he enjoyed the friendship of Leopold Van Buch and André de Rio.

* Had I been able to carry away with me some of the books published by the French Government, I could here have given some correct statistical information with regard to the agriculture of the country; and so soon as I can lay my hands on these publications, I shall be happy to continue these notes on a tour fraught with the deepest interest to myself, and, I am sure, to every botanist who may have the good luck to make it.

During his sojourn in Freiberg he devoted attention to the subterranean Flora, and published a work entitled, "Specimen Floræ Subterraneæ Fribergensis," which he dedicated to his master, the celebrated botanist, Willdenow. From 1792 to 1797 he occupied the position of Director-General of the mines of Anspach and Bayreuth. In 1792 the experiment of galvanism attracted his notice, and he wrote a work on the irritability of muscular fibre, &c. He was a fellow-labourer with Schiller in the periodical entitled "The Hours."

In 1796 the death of his mother seems to have excited more fully his desire to travel. He studied astronomy under the Baron Von Zach; and, after some months' sojourn in Jena and Vienna, he started with his friend Von Buch for Italy, with the view of studying the volcanoes. He was, however, prevented by the wars which prevailed at that time from accomplishing his object; and he passed the winter of 1797–98 at Salzburg and Berchtesgaden, devoting his attention to meteorology. He was invited by Lord Bristol to join an expedition which he was about to undertake to the upper parts of Egypt. He accepted the invitation, and repaired to Paris for the purpose of getting the necessary instruments, when he learned at one and the same moment, in May 1798, that Buonaparte had departed for Egypt, and that the Earl of Bristol had been arrested at Milan. He received a hearty welcome in Paris from Laplace and Berthollet, and made the acquaintance of Aimé Bonpland, his future companion in travel. He passed the winter of 1798 99 in Spain with the last-named friend. On 5th June 1799 he embarked with Bonpland in the Spanish frigate Pizzaro, and proceeded to Santa Cruz, which he reached on 19th June. The two friends ascended the Peak of Teneriffe. On 16th July they reached the Port of Cumana in South America, and during eighteen months they were employed in exploring the provinces of the State of Venezuela. In February 1800 they went to Caracas, and visited the country between the Orinoco and the Amazon. He gives a glowing description of this journey in his "Tableaux de la Nature." The basin of the Orinoco was fully explored. He traversed by river navigation 2301 geographical miles, from the Rio Negro, by the Cassiquiare River, to the Orinoco. Humboldt subsequently went to Havannah, and proceeded to Callao and Lima in Peru. At Callao he was enabled to make an important observation relative to the passage of Mercury over the sun's disk.

After two months' navigation on the Magdalena River, he visited the plateau of Bogota. Passing over the cordillera of Quindiu. the volcano of Popayan, the Paramo of Almaguer, the high plateau of Los Pastos, he reached Quito in January 1802. During five months he explored the Valley of Quito, and the chain of volcanoes on the snowy summits of the Andes. He ascended Chimborazo, and reached an elevation higher than had been attained by any one, but was prevented by a crevasse from attaining the summit of the peak.

He descended by Cuença and the Cinchona forests of Loxa to the Valley of the Amazon near Jaen de Bracamoros; then traversing the plateau of Caxamarca, he reached Micuipampe and the western slope of the Cordilleras of Peru. From the Allo de Guangamarca he first had a view of the Pacific Ocean, an event which is graphically detailed in his "Tableaux." On 23d March 1803 Humboldt and his companions arrived at Acapulco, after having touched at Callao and Guayaquil; they then visited the capital of Mexico and the volcano of Sorullo. After ascending the volcano of Toluca, and of Cofre de Perote, he proceeded by the oak forests of Xalapa to Vera Cruz. On 7th March 1804 he quitted the coast of Mexico and sailed for Havannah, where he spent ten months; then he embarked with Bonpland and Montufar for Philadelphia, and received at Washington a hearty welcome from Jefferson. Leaving America on 9th June, he reached Bordeaux on 3d August 1804, after having been absent from Europe for five years.

The results of this tour, so important in a geographical, ethnological, geological, and zoological point of view, have been given in his admirable works,—(1.) "Voyages aux Regions Equinoctiales du Nouveau Continent;" (2.) "Vues des Cordilleres et Monuments des Peuples Indigènes de l'Amerique;" (3.) "Recueil d'Observations de Zoologie et d'Anatomie Comparée;" (4.) "Essai Politique sur Royaume de la Nouvelle Espagne;" (5.) "Recueil d'Observations Astronomiques;" (6.) "Physique Générale et Geologique;" (7.) "Essai sur la Geographie des Plantes."

Humboldt may be said to have been the first who attended to the last-mentioned department of science. It is developed in his "Plantes Equinoctiales;" his "Monograph of Melastomaceæ," &c.; his "Nova Genera et Species;" his "Synopsis of the Plants of the New World," &c. All these works were published by him during his stay in Paris from 1805 to 1827.

During this time he also found leisure to attend to chemistry. He made a tour in Italy with Gay-Lussac and Von Buch, and visited Vesuvius. He accompanied his brother William in his embassy to London in 1811, and undertook several excursions in England and Germany with Arago and Valenciennes.

In 1827 he settled finally in Berlin, and became a friend of the royal family of Prussia, occupying an important position as Counsellor of State.

In 1829 he explored Central Asia with Ehrenberg and Gustavus Rose, under the auspices of the Emperor Nicholas, visiting Moscow, the Ural and Altai Mountains, and the empire of China; also visiting the steppes of Astrakan and the Caspian Sea, travelling more than 2300 geographical miles in the course of nine months. He communicated the principal results of the expedition in his "Asie Central, Recherches sur les Chaines de Montagnes et la Climatologie Comparée." This journey to Asia also enriched his "Ansichten der Natur." In this journey he completely demolished the pretended plateau of Central Asia, which had been believed by all geographers from the time of Marco Polo.

In 1843 he published his "Carte des Chaines des Montagnes et des Volcanes de l'Asie Centrale." In this map he marked the mean direction and heights of the mountains, and represented the interior of the Asiatic continent from 30° to 60° lat., between the meridians of Pekin and Cherson. The Academy of St Petersburg, as the result of this expedition, established, at the suggestion of Humboldt, magnetic and meteorological stations from St Petersburg to Pekin.

After the revolution of 1830, Humboldt was sent by Frederick-William III., as a special ambassador on the part of Prussia, to recognise Louis Philippe. He continued afterwards to pay an annual visit to Paris. His last sojourn in Paris was in 1847-48. In 1841 he went on two occasions to London with Frederick-William IV., and in 1845 he visited Copenhagen.

He who had thus about fifty years before explored the New World, and at the age of sixty visited Central Asia, now commenced, at the age of eighty, to pass in review all the knowledge which had been acquired by man relative to the heavens and the earth, in his immortal work entitled "Cosmos," the first volume of which appeared in April 1845, and the fourth at the beginning of 1858. This work contains an epitome of the physical history of the globe, and is a wonderful monument of the author's powers even at the age of ninety.

A writer in the *Daily News* makes the following remarks regarding him :—"His frame wore wonderfully; and there was no sign of decay of external sense or interior faculty, while younger men were dropping into the grave completely worn out. He was the last of the contemporaries of Goethe; and as the tidings came of the death of each—philosopher, poet, statesman, or soldier—Humboldt raised his head higher, seemed to feel younger, and, as it were, proud of having outlived so many. If silent, he was kind and gentle; if talkative, he would startle his hearers with a story or scene from a Siberian steppe or a Peruvian river-side. fresh and accurate as if witnessed last year. He forgot no names or dates, any more than facts of a more interesting kind. In the street, he was known to every resident of Berlin and Potsdam, and was pointed out to all strangers as he walked, slowly and firmly, with his massive head bent a little forward, and his hand at his back holding a pamphlet. He was fond of the society of young men to the last, and was often found present at their scientific processes and meetings for experiment, and nobody present was more unpretending and gay. He has been charged with putting down all talk but his own; but this was the natural mistake of the empty-minded, who were not qualified either to listen or talk in his presence. There was no better listener than Humboldt in the presence of one who had anything worth hearing to say on any subject whatever.

"It is a great thing for Germany that, at the period when the national intellect seemed in danger of evaporating in dreams and vapours of metaphysics, Humboldt arose to connect the abstract faculty of that national mind with the material on which it ought to be employed. The rise of so great a naturalist and initiator of physical philosophy at the very crisis of the intellectual fortunes of Germany is a blessing of yet unappreciated value; unappreciated, because it is only the completion of any revolution which can reveal the whole prior need of it. If Alexander Humboldt suffered, more or less, from the infection of the national uncertainty of thought and obscurity of expression, he conferred infinitely more than he lost by giving a grasp of reality to the finest minds of his country, and opening a broad new avenue into the realm of nature to be trodden by all people of all times."

Of Humboldt it has been said, that "his canvass was the universe, and he used his pencil with a master's hand. His mind grasped with iron strength everything it met, and instead of being weakened by the immensity it was brought in contact with, its appetite grew with what it fed upon. His merits are of such transcendent quality that praise is out of place. There is not one branch of science to which Humboldt has not contributed something—nay, much. We may say of him what the Tuscans proclaimed on Machiavelli's tomb in Santa Croce, 'Tanto nomini, nullum par elogium.'"

2. *Abstract of Remarks made by M. Charles Martin of Montpellier, on the Vitality of Seeds, particularly when subjected to the Action of Sea-Water.*

In his botanical geography, Decandolle suggests several subjects of investigation for physiological botanists; and among them he reckons the vitality of seeds in sea-water as one of the most important. It has accordingly been taken up by M. Charles Martins of Montpellier, who has given the results of his observations.

It has long been known that seeds are transported by oceanic currents. So far back as 1695, Sloane speaks of extraordinary beans being thrown by the sea on the shores of Scotland and of Ireland, and of which the inhabitants made snuff-boxes. One of the seeds he named *Phaseolus maximus perennis*—which may be recognized as *Mimosa scandens;* the second was *Dolichos urens;* and the third *Guilandina Bonduc.* Sloane accounts for the transport of these seeds by the gulf stream and by westerly winds. Linnæus, in his travels along the northern coasts of Norway, tells us that the inhabitants of these regions found on the shores the seeds of *Cathartocarpus Fistula, Anacardium occidentale, Mimosa scandens,* and *Cocos nucifera.* M. Martins has gathered at North Cape, lat. 71° 12′ N., and long. 23° 30′ E., specimens of the seeds of *Entada Gigalobium* of *DC.*, or *Mimosa scandens, L.* The double coco-nut (*Lodoicea seychellarum*) is carried by a current from Praslin Island to the Maldives. If these currents are to contribute to the dissemination of seeds, it is of course necessary that the seeds should preserve their vitality—*i.e.*, their germinating properties. Few experiments have been made on this subject, which is interesting not merely as regards the distribution of plants at the present epoch, but also as regards the distribution in fossil periods. During the Tertiary and other epochs, it is supposed that there was a vast expanse of the ocean, and that the land consisted of a series of islands or archipelagos in the midst of it. In that case, currents must be reckoned as the chief agents in the dissemination of plants at these periods of the earth's history. If it is shown that currents could not contribute to this diffusion, then we must conclude that species separated by immense extents of ocean have not had a single centre of creation, but numerous centres. A single individual of each species could not be the common stock whence have arisen all the individuals existing on the surface of the earth. On the contrary, a certain number of individuals, specifically identical, must have appeared independently at different points of the globe, very distant from each other.

Necker affirms that the seeds thrown by the gulf stream on the coasts of Scotland do not germinate. Lyell, however, states, on the authority of Brown, that a plant of *Guilandina Bonduc* grew from a seed cast on the west coast of Ireland. Godron maintains that seeds immersed during the whole winter in pools of salt water did not lose their vitality. Martins has seen seeds of *Cassia Fistula* germinate well, after being taken from fragments of the pods which had been thrown by the current on the coasts of Provence and Languedoc. These seeds had been protected by the pericarp, with its separate partitions. Salter also found grains of barley and oats, and seeds of *Lysimachia vulgaris*, *Epilobium hirsutum*, and *Centaurea Calcitrapa*, germinate after long submersion in sea water.* He says,—In the year 1843 the authorities of Poole, in Dorsetshire, determined to deepen the channels of the Poole harbour, to facilitate navigation. For this purpose a large number of ballast lighter barges were employed to scrape the mud from the bottom of the channel, and convey it to the shore, where it was deposited. The mud was collected in such quantity as to form a quay, which, however, was never used, nor was its surface disturbed. In the early spring, abundant vegetation appeared on the quay, the plants being distinct from those of the neighbouring shores. The ordinary vegetation on the shores around was *Statice*, *Salicornia*, *Salsola*, *Atriplex*, *Carices*, *&c.*; whilst in the mud there were *Lysimachia vulgaris*, *Centaurea Calcitrapa*, and *Epilobium hirsutum*. The seeds of these plants, Mr Salter shows, must have been deposited in the mud of the harbour, and most probably have lain there for a long period.

Charles Darwin called attention to the subject in 1856, and along with Berkeley he gave the results of his obser-

* See Linn. Soc. Proc., I., 1856, p. 140.

vations in the "Journal of Proc. of Linn. Soc., I., p. 301," 1856. Darwin put seeds into small bottles filled with artificial sea-water; while Berkeley sent his to Mr Hoffman at Ramsgate, where they were exposed in baskets to the action of sea-water for about a month.

Martins also carried on his experiments in 1856. He chose recent seeds, the germination of which was usually certain. He selected them from the principal natural orders, preferring, however, in general, seeds of large size, provided with a thick episperm, those especially of littoral plants; the former being more likely to resist the action of sea-water on account of their size and the thickness of their envelopes; the second being those which, when stranded on a sandy shore, were the most likely to germinate. M. Martins first determined which of the seeds floated in the sea-water and which of them sank. Of 98 seeds observed, 59 floated and 39 sank. The specific gravity of the water of the Mediterranean, in which the seeds were placed, was found to be 1·0258. The seeds of *Nelumbium*, *Stramonium*, the black walnut, and *Gingko*, were nearly of the same specific gravity as the water. Others, such as the seeds of most of the *Leguminosæ*, some *Cruciferæ*, and some *Monocotyledons*, sank at once. We must not suppose that large seeds are in general specifically heavier than small ones. Thus, while the large seeds of *Juglans nigra*, *Nelumbium*, *Gingko*, and *Mimosa scandens* floated, the small ones of *Brassica hispida*, *Sinapis alba*, *Lithospermum officinale*, *Medicago marina*, *Lotus siliquosus*, and *Plantago Psyllium*, sank very rapidly. The condition of floating in water is most important for the transport of seeds to a great distance. Those of *Mimosa scandens*, *Cassia Fistula*, *Dolichos urens*, *Guilandina Bonduc*, and *Cocos nucifera*, which are found on the western shores of Europe, float. It is probable that the *Cashew*, which has been found on the coasts of Norway, and which sinks in water, is enabled to float at first by means of its fleshy peduncle.

In making experiments on the action of sea-water on seeds, M. Martins prepared a square box of sheet-iron, which was divided into 100 compartments, and the sides perforated with numerous holes to allow the free entrance and exit of water. A species of seed was placed in each compartment, and the box was lashed firmly to a floating buoy. The waves raised and depressed the buoy, so that the seeds were at one time under the surface of the ocean, at another time above it. They were thus exposed to the action of air and water, just as in the case of floating seeds. Each compartment contained at least 20 seeds, except in the case of some of the larger kinds; the seeds were left in the condition in which they usually were when they fell from the plants on which they grew. The box was lashed to the buoy on 14th February 1856, and it remained there till 1st April—*i.e.*, forty-five days. The box was then opened; 41 species of seeds out of the 98 were decayed and were thrown away; the rest were sound. Out of 57 specimens of seeds which appeared unaltered, 35 only germinated; from these 35 we must take away 16, which were specifically heavier than the salt water, and could not swim on the surface. That reduces the number to 19; these were *Asclepias cornuta*, *Asphodelus cerasiferus*, *Beta vulgaris*, *Cakile maritima*, *Cucurbita Pepo*, *Ephedra distachya*, *Eryngium maritimum*, *Euphorbia Paralias*, *Gingko triloba*, *Linum maritimum*, *Nelumbium speciosum*, *Paliurus aculeatus*, *Pancratium maritimum*, *Ricinus africanus*, *R. communis*, *Rumex aquaticus*, *Salsola Kali*, *Scabiosa maritima*, *Xanthium macrocarpum*. Such are the seeds which, when stranded after a voyage of six weeks on the ocean, would be likely to germinate and establish themselves on the shore.

In another experiment, M. Martins took specimens of the 34 seeds which had germinated after exposure of forty-five days to sea-water, and put them into a box as before, leaving them from 17th June till 18th September,—*i.e.*, ninety-three days, or three months. At the end of that time, 11 of the species of seeds had become putrid. The 23 others were sown on 18th Sept., and examined on 29th Sept., 6th, 11th, and 20th October; 14 of the species did not sprout, 9 only germinated. From these 9 we must deduct 2—viz., *Acacia Julibrissin* and *Canna gigantea*—which did not float in sea-water. There thus remained 7 species which had not lost their vitality after floating for three months in the sea,—*i.e.*, only one-fourteenth of the whole number experimented on. We may thence conclude with Alphonse Decandolle that this mode of transport has had but a small share, at the present epoch or in geological epochs, in the diffusion of plants over the surface of the globe.

The number of seeds experimented on by Darwin and Berkeley were 88,—viz., 71 *Dicotyledons* and 17 *Monocotyledons*. Of these 88 species, 13 germinated after being from seven to twenty-two days in salt water, 23 after a month, and 12 after six weeks. Martins finds there are five species of seeds common to his list and to that of Messrs Darwin and Berkeley—viz., *Crambe maritima, Pisum sativum, Ricinus communis, Hordeum vulgare*, and *Zea Mais*. The first germinated after thirty-seven days of immersion in salt water in Britain, while at Montpellier it had lost its vitality after twenty-five days of immersion. Some of the seeds in Darwin's experiment germinated after eleven days. Castor-oil seeds gave the same results in both sets of experiments; resisting the action of sea-water well, germinating after thirty-six days' immersion in Britain and after ninety-three days at Montpellier. Barley germinated after forty-five days' immersion in both countries, but did not bear ninety-three days. Maize did not germinate after a month's immersion in the sea.

In the English experiments, the seeds which bore more than eighty days' immersion were *Rheum Rhaponticum*, 82 days; *Raphanus sativus, Lepidium sativum, Daucus Carota, Lactuca sativa*, and *Phalaris canariensis*, 85 days; *Brassica oleracea, Cucurbita Melopepo, Ageratum mexicanum, Solanum tuberosum, Atriplex hortensis, Beta vulgaris, Avena sativa*, and *Allium Cepa*, 100 days; *Spinacia oleracea*, 120 days; *Apium graveolens* and *Capsicum annuum*, 137 days.

Beta vulgaris was the only one of these seeds used in the Montpellier experiments, and it showed equal vitality.

In examining the results, Martins finds that the seeds of *Polygonaceæ* and *Chenopodiaceæ* seemed to resist best the action of sea-water; next came *Cruciferæ*, then *Gramineæ*, then *Leguminosæ*, and last of all may be reckoned *Ranunculaceæ* and *Malvaceæ*.

M. Martins' conclusions are as follows:—

1. The greater number of seeds float in sea-water; about one-third sink instantly to the bottom.

2. One-third only of the seeds tried germinated after six weeks' immersion, and one-eleventh after three months.

3. Taking only into account the seeds which floated, the number of these which sprouted after six weeks' immersion

was one-fifth of the whole, and after three months one-fourteenth.

4. *Ranunculaceæ*, *Malvaceæ*, *Convolvulaceæ*, seem least capable of resisting the action of sea-water.

5. *Chenopodiaceæ*, *Polygonaceæ*, *Cruciferæ*, *Gramineæ*, and *Leguminosæ* resisted best prolonged immersion in the sea.

6. A hard perisperm and the presence of albumen seem to be favourable for the preservation of seeds.

7. The transport of seeds by currents seems to have had an insignificant share in the diffusion of species over countries separated by the sea; and if we consider the number of disjoined species which could only have been diffused in this way, the idea of numerous specific centres of creation acquires great probability.

III. *On the Flowering of a Variety of* Cratægus Oxyacantha *in the Edinburgh Botanic Garden.* By Mr James M'Nab.

During the past winter my attention was directed to a tree of the double-white flowering *Cratægus Oxyacantha*, which retained most of its leaves in a green state during the whole winter, some of them still remaining on the tree even to this day (12th May 1859). Early in February this tree presented a greenish appearance before all the other thorns, contrasting singularly with the old dark-green leaves. Owing to the comparatively mild weather we were then experiencing, the progress of leaf-development was rapid. On the 14th of April the tree was covered with flower-buds, having blossoms expanded on one small branch. At the present time (May 12) the tree is covered with flowers, but, strange to say, instead of being double, all are single, none of the blooms possessing more than five petals, and having the stamens and pistils perfectly normal. The tree has been grafted, and has been growing in its present situation for upwards of thirty years. It is eighteen feet high, having a circular-shaped head fifty-four feet in circumference, with a stem thirty inches round. This thorn has flowered regularly during the month of June for many years; last year the flowering was particularly abundant, and remained long on the tree. Neither the leaves nor flowers are as large as usual, and the general health of the tree does not seem changed.

9th June 1859.—Andrew Murray, President, in the Chair.

The following donations were presented to the Society's Library:—

From the Royal Dublin Society—Nos. XII. and XIII. of their Journal.

The Linnæan Society—Vols. I., II., and No. 3 of Vol. III., of their Proceedings.

The Smithsonian Institution, Washington—Catalogue of the described Diptera of North America, by R. O. Sacken. Meteorology, in its Connection with Agriculture, by Professor Joseph Henry. Eleventh Annual Report of the Board of Agriculture of the State of Ohio for 1856.

The Lords Commissioners of the Admiralty—"Report on the Teneriffe Astronomical Experiment of 1856, by Professor C. Piazzi Smyth."

Mueller's Fragmenta Phytographiæ Australiæ, Vol. I.—From the Author.

The following donations to the Museum and Herbarium were announced:—

From Mr William Milne—Collection of Dried Specimens from Feejee Islands, King George's Sound, Shark's Bay, &c.

Andrew Murray, Esq.—Collection of Fruits and Seeds from Old Calabar.

H. Scott, Esq.—Specimen of De Vere's Fluid Extract of *Sarza*, also Cotyledon of *Nectandra Puchury* called Sassafras Nut, from the Rio Negro in South America, used in the above extract in order to give flavour and to preserve it.

Mr William Milne—Collection of Woods from the South Sea Islands.

Colonel M'Laverty—Specimen of Bark of a species of *Melaleuca* from New England, and Leaves of *Celmisia coriacea*, used in New South Wales by the natives to ornament their chiefs.

H. L. Beaugeard—Specimen of a kind of Cloth, called Pagne de Madagascar.

Mrs Drummond, Bridge of Earn House—Furniture-print with representations of Ferns.

Archibald Hewan, Esq., surgeon, Old Calabar—Specimens of the Pod and Seeds of the Calabar Poison-bean, and Fruit of (*Elais guineensis*) the Oil-palm of Guinea.

Mr H. Petry—Specimen of Branching Stem of an Ash in which the Branch of a Larch is imbedded. The larch branch appears to have fallen into the axil of the ash branch, and to have ultimately been covered by woody matter.

Mr Laurence Henderson (a young lad for some time employed in the Edinburgh Botanic Garden, and who lately went out to New South Wales)—Collection of Woods, Red and White Gum, Wooden Spear used by the natives, and a very fine Section of the Grass-tree (*Xanthorrhœa arborea*), from New South Wales.

Professor Balfour stated that a large collection of Australian plants had been presented to the University Herbarium by Dr F. Mueller, of Melbourne; and that an addition had been made to the South American Collection by the receipt of specimens from R. Spruce, Esq.

The following communications were read:—

I. *Remarks on the Development of the Seed-vessel of* Caryophyllaceæ. By ALEXANDER DICKSON, Esq. (Plate IV. B.)

The author gave the results of his investigations on the development of the flower, and especially the pistil of *Lychnis dioica*, which may be shortly stated as follows:—

At an early period the rudiment of the flower may be observed to consist of the five sepals (then distinct from each other) surrounding the rounded termination of the floral axis. The five petals next make their appearance, alternating with the sepals. The outer row of five stamens next appear, alternating with the petals; and then the inner whorl of five stamens, alternating with the outer. The limb of the petal is developed first, the claw subsequently. In the "female" plant the stamens do not advance beyond a rudimentary condition.

After the development of the inner staminal whorl, the termination of the flower, hitherto hemispherical, assumes a slightly flattened pentagonal form, by the development on its circumference of five elevations, alternating with the inner staminal rudiments. Shortly after this, a shallow depression is formed internal to each of these elevations, by the growth of the surrounding parts, so that the termination of the flower appears as a pentagonal cushion, having a slight dimple contained in each angle. The young germen is now sketched out. The dimples are the future loculi; they are bounded externally by the five elevations before mentioned, which are now somewhat crescentic, and form the walls of the rudimentary germen; and internally by the slightly rounded centre of the cushion, which afterwards forms the central placenta; laterally, they are separated from each other by the rudimentary septa of the germen. Later, these dimples become deepened by the further development of the parts bounding them, until the germen assumes the form of a five-celled cup, open at the top. The cells, or loculi, are separated from each other by septa extending between the wall of the germen and the young placenta, which forms a central column continuous in direction with the axis of the flower. The free upper margins of the septa and wall of the germen are nearly in the same plane with the upper surface of the central column.

Later, the brim of the germen begins to grow inwards, opposite the five septa; and through the convergence of these points towards the centre, each loculus becomes closed in by the approximation or folding together of the two halves of the margin of its outer wall.

The five styles first appear at the time the capsule begins to close. They are gradually developed prolongations of the outer walls of the loculi, and alternate with the septa; the cells on their internal aspect become subsequently developed in a papillose manner, so as to constitute the stigma.

While the capsule is thus being closed in, the placenta branches above into five portions, which remain in connection with the septa; these branches (which are short) taper off superiorly and are lost in the septa, whose free margins become approximated to each other in the middle line, by the closure of the capsule. There is a somewhat fusiform space left in the middle line, at the upper part of the germen, between the branches of the placenta; and if a cross section of a young capsule be taken at that part, the appearance of a parietal placentation is presented, as in Plate IV. B, fig. 1. In fig. 2 a transverse section of a capsule, taken lower down, is shown.

The ovules are developed in double vertical rows on the central column and its branches, in the internal angles of the loculi; they first make their appearance about the time that the capsule begins to close in; they are developed in order from above downwards, the furthest developed and oldest ovules being at the upper part of the placenta, the youngest at the lower. This remarkable development of ovules in order from above downwards upon central placentas has been shown by M. Payer to occur also in the *Mesembryaceæ*, and some of their allies.*

At a later period in the growth of the capsule, the septa, as is well known, become ruptured, leaving the placenta free in the centre of a one-celled seed-vessel.

In the "male" flower the capsule is wholly absent, the termination of the floral axis being prolonged beyond the inner staminal whorl as a slender style-like body on which some scattered hairs are developed.

The author regretted that he had not been able to prepare a sufficient number of drawings to illustrate the several developmental stages. He hoped, however, at some future time to publish such illustrations with more extended remarks on this subject.

II. *Remarks on some Plants from Old Calabar.* By ANDREW MURRAY, Esq.

Mr Murray, in giving a *résumé* of the different contributions to various branches of Natural History which had been made to himself and others by the United Presbyterian missionaries at Old Calabar, remarked, that the Rev. Mr Hope N. Waddell, the Rev. Mr Goldie, the Rev. Mr Thomson, Mr Hewan, Mr Baillie, and the late Mr Wylie, had all contributed largely to science. It was through them that the interesting electric fish, the *Malapterurus Beninensis*, had been first made known, and subsequently had, on various occasions, been introduced alive into this country. When the first living specimens arrived, Professor Goodsir (to whom they had been sent), with that total abnegation of self and pure devotion to science which so strongly characterizes him, took them to Berlin, to place them at the disposal of Professor Du Bois Raymond, who was engaged upon the third volume of his great work on Electricity, being the volume which related to animal electricity. The value which was attached to this opportunity of studying the phenomena of electricity shown by these animals may be estimated by the fact that after these specimens died (which, whether from over-experimenting, or unsuitable management, soon happened), the Berlin gentleman made interest to get more specimens, but in a way which may be thought illustrative of the difference between the two nations in relation to private enterprise as compared with that of the Crown. They applied to Prince Albert, through the royal family of Prussia. It is unnecessary to say that Prince Albert could do nothing; but what he was unable to do, we were soon enabled to do here by receiving a second consignment, addressed in this instance to Professor Balfour, who, not less liberal nor less devoted to science than Professor Goodsir, willingly sacrificed them to Professor

* Payer —— Organogenie de la Classe des Cactoideæ, &c. Ann. des Sciences Nat., 3e ser., Botanique, xviii., p. 233.

Du Bois Raymond. Others have since been received, and Mr Hewan has brought two with him on his return from Old Calabar about a month ago. These were placed in one of the tanks in the Botanic Garden of Edinburgh. One of them died, but the other is still alive and healthy. Mr Murray enumerated various other novelties in science which had been sent home by the missionaries, and had been described by himself and other naturalists. Until now their contributions had been chiefly confined to zoology, but last month he had received a box from the Rev. W. C. Thomson, containing a number of seeds and botanical specimens collected at Ikoneto, some of which possessed much interest. The seeds he had handed over to Mr M'Nab, who had sown them, and symptoms of germination had already begun to appear. The botanical specimens he had presented to the Museum of the Botanic Garden. The most interesting of these was a number of specimens of the poison ordeal bean of Old Calabar, which had been first brought home a number of years ago by the Rev. Mr Waddell. It was then analysed and examined by Professor Christison, who reversed the adage of *fiat experimentum in corpore vili*, by experimenting upon himself, and nearly making a vacancy in the Chair of Materia Medica in the University. His experiments and analysis were published in the "Proceedings of the Royal Society." The bean was used as an ordeal by the natives, and it was undoubted that some escaped, while to others it was fatal. It had been suggested that this might arise from the fetish men or priests who administered the poison, causing those whom they had destined to death to take a smaller dose than those who were to escape, because when taken in a large dose it occasioned vomiting, which might relieve the stomach of its perilous inmate. The seeds brought by Mr Waddell had been grown by Mr M'Nab, but had died before flowering. It has not yet been described, and Mr Murray now gave a description of it, so far as the materials sent to this country allowed. It appeared to him to be a Mucuna, and he designated it *Mucuna venenosa*. The Mucuna was well known as the genus which furnished the drug called Cow-itch, which was derived from the hairs with which the pod is covered, and was used as an anthelmintic. The larger seeds, often thrown on the west coast of Ireland, are the seed of the West Indian *Mucuna pruriens*. No species from Africa has yet been described. There is, however, a species, besides the poison bean, which has just been sent by Mr Thomson, very distinct from the West Indian species, but very closely allied to a species from Tranquebar. Had the latter been a native of the West Indies, instead of the East, he would have had some hesitation in describing this as new, as it might have been floated across to Africa from the West Indies, and so become naturalized there; but it was difficult to believe that this could be the case with an East Indian species. He therefore described this species under the name of *Mucuna Balfouriana*, after Professor Balfour, who had had specimens of this unnamed standing in the Museum for many years. There were several other most interesting specimens which botanists seemed to be unacquainted with, and had difficulty in localising. But as the specimens only consisted of the fruits and seeds, the materials were too scanty to allow of their being described and named.

Mr Hewan, in reference to Mr Murray's remarks regarding the poison ordeal bean, stated that the natives generally did not put much faith in its being a true ordeal, rather looking upon a summons to undergo the test as sentence of death, and, if in their power, making their escape and going into exile. He did not think the suggestion that the larger dose producing vomiting was the true explanation why some escaped while others did not. In one case which had come under his own notice a short time ago, a woman, who was accused of injuring her child by witchcraft, came in from a distance strong in innocence, and demanded to have the ordeal administered. She ate twenty-four beans and did not die. Next day another woman, encouraged by her escape, underwent the ordeal, and she ate twenty-two beans and died. The difference in quantity here was too slight to affect the result. He rather thought it was from the mode of preparing the beans that the different results followed. The beans were steeped before being eaten; and as the fetish man had the preparation of them, he could, if he chose, boil all the poison, or much of it, out of them before administering them.

III. *Biography of* Dr William Nichol. By Professor Balfour.

Dr Balfour remarked—The painful duty devolves on me this evening of recording the death of Dr William Nichol, one of the Fellows of the Botanical Society. This melancholy event took place at Alexandria, on the 7th of May 1859, while he was on his passage to India, to join Her Majesty's service there. Dr Nichol was the son of the late Walter Nichol, LL.D., for many years a successful teacher of Mathematics in Edinburgh. I was one of his father's pupils. I am indebted to his friend Mr William Millar for some particulars in regard to the early life of Dr William Nichol. He was born in March 1836, and died, therefore, at the early age of twenty-three. He received his school education in the Edinburgh Institution, under the superintendence of Mr George Murray, a cousin of his father's. He was a diligent scholar, and gained prizes for Latin and Greek. From his earliest youth he evinced a desire for scientific knowledge, and received from his father encouragement in the prosecution of science. He pursued with much zeal mechanics and conchology, and acquired considerable proficiency in both. He also applied himself to the study of modern languages, and had a fair knowledge of German, French, and Italian. His taste, however, did not lie in the direction of languages, and he acquired them chiefly with the view of opening up means for the study of science. He always exhibited a remarkable desire to excel in anything to which he turned his mind. He became a student of the University of Edinburgh in 1850, at the age of sixteen.

After attending the literary and mathematical classes, he commenced the study of medicine in the session 1853–54. I became acquainted with him in 1854, when he entered the botanical class. In that year he gained the first prize in the junior division of the class, for excellency in the competitive examinations. He became ardently fond of botany, and directed his attention in a special manner to the more difficult department of cryptogamic botany. In muscology he became a proficient, and added many species of mosses to the flora of Scotland. He attended the botanical class again in 1855, and gained the highest prize in the senior division of the class. He also entered as a pupil in 1856. During these three years, as well as subsequently, I had ample opportunities of observing his zeal and enthusiasm, as well as his great power of diagnosis. I was satisfied that he was well fitted for occupying a situation of importance in the botanical world. Accordingly, after he had passed his examination for M.D. and surgeon in 1857, I recommended him to Sir William Hooker for a botanical expedition. The situation, however, was filled up before Dr Nichol's application was received. By the advice of Sir William, Dr Nichol became a candidate for a medical appointment in the navy, and after passing his examination he was sent to Portsmouth. His health, however, began to suffer at this time, and he was compelled to give up work for a time. The unexpected death of his father afterwards led to an alteration of his plans, and he resigned his appointment in the navy. The death of a sister afterwards affected him much. These calamities seem to have operated painfully on his mind, and for a time he was unfit for much exertion; still he continued to prosecute his favourite studies in his own quiet way. His habits were naturally retiring, and his manner was such as not to secure for him at once that reception which his merits deserved. Had he possessed more confidence, and advanced his claims with greater vigour, he would have had great success. As his health and spirits improved, he became a candidate for an Indian medical appointment, and stood high on the list. He made preparations for his departure, and left Edinburgh about the beginning of April. At the time he left he had just recovered from an attack of gastric fever. This illness seems to have debilitated him much, and probably led to the fatal result. Dr Nichol sailed in the Pera, and by the time the vessel reached Alexandria he was dangerously ill. On the 5th of May, Dr F. F. Ossler of Alexandria writes that he had been called to see him when he was landed from the Pera, and that he found him in a very precarious state indeed. All attention was paid to him by the surgeon of the vessel during the passage, as well as by Dr Ossler. He had suffered much from sea-sickness during the voyage, and he was brought on shore at Alexandria, labouring under typhoid fever, which carried him off in a few days, notwithstanding all the kind medical attention of Dr Ossler.

The Society agreed to record on their minutes their sense of the loss which they had sustained in the death of Dr Nichol, and to convey their sympathy to his afflicted mother.

IV. *Remarks on the Temperature of Plants.* By M. Becquerel.

M. Becquerel has recently made observations on the temperature of plants, by which he shows that the calorific condition of plants depends on the air, and that, like the atmosphere, it is liable to diurnal, monthly, and annual variations.

The first experiments on the heat of plants which attracted the attention of botanists were those of Hunter, published in the "Philosophical Transactions" for 1775 and 1778. He simply introduced a thermometer into a hole made in the trunk of a tree, protecting the stem of the thermometer from external influences by means of a box filled with wool, through which the thermometer passed. This arrangement did not prevent the entrance of air and water, and hence resulted errors in the observations. The experiments were also of a very limited extent, and no indication is given of the hours of the day when they were made. Hunter concluded that in winter trees had a temperature above that of the air.

In 1783, Schoeffs made experiments on the subject in New York under still less favourable conditions, since he operated on trees of different diameters and of different kinds, with thermometers which he introduced during some minutes only into cavities prepared for the purpose. The observations made by him show only that the temperature of trees was sometimes higher, sometimes lower, than that of the air.

At Geneva, from 1796 to 1800, and for some years afterwards, Pictet and Maurice made a continuous series of observations on temperature, at sunrise, at 2 P.M., and at sunset, on a horse-chestnut, which was about 1 foot 9 inches in diameter.

The cavity in which the thermometer was placed was filled with melted tallow, in order to prevent the access of air and water. They made during the period mentioned 11,000 observations, the results of which were registered by them without any discussion of the subject. M. Becquerel has taken up these observations, and has drawn conclusions from them. He has also constructed curves representing the results.

During the years from 1795-1800, the mean annual temperature of the air in the north was the same as that of the tree, the differences being not more than one or two tenths of a degree; and these may be attributed to the displacement of the zero or basis of observation.

Founding on a certain series of observations, it had been supposed that the tree had a temperature more elevated than that of the air during winter, and lower during summer; and it had been concluded from this that the effects were due to this—viz., that the fluids drawn up by the roots were themselves warmer than the air in winter, and colder in summer. This theory, however, is shown to be inadmissible, so far as the results of the Geneva observations are concerned. Thus, in the years 1796, 1798, and 1799, during the months of May to August, the temperature of the tree was decidedly above that of the air; but the contrary was the case during the years 1797 and 1800, with about two exceptions. On the other hand, during the winters 1796-97, 1797-98, 1798-99, the tree was colder than the air.

Observations have also been made at Geneva relative to the temperature of the earth, at about 4 feet of depth—a depth to which the principal roots penetrate. M. Becquerel concludes from this that the temperature of the soil does not produce any influence on the temperature of the tree. During the years 1796, 1797, 1798, and 1799, the temperature of the soil in winter was higher than that of the air and of the tree; it was lower in spring; and again it was higher in summer and autumn. The water absorbed by the roots does not therefore appear to affect the temperature of the tree. M. Becquerel therefore concludes that the cause of plant temperature must be looked for in the air.

He finds that the curves of mean temperatures of the air present great inflexions, while those of the tree are much more uniform in their course. The curves and variations show that the hours of maximum and minimum are not the same in the air as in the tree. The maximum of the air occurred, according to the season, between 2 and 3 P.M., whilst in the tree it showed itself a considerable time after sunset.

In the month of December last, M. Becquerel made observations on a horse-chestnut in the Jardin des Plantes, having a diameter of about 1 foot 8 inches. He made holes 11, 6½, and 5½ inches in depth in the trunk of the tree, at the height of 1 metre above the ground. Into these holes were introduced mercurial and electric thermometers. The hollows were filled with melted tallow. The parts of the instruments outside the tree were protected from the variation of temperature in the air, in order to be certain that they did not exercise any influence on the temperature indicated by the thermometers. It was ascertained by experiment that the changes of temperature in the portions of the thermometers in contact with the air did not modify in any degree the temperature of the tree when that of the air changed; since by maintaining at zero, by means of melting ice for forty-eight hours, the stem of one of the mercurial thermometers, it was found that the same thermometer gave indications similar to those of others placed at the same depth in the tree. Comparative observations made during the months of December, January, February, and March last have given results from which the following conclusions are drawn:—

1. The mean temperature of the air and the tree have been sensibly the same, a result which has been deduced equally from the observations made at Geneva from 1796 to 1810, and at Chatillon-sur-Loing last

summer. The result is the same whatever the diameter of the tree is; only, the smaller the diameter the more quickly the equilibrium of temperature is established. In the leaves it takes place at the end of a short period; in the branches and small twigs a little more slowly; then in the thick branches and the trunk, and finally in the root. When there are great variations of temperature in the air, complex effects are produced on the tree, which disappear, however, in taking the means.

2. The production of heat resulting from chemical reactions taking place in the vegetable tissues, seems to account only for an inappreciable portion of heat in plants. Such is also the case with regard to the proper heat of fluids absorbed by the roots, and which afterwards form the sap.

3. During the months of December, January, and February, the mean variations of temperature in the air from 9 A.M. to 9 P.M. was 0°·84, in the tree 0°·19 at the depth of 6½ inches, and 0°·10 at the depth of 11 inches. The variations at these depths have thus been six times and eight times less than in the air.

4. The maximum of temperature in the air took place in winter about 2 P.M., and in the tree about 9 P.M., and only about midnight in summer.

5. The transmission of heat takes place gradually from the periphery to the centre in a definite time, which can be determined by electric thermometers, placed at different depths in the tree.

6. The atmosphere is the natural source whence plants derive the heat which constitutes their caloric condition, and which they require in order to perform their functions. They are in the same condition as fishes which possess sensibly the same temperature as the medium in which they live. As these animals, however, have the power of locomotion, they can protect themselves from variations, by approaching the surface and going deeper into the water at pleasure. Plants, on the contrary, are forced to submit to the temperature of the medium in which they grow, and cannot withdraw themselves from it.

Professor Balfour announced the flowering of *Rhododendron cinnabarinum*, in Miss Walker's garden, at Drumsheugh. The plant is called *Kema Keechoong* by the Lepchas, and proves poisonous to goats and sheep on the Himalayas.

There were exhibited specimens of germinating horse-chestnut seeds in which the young plumule had been destroyed by frost, and the cotyledons had subsequently sent out two buds, which were growing vigorously.

Professor Balfour exhibited from Sir Thomas Buchan Hepburn, Bart., drawings of a plant of *Altingia excelsa*, which was growing in the garden of Mr St Clair, at Hyères. The plant bore cones, and the leaves around them differed much from the ordinary leaves of the plant. Specimens of the leaves were shown.

Dr Thomas Aitken, of Durham County Asylum, sent fresh specimens of *Primula farinosa* for exhibition and distribution.

There were exhibited specimens of a leguminous plant which had grown from seeds sent by Dr Lindley, on Dr

Rauch's authority, as the produce of a hybrid between the Pea and Lentil. The plants were partly in flower and partly in fruit. They seem to be only a variety of *Vicia sativa*, with paler flowers than usual, and the pod with a somewhat lomentaceous tendency. There was no character of the pea in them at all.

Mr M'Nab laid on the table plants of *Polygala vulgaris*—in colours, blue, lilac, pink, and white. They had all been raised from seeds taken from plants of the same colours, blue being the normal one. He particularly called attention to the changes which in many instances occur when raising seeds taken from varieties different from the ordinary normal colours. Besides the above, the following instances were stated :—1. Out of eighteen seedlings raised from the superb scarlet flowering thorn, seventeen produced flowers which were pure white—one only having a slight pink tinge ; 2. Seedlings raised from the white variety of *Salvia patens* (blue being the normal colour) produced plants whose flowers were all blue ; 3. Of seedlings raised from the white variety of *Digitalis purpurea*, scarcely one in twenty had white flowers.

14th July 1859.—ANDREW MURRAY, President, in the Chair.

The following Candidates were balloted for and duly elected :—

As Resident Fellow.

ALEXANDER GRAHAM, Esq. of Kirkhill, Stirlingshire.

As Foreign Members.

JAMES AFRICANUS BEALE HORTON, Esq., L.R.C.S. Eng., Sierr aLeone.
WILLIAM BROUGHTON DAVIES, M.D., Sierra Leone.
WILLIAM MURRAY, Esq., San Francisco.
Rev. W. C. THOMSON, Old Calabar.
ARCHIBALD HEWAN, L.R.C.S. Edin., Old Calabar.
EMILE WM. DUBUC, M.D., Bilboa, Spain.

The following donations were presented to the Library :—

Heuffel, Enumeratio Plantarum in Banatu Temesiensi.—From the Author.

Dr Balfour's Account of a Botanical Excursion to Switzerland with Pupils.—From the Author.

Verhandlungen des Naturhistorischen Vereines der Preussischen Rheinlande und Westphalens: Von Dr C. O. Weber—Parts I.–XI. for 1857, and I.–XXIX. for 1858.—From the Author.

Dr Thomas Aitken, of the Inverness Asylum, sent specimens of *Hottonia palustris*, and of *Hydrocharis Morsus Ranæ*, from Mordan Carrs, county Durham.

The following donations to the Museum were announced:—

From Archibald Hewan, Esq., Old Calabar—Stick made of African Teak; Hats and Mats made from the leaves of *Pandanus odoratissimus;* Fibres, Cloth, and Musical Instrument, made from Palm-leaves; Sasswood, or Krooman's Ordeal Bark; Ornamented Cupping Gourd (*Cucurbitula*), and other larger Carved Gourds used by the natives of Old Calabar for domestic purposes; Bird's Nest, formed from the leaves of *Elais guineesis*, the Oil-Palm; Portion of Pod of *Entada scandens*, and another large Pod which supplies a varnish in Old Calabar.

Andrew Murray, Esq.—Root, showing natural grafting.

Mrs Knapp—Specimen of wood of *Garrya elliptica.*

Thomas Clifford Davies, Esq.—A large collection of Woods, Fruits, Extracts, and other Materials used in the Lancashire Cotton Manufactory as dyes,—arranged in glass-cases.

James G. Reid, Esq.—Dried Peaches from Cape of Good Hope.

Hugh Cowan, Esq.—Seeds of the Wax-plant of Japan.

Dr H. R. Oswald, Indian Service—Specimen of Bamboo Rice and of Tabasheer, from India.

Dr Alexander Hunter, Madras School of Industrial Arts—Specimens of Dyed Cloths from Mangalore in India; also specimens of Paper from India, with the Fibres from which they are manufactured.

Mr Sang and Mr William M'Nab—A series of Stereoscopic Representations of Plants.

Miss M. Frome—Large specimen of the Fruit of *Urania speciosa*, or "Traveller's Tree," from Madagascar.

The following communications were read:—

I. *Statistics of Botanical Class in the University of Edinburgh from* 1777 *till* 1859 *inclusive.* By Prof. Balfour.

Date.		Medical.	General.	Winter.	Summer.	Total Students.
1777	....	—	—	—	—	54
1778	....	—	—	—	—	33
1779	....	—	—	—	—	45
1780	....	—	—	—	—	32
1781	....	—	—	—	—	58
1782	....	—	—	—	—	39
1783	....	—	—	—	—	52
1784	....	—	—	—	—	51
1785	....	—	—	—	—	67

Date.		Medical.	General.	Winter.	Summer.	Total Students.
1786	....	—	—	—	—	53
1787	....	—	—	—	—	48
1788	....	—	—	—	—	54
1789	....	—	—	—	—	54
1790	....	—	—	—	—	51
1791	....	—	—	—	—	71
1792	....	—	—	—	—	44
1793	....	—	—	—	—	58
1794	....	—	—	—	—	55
1795	....	—	—	—	—	59
1796	....	—	—	—	—	58
1797	....	—	—	—	—	76
1798	....	—	—	—	—	79
1799	....	—	—	—	—	82
1800	....	—	—	—	—	97
1801	....	—	—	—	—	106
1802	....	—	—	—	—	122
1803	....	—	—	—	—	106
1804	....	—	—	—	—	103
1805	....	—	—	—	—	75
1806	....	—	—	—	—	103
1807	....	—	—	—	—	115
1808	....	—	—	—	—	98
1809	....	—	—	—	—	127
1810	....	—	—	—	—	111
1811	....	—	—	—	—	132
1812	....	—	—	—	—	123
1813	....	—	—	—	—	136
1814	....	—	—	—	—	131
1815	....	—	—	—	—	140
1816	....	—	—	—	—	157
1817	....	—	—	—	—	180
1818	....	—	—	—	—	130
1819	....	—	—	—	—	124
1820	....	134	35	—	—	169
1821	....	171	30	—	—	201
1822	....	148	30	—	—	178
1823	....	162	25	—	—	187
1824	....	187	26	—	—	213
1825	....	217	31	—	—	248
1826	....	214	30	—	—	244
1827	....	181	19	—	—	200
1828	....	251	29	—	—	280
1828–29	....	220	38	37	219	258
1829–30	....	213	27	35	205	240
1830–31	....	221	22	38	205	243
1831–32	....	194	19	58	155	213
1832–33	....	229	31	46	214	260
1833–34	....	216	28	62	182	244
1834–35	....	213	26	42	197	239
1835–36	....	188	24	45	167	212
1836–37	....	188	39	38	189	227
1837–38	....	187	39	33	180	213
1838–39	....	146	17	24	139	163
1839–40	....	122	11	23	110	133
1840–41	....	101	18	24	95	119

Date.		Medical.	General.	Winter.	Summer.	Total Students.
1841–42	....	126	27	29	124	153
1842–43	....	113	23	26	110	136
1843–44	....	114	22	17	119	136
1845	....	106	17	—	—	123
1846	....	152	32	—	—	184
1847	....	145	54	—	—	199
1848	....	147	39	—	—	186
1849	....	148	36	—	—	184
1850	....	148	49	—	—	197
1851	....	169	37	—	—	206
1852	....	161	24	—	—	185
1853	....	194	39	—	—	233
1854	....	198	28	—	—	226
1855	....	163	26	—	—	199
1856	....	164	47	—	—	211
1857	....	155	37	—	—	192
1858	....	147	40	—	—	187
1859	....	211	42	—	—	253

II. *On the Fruits of the* Cucurbitaceæ *and* Crescentiaceæ, *as the Original Models of various clay, glass, metallic, and other hollow or tubular vessels and instruments employed in the Arts.* By Professor GEORGE WILSON.

I would commence by drawing a contrast between the plan of procedure of an animal artist, such as a bird or an insect, and that which guides a human workman, when each is executing a design. Both classes of artists agree in eschewing chance, and following in their work a pre-arranged plan. They differ in this, that the human artist carries out his own conception, realizing an idea which has arisen in his own mind, or at least a scheme which has been wrought out there; whilst the animal artist carries out a conception which is not its own, but a divinely-implanted instinct; in other words, a thought of God's. Each animal instinct is thus equivalent to an infallible recipe, or formula of guidance, furnished by God to the creature which follows it; and the instinctive workmanship which results, for example, in the exquisite cell of the bee, the geometric web of the spider, the caterpillar's resurrection-shroud, and the swallow's nest, is as truly the copy of a God-given pattern as were the Mercy-Seat or the Golden Candlestick of the Hebrew Tabernacle, which Moses constructed after the perfect models shown him on the Mount. However inferior, accordingly, the animal may be to the human workman, the work of the former, as an example of Divine design, may serve the latter better as a pattern for his own work than anything he could devise himself.

A conviction of this kind has always dwelt in the minds of the intelligent men of all ages, and has induced them to admire and to copy both the workmanship and the organs or tools of the lower animals, as in many cases not admitting of being surpassed, or even equalled, by human devices.

From the animal it is but a step to the plant; and if we miss consciousness, and cannot assure ourselves of even the smallest amount of intelligence, we are still certain of the presence of a manifold, energetic, subtile life, which gives to each vegetable organism powers of transforming matter still more marvellous in some respects than those of the animal. If, for example, the animal is more wonderful as a mechanician, the plant is more wonderful as a chemist. Nor do we fail to realize that the inner vegetable life which invests the plant with energies so far transcending those of the mineral on the one hand, and of the animal on the other, may be traced back from seedling to parent plant through thousands of years; whilst we find for this life no beginning except in the will of God, and perceive that He is behind it, guiding and controlling it wherever it appears. The flowers, fruits, leaf-appendages, and other organs of plants which have in all ages been resorted to by mankind as models, are thus, though in a different sense, as truly Divine patterns as the organs or workmanship of animals.

Whilst thus to plants is given the unconscious realization of Divine designs, and to animals the spirit of conscious and delightful obedience to perfect plans of work, to man has been granted the God-like power to create what in its degree shall bear his stamp as its maker, even as the universe shows everywhere the finger-touch of the Almighty. The human industrialist has thus plainly in his choice two modes of working: he may either fall back entirely upon his creative or inventive faculty, and devise novel instruments, or he may imitate, in whole or in part, vegetable or animal organisms (including animal workmanship), accepted as Divine patterns ready to his hand. In reality, industrial man has constantly been following both modes; sometimes inventing, sometimes copying, often combining both.

It is to certain of his *imitative* proceedings that reference will now be specially made; with, however, the proviso, that those proceedings can in no case, from the difference of tool and material with which man works, be absolutely imitated, but only partly so.

In endeavouring to ascertain what human instruments are copies of natural objects, we must not forget that certain forms are so common, that mere similarity in shape between a particular industrial instrument or vessel and a natural object is not enough to show that the one has been imitated from the other. Thus, a very familiar form of wine-cup recalls closely the configuration of a truncated, polished cocoa-nut; but not more than it does an ostrich egg similarly treated, or the lower part of a bottle-gourd. It also closely resembles the capsule of some species of poppy, and also the *theca* or *spore-case* of certain mosses; whilst the calyx of the rose gives also the perfect contour of our wine-cup. It might thus have been modelled after any one of those patterns, and it may have been after none of them; for among the ovals of the mathematician would be found outlines which would exactly give the forms we have been describing. Similarity, then, or even identity of form, especially in the case of simple shapes, is no certain proof of the one having been copied from the other, but it is an important guide to the derivation of an artificial shape from a natural one.

In seeking for further means of certifying the relation of similar forms to each other, it will be found that the name by which an industrial instrument or vessel is known often points to the form or material of its prototype, which it has long ceased to resemble in most particulars. Thus, the brewer offers his visitor a *horn* of ale. If the offer is accepted, the *horn* makes its appearance in the shape of a tin mug, still indicating by its shape and name that the original drinking-vessel was made from the wider part of a cow's horn. A hunting-*horn*, again, is now a brass trumpet, which in its more elaborate forms completely conceals from us that it is but a lengthened, many-coiled, and very wide-mouthed horn of brass. So also a shoe-*horn* is often a scoop of metal. We have, in the same way, the Latin name *tibia* applied to a musical pipe or flute, preserving the fact that it was originally made from the leg-bone of an animal; and the name *avena* applied to the pastoral pipe, recalling that it was at first a straw or reed. So also the Greek αλαβαστρον (*alabastron*), primarily limited to a perfume-box made of alabaster, came latterly, among the ancient orientals, to signify any kind of box employed to contain a fragrant oil or ointment of high price.

In addition to the name, we have an important means of identifying the originals of modern and familiar vessels, which have been long in use among highly civilized nations, by observing the mode in which nations of another type of civilization than ourselves, or little advanced in civilization at all, supply the absence of such vessels as we use.

Keeping those points in view, it would appear that our modern hollow and tubular vessels have been mainly modelled on three distinct types:—

Firstly, The stems, leaves, flowers, and fruits of plants.

Secondly, The bones, including the hollow horns of the mammalia.

Thirdly, The shells or external skeletons of the mollusca.

Omitting all reference to the two last heads, and limiting attention solely to fruits under the first, the relations of the *Cucurbitaceœ* may now be considered.

No tribe of plants appears to have yielded so many different hollow vessels as the *Cucurbitaceœ* or gourd-family, with which, however, it will be convenient to include the *Crescentiaceœ*, or calabash-trees, yielding the calabash. This has apparently arisen because—

1*st*, Of their wide distribution over the globe, which is so extensive that, in all its hotter regions, members of this family are indigenous, whilst they are easily cultivated in the warmer temperate regions.

2*d*, They yield fruits of great diversity of form, but possessed in certain varieties of firm, hard rinds.

3*d*, They are easily deprived of their pulp and rendered hollow.

4*th*, They can whilst growing be to a considerable extent moulded in form; and though their rinds when dry are hard, they are easily cut and perforated.

Next to the hollow horn of the mammalia, the gourd, representing all the *Cucurbitaceœ* and the calabashes, yields the greatest variety of vessels.

In illustration, I adduce the following examples, along with others bearing on different references in the paper; the specimens being taken from the Botanical and Industrial Museums:—

An elaborately carved ovoid work-box; one basket with, and one without a handle; various South and West African snuff bottles or boxes; plates; plate-covers; cups; bowls; water jug; water jar; cooking pot; spoon or ladle; scoop or skimmer; vessel with suction-tube and strainer, answering as teapot, cup, and saucer in one (used by South American Indians for maté-tea); funnel used for medical purposes by Africans at Old Calabar; flask-like bottle; constricted or hour-glass bottle; pilgrim's bottle; cupping instrument as used at Old Calabar.

Besides these, I would refer, on the authority of Dr Hunter of Madras, to the construction, by the natives of India, of a musical instrument resembling the guitar, from a large flask-like gourd; and to their conversion of a similar but much smaller gourd into a suckling-bottle for children. I would also allude, on the authority of the same gentleman, and also on that of Mr A. Hewan, surgeon, of the Old Calabar Mission, to the employment in India and Africa of empty calabashes as floats, or the components of rafts, by means of which men, animals, and baggage are ferried across rivers. A single calabash, it is stated, is quite sufficient to float a man; and the Africans contrived to balance themselves on one in a very adroit, but by white men inimitable way.

I would further remind my audience that, according to an authority in whom they had much faith in their early days, Cinderella's friend the Fairy made her a splendid coach out of a pumpkin or immense gourd. I am afraid this mode of coach-making is a lost art; at least at this season: it can apparently be practised only at Christmas-time, when the pantomime is in vogue. Nevertheless, it may be that Cinderella's pleasant story contains, besides much else, a recognition of the manifold uses to which a gourd may be industrially applied.

Without insisting on this, the gourd may with confidence be regarded as having been, in both hemispheres, the precursor and natural model of the cup or bowl afterwards fashioned in clay and metal.

In particular, however, it was the prototype of three hollow vessels. The first is the long-necked bottle, with an egg-shaped body, which has been imitated in clay from a cucurbitaceous fruit by the Chinese, the natives of India, the ancient Egyptians, and various African tribes, as well as by the ancient Peruvians, to mention no others. The similarity of the clay bottles of these nations to gourds has struck all observers; and the botanist, by the term bottle-gourd, applied to the fruit of one particular plant, has implied his recognition of that species, as the best marked vegetable prototype of the artificial liquor-flask. Recently Minton has produced a graceful copy of the bottle-gourd, in yellow Majolica ware, with curling tendrils and leaves in green, as if, in the name of the ceramic art, to do homage to a natural model which it has followed in all countries for thousands of years. From clay the transition is ready to glass, in which the bottle-gourd, either at first or second hand, has been constantly imitated.

Secondly, the constricted or hour-glass gourd is the accepted or traditional pilgrim's bottle, drawn by our artists, as slung by its narrow waist over the shoulder of the wayfarers in their illustrated Pilgrim's Progresses, and Palmer's Crusading Journeys. The gourd is supposed by some to owe its constriction and hour-glass form to the effect of a ligature tied round it whilst growing; but such a process, though often employed, is certainly not necessary. Plants grown abroad under the eyes of botanists, as well as several raised in the Botanic Garden here by Mr M'Nab, spontaneously produced fruit with the useful constriction which enables it to be hung by a string across the shoulder.

In Europe this form of bottle is now little seen, but it is otherwise in the East, where it is copied in clay and porcelain as a convenient water vessel. For actual pilgrims, the hollow gourd itself has the advantage of being less fragile than its clay copies. Both, however, are used. In illustration of this, I have brought two small porcelain figures of Chinese wandering beggars, each provided with his hour-glass gourd, or its facsimile in clay.

The third, and perhaps the most curious, as certainly it is the most novel, relation of the gourd to hollow vessels, is as the prototype of the cupping-glass. I was led to suspect this, in consequence of receiving, a year ago, the gift of a small gourd for the Industrial Museum. It had been sent to Dr Greville by Mr Hewan, the mission-surgeon at Old Calabar, and was stated to have been used by the natives for *cupping*. This prompted me to recall the fact that the Latin name of the cupping-glass was "cucurbitula cruenta," and to surmise that the name was a standing memorial of the earliest cupping instrument having been a gourd. This summer I had the opportunity of meeting Mr Hewan, who is on a visit to this country, and from him I learned that the practice of cupping with gourds is common in Western Africa, as well as among the negroes in Jamaica.

Lexicographers have explained the Latin name of the cupping-glass as referring to the resemblance in *shape* of the latter to a gourd. But it does not more resemble a gourd than various other objects. Moreover, a cupping instrument as ancient as the *cucurbitula* was the tip of a cow's horn, perforated at the apex, so as to allow the air to be sucked out by the lips, after the base had been applied to the scarified skin. Yet no two shapes are more dissimilar than those of the egg-like gourd and the conical horn. I accordingly infer that alike the Latin *cucurbita* or *cucurbitula*, and the Greek σικύα (*sicya*), were applied to the cupping-glass, mainly because originally it was a gourd, although unquestionably the permanency of the term was secured by the instrument retaining the gourd form after it parted with the gourd substance. The gourd was thus in a twofold way the prototype of the cupping instrument.

In illustration of these points, the author showed three African cupping-gourds; a Shetland "blûde horn" or cupping-horn as used at the present day, obtained through the kindness of Professor J. Y. Simpson; and drawings of the gourd-shaped bronze *cucurbitulæ* found in the ruins of Herculaneum and Pompeii. A brief allusion was made to the cupping-gourd and cupping-horn, as the earliest artificial vacuum-producers, and precursors of the air-pump; but this subject was reserved for a special investigation.

Mr M'Nab placed on the table a series of living Alpine Plants, including fifteen or twenty collected by Dr Balfour's party in Switzerland. Also a specimen of *Sabbatia stellaris*, showing a peculiarity in the style, which lies at first flat on the corolla with the two stigmas close to each other, and after the pollen is applied becomes erect, with the stigmas separate.

Mr M'Nab exhibited specimens of *Helleborus niger*, or Christmas Rose, in full flower; also a hawthorn branch, with the fruit of last year and of the present year attached to it.

Mr Hewan exhibited a specimen of the flower of *Aristolochia gigantea* from Africa.

TRANSACTIONS

OF THE

BOTANICAL SOCIETY.

VOL. VI.—PART III.

EDINBURGH:

PRINTED FOR THE BOTANICAL SOCIETY.

MDCCCLX.

The Botanical Society of Edinburgh is prepared to make exchanges of plants with Foreign Botanists. Extra-European species, and more particularly Ferns, are desirable.

British or Foreign species will be given in exchange, in accordance with the wish of the Contributor.

TRANSACTIONS

OF THE

BOTANICAL SOCIETY.

10th November 1859.—ANDREW MURRAY, F.R.S.E., President, in the Chair.

The following donations to the Library were announced:—

Report of the Smithsonian Institution, Washington, for 1857. —From the Institution.

Transactions of the Royal Scottish Society of Arts, Vol. V., Part II.—From the Society.

Memoires de la Société Imperiale des Sciences Naturelles de Cherbourg, Tome V.—From the Society.

Review of Watson's Cybele Britannica, by Alph. de Candolle. From the Author.

Proceedings of the Literary and Philosophical Society of Liverpool for 1858–59.—From the Society.

Scripture and Science, by Wm. Mitchell.—From the Author.

Proceedings of the Royal Dublin Society for 1858–59.—From the Society.

The following donations to the Herbarium were noticed:—

From Mrs Terrot—Irish and Scotch Plants, collected by the late Colonel Madden.

Mr John Sim, Perth—Specimens of *Arenaria balearica* found on a wall near Moncrieffe House, and specimens of *Claytonia alsinoides* from the neighbourhood of Perth.

Dr Mueller, Melbourne—Collection of Australian Plants.

Mr Robert Brown—Specimens of *Hierochloe borealis* from the banks of the Thurso.

Mr James Clark, Whithorn—Three old Herbals containing dried Plants.

Mr John Sadler—Parcel of Scottish Alpine Plants.

Professor Balfour mentioned that there had been also added to the University Herbarium, Dr Greville's large and valuable Herbarium of Ferns; also a collection of Medicinal Plants from R. F. Hohenacker; and Arctic Plants from Mr J. Taylor, collected in 1858.

The following donations to the Museum at the Botanic Garden were announced:—

From Dr T. Anderson—Roots of *Aconitum ferox*, purchased in the bazaars of Northern Cachar, to which they are brought from the Himalaya, about the district of Aboo.

Mr Andrew Rutherford—Piece of gnarled Black Alder from Jed Forest.

Mr W. Ramsay M'Nab—Species of Polyporus found in a fire-clay mine near Joppa, about thirty feet below the surface of the ground, and in such a position that no daylight could reach it; also specimen of Potato which had been allowed to grow in a dark cellar, and which had produced numerous small potatoes upon the stalks in place of leaves.

Dr Dor, Switzerland, per Professor George Wilson—Rasped Wood, and Paper made from it at Gottenburg, Sweden.

Dr Ogilvie, Aberdeen—A large series of Fern Stems, prepared and dissected to show their structure; also Stems of Ivy, showing the fusion of the woody tissue and disappearance of the bark from mutual pressure.

The Royal Society of Edinburgh—Juice of India-Rubber Tree, from the Calcutta Botanic Garden; also a collection of Exotic Woods and two planks of Ebony.

Mr Adam Matheson—A peculiar fasciated Branch of *Pinus sylvestris*.

Mr Ashenheim—Fresh and dried specimens of the Fruit called Hadar, used in the Jewish synagogues.

Rev. Zerub Baillie—Preserved specimens of Plant, Flower, and Fruit of the Calabar Ordeal Bean.

N. A. Dalzell, Esq., Kurrachee, Bombay—Specimens of Ropes made by the natives from Vegetable Fibres.

Mr Taylor—Specimens of Vegetable Fibres from India.

Dr Lyon Playfair—Indian Corn from the Pyrenees.

Messrs James Backhouse and Son, nurserymen, York—A large Trunk of Tree Fern (*Dicksonia antarctica*); the specimen measures 13 feet 2 inches in length, 5 feet 10 inches in circumference at base, 3 feet 4 inches in circumference at centre of stem, and 3 feet at summit.

Mr Alexander Brydon—Stem of *Daphne Laureola.*

Mr D. Ross, Rockville, Murrayfield—Beautifully prepared specimens of *Neckera crispa.*

A. G. Spiers, Esq.—Cone of *Cedrus Deodara* grown at Culcreuch.

The President delivered the following Opening Address:—

It is the custom for merchants once a year to make an inquiry into their affairs: to take stock, as they call it, balance their books, reckon their gains and their losses, and see what the progress of their business has been during the bypast year. It is a good and a salutary custom, and one which many of us adopt to a greater or less degree in regard to our own past conduct and life, when the advent of another year invites our thoughts to such considerations. Let us, at the commencement of our New Session, follow this example; let us take a retrospective view of our position, and estimate the gains and losses which we as the representatives, at least as the only embodied representatives, of the Science of Botany in this city, have made during the past year. Let us see how the progress of Botany has been affected by the events of that period.

And first, let us, like stout men, look our losses in the face. These, gentlemen, have not been small. We have no loss in the actual progress of our science to deplore; we have no false step in the mode of conducting our investigations to announce; we have no fundamental principle to correct. The science is firmly based on the natural system. Its principles are sound, and are being day by day worked out to more and more perfection. Our physiological views have received no rude check; and we are progressing steadily and surely in our search after truth, and in the acquisition of fresh knowledge. But if we have no loss in this respect to regret, we have suffered deep and heavy loss in the persons of some of those who have been mainly instrumental in bringing the science into this satisfactory position. We have to bewail the loss of Alexander von Humboldt and of Robert Brown, the topmost trees of all the forest. You have already heard the eulogium and the history of their labours from the pen of our excellent Professor, and I shall not do myself the injustice, nor inflict on you the tedium, of retreading the same ground. You have also heard from him an account of the loss we have sustained in the death of Professor Agardh of Lund, the great algologist. Of our young friend and fellow-member, Dr Nichol, he has likewise spoken; and we have recorded in our minutes the sense we felt of his loss; but in speaking of him and of similar losses, I cannot refrain from uttering the reflection which has sometimes forced itself upon me, on the occasion of the death of some of those heroes of Science, who have long stood in the front rank, and, full of years as well as honours, have at last succumbed before the assaults of time,—that their removal was, perhaps, a less loss to Science than that of some promising young man just entering on his career. They are like old trees which stand out as great landmarks, but which have almost done growing. Their powers of work are nearly exhausted; while the fresh intellect, keen eye, and powers of labour of the young man, might justify us in anticipating a greater harvest from him, were he spared, than perhaps the giant could now produce. The loss of the great man is felt keenly by those who come in contact with him. His stores of information, applied by a profound and practised intellect, render his loss to them irreparable. To-day they might go to him secure of getting information on any subject they had on hand; to-morrow, not all the reading, nor all the correspondence with all the learned in Europe, could procure it. To them the loss is irreparable. But to you or to me, and the general scientific world, who had no access to his well-stored mind, and look for no new work from his pen, the loss is one of sentiment and feeling. In the pure practical, selfish point of view, the talented young man is probably the greater loss of the two. But in this practical and selfish light, a greater loss than either is that of the matured man, as yet in the full vigour of life, prolific in work, accomplished in science, and eager and zealous in its pursuit. And such a loss we have sustained since we last met. Arthur Henfrey, Professor of Botany in King's College, London (in which chair he succeeded Edward Forbes), has been taken from us in the prime of life and intellectual vigour, and in the full career of laborious and successful research. He was only thirty-nine years of age when he died on the 7th of September last—not a great space of time to acquire the position and to leave the numerous contributions to Science which he has done. His walk was specially vegetable physiology and histology. His contributions to the Royal and Linnean Societies of London were numerous and valuable; the last of which is a paper in this year's Proceedings of the Linnean Society, on the Morphology of the Balsaminaceæ. Not his last literary bequest, however; for he was in course of contributing papers on Vegetable Structure to "The Journal of the Royal Agricultural Society of England;" and the last proof-sheets of the second edition of his papers in the "Micrographic Dictionary" were only out of his hands a few days before his death.

Such, gentlemen, are the losses by which the past botanical year has been distinguished. Let us now turn to the more cheerful side, and reckon up our gains. In doing so I shall pass lightly over the not light labours of descriptive and of systematic botanists. Hooker, Bentham, De Candolle, Lindley, Miers, Bennett, Anderson, Berkeley, with many others, are ably continuing their labours in this department of botany. But time will not permit me to do more than merely notice the fact, that much progress has been made in this most important and most necessary, although rather dry branch of our science. Neither shall I have to detain you with a long list of new botanical works. In that respect, the year has not been fruitful. I see a new German book ("Die Pflanzendecke der Erde von Ludwig Rudolph," Berlin, 1859), which attracted my notice from being a sort of anticipation of one which most of us know is in progress by Professor Balfour and Dr Greville,—a Climatic Flora; showing the character impressed upon different countries by the vegetation peculiar to them. It is illustrated with a number of coarse woodcuts, representing the different regions referred to. It shows that the idea has got abroad, or has originated in other minds besides those of our friends; and suggests the desirableness of pushing on more rapidly the work to which we all look forward with so much pleasure.

But if little has been done this year in the way of producing botanical works of a general nature, a great deal has been done in the way of procuring materials for such works in the future. Much new material regarding the Flora of special regions has been published; many short notices of new plants have appeared; and various accounts of the results of public and private expeditions have either already been published, or shortly will be so. It will, I hope, not be uninteresting to the Society, if I give a hasty notice of what has been done in this way. But, first, I would direct your attention to the fact, and claim your mutual congratulations upon it, that by far the greater portion of this work has been done by members of this Society, and men educated in this school. In every one of the public expeditions which have been sent out by Government, the post of Naturalist is filled by one of our body. Of the expedition up the Niger, Dr Balfour Baikie is Chief. In the United Presbyterian Mission at Old Calabar, which, although not a public scientific expedition, has assumed so much scientific interest and importance in the eyes of the public as almost to be looked upon in that light, we have no less than three members of this Society zealously working for us—Mr Baillie, Dr Hewan, and the Rev. Mr Thomson. In Livingstone's Expedition to the Zambesi, we have Dr Kirk and Mr Bankes, the former of whom, at least, we know to be an alumnus of this school; and in Captain Palliser's Expedition to the Rocky Mountains, Dr Hector is Geologist and head of the Naturalist Department. And these are not our only members who are ably working for us abroad. I shall, as I go along, have occasion to refer to others.

I shall now, following the sun round the globe, give a short summary of the progress which has been made in our knowledge of Geographical Botany during the past year.

In Europe, few new discoveries have been made; and in Britain, I believe, none. There may be one or two additions made to our Flora by the discovery of some minute cryptogamic plants which have escaped my notice; but I have better authority than my own (my friend, Mr M'Nab's) for saying that nothing of any moment has been added to our Flora. In Africa, a great deal has been done, although little has yet been published. Mr Charles Barter, of the Niger Expedition, had addressed two letters (dated January and March 1859) to Sir William Hooker, giving an interesting account of the vegetation of tropical West Africa. These letters have been published in the Linnean Society's Proceedings of this year, but I do not find much that is new. He states that orchids were very scarce; aquatic plants, which might have been expected to be numerous, were not found to be so. His list only contains thirteen, among which is the *Papyrus antiquorum*. In regard to the economic expectations from the vegetation of Africa, he says, "Too much must not be expected of Central Africa as a cotton-producing country; the plant needs more moisture than it would obtain in much of the land of the interior, and water-carriage should never be far distant in a country where all loads are conveyed by canoe or on the heads of men and women. There is plenty of available land near the sea and by rivers; the great valley of the Niger would alone yield an enormous supply. It is here cotton must be looked for, and its growth encouraged. The great plains of the interior are almost as useless in this respect as Sahara itself."

During upwards of two years' exposure to the climate, Mr Barter enjoyed excellent health under the most peculiar and trying circumstances; and it is only recently that the news of his death has reached England, from a rapid attack of dysentery at Rabba, and while surrounded with comparative comforts—the first death that has occurred (such has been the care and attention devoted to health) among Dr Baikie's small party. Mr Barter's place has been supplied by the appointment of Mr Gustave Mann, who is to sail for Lagos on 24th November.

Of the Old Calabar station, the fruits are only now beginning to come in,—zoology having taken precedence of botany in the interest of the missionaries. They are now making up for lost time, and both specimens in spirits and living plants in Wardian cases (as well as seeds) have been liberally sent home. The information received from these proves of much importance, and puts us right on some points in which we had fallen into error from imperfect materials. The entire history and structure of the poison-bean is now known, and will, I hope, be described by Professor Balfour either here or in the Royal Society this winter. There are other novelties to be described; and when the seeds and the contents of the Wardian cases develope themselves, there will be still more.

Dr Livingstone's expedition does not seem to have yet reported progress on botanical points. But passing on to India, a good deal has been done. Those of you who heard Dr Hunter's exposition to the Society last winter, and Dr Cleghorn's papers read, will readily admit that the economic department is in good hands. I also notice a valuable and interesting paper by another member of this Society, and an alumnus of this school, in the Journal of the Asiatic Society of Bengal, No. II., 1859, entitled "Notes on the Flora of Lucknow, with Catalogues of the Cultivated and Indigenous Plants," by Thomas Anderson, M.D. This paper has especial value as regards the geographical distribution of plants in India, inasmuch as the author has specially distinguished those plants which have been introduced from those which are wild. This has hitherto been greatly neglected. A botanist coming to India, and finding an Indian plant growing in any locality, is very apt to set it down as indigenous to the spot, although, in point of fact, it has been introduced from some other parts of India by the natives into their gardens, from which it has escaped in consequence of boundaries being broken down and the gardens abandoned,—the luxuriant soil and climate of India being peculiarly favourable to such naturalization. Dr Anderson, in eliminating the genuine wild plants of his district from those introduced or cultivated, has performed a most useful service to the Indian botanist, and his example will doubtless be followed in other parts of the Peninsula. Dr Lindley has also, in the Linnean Society's Transactions, given a valuable contribution to the Orchidology of India.

I must not omit to record a work on the Mosses of India by Mr Mitten—a laborious work, but one labouring under the disadvantage of want of plates, an auxiliary almost essential in all minute natural history researches.

Much has been done during the past year in zoology in the Indian Archipelago; but an equal return has not been obtained by botany. Still, if she has had less interest in the scientific researches in that quarter, she has not had to mourn, like zoology, the murder of her votaries; and only grieves for the loss of Mr Motley on grounds common to all humanity.

Passing to Australia, we find that the labouring oar there has been taken by Dr Mueller, Government Botanist for the colony of Victoria. He has contributed several papers to the Linnean Society during the past year, the chief of which are contributions to the knowledge of the Acaciæ of New Holland, and a monograph of that curious tribe of plants the Eucalypti. Besides these, he has made a report to Government on the plants collected during Mr Babbage's expedition into the north-western interior of South Australia in 1858; and he has published the first parts of a separate work on the plants of Australia.

Returning northward by New Zealand, I may notice a paper by Mr Ralph on the Tree-ferns of New Zealand. And proceeding onwards to China, we find Mr Bentham revising some parts of his Hong Kong Flora; but since Mr Fortune's last expedition, there has been an intermission in the receipt of botanical novelties from that quarter. Japan, however, makes up for China.

Japan is the country to which all eyes are now turned. This so long hermetically-sealed kingdom is at last opened. The merchant is rushing to it with his commodities, doubtless to meet the usual fate of new markets—wealth *primis venientibus*—a glutted market and ruinous depreciation to those who follow. The naturalist is preparing to follow—nay, has already tasted of the long-forbidden fruit. The Russian expedition which concluded the treaty betwixt Russia and Japan had with them a naturalist, M. Gashkevitch, who made considerable collections, a portion of which has been described and published in the Russian scientific journals, but the larger portion was lost in the shipwreck of the Russian frigate Diana, consequent upon a terrible earthquake. Other collectors have been more fortunate, and the botany of that region has been so far explored as to allow Dr Asa Gray to give a most interesting and valuable report upon it in the "Memoirs of the American Academy of Arts and Sciences," New Series, vol. iv., and abridged in the last number of "Silliman's Journal." I call this paper most important, not only on account of the interest which attaches to Japan at present, but from the philosophic spirit in which he uses his materials, and the important inferences which he draws from them in regard to two most interesting questions now occupying the minds of men of science—the mode of distribution of species, and the question of the origin of species; and as I have come to a different opinion from him on more than one of these points, I shall take the liberty to point them out to you. From Dr Gray's observations, it appears that, notwithstanding the comparative proximity of Japan to Western North America, there are actually more of its species represented in far distant Europe than in that country; also,—showing that this difference is not owing to the separation by an ocean—that far more Japanese plants are represented in Eastern North America than in either. And if, instead of looking at representative species, we regard the identical species only in the several floras, the preponderance is equally against Western as compared with Eastern North America, but is more in favour of Europe; for the number of Japanese species given by Dr Gray as also found in Western North America is about 120; in Eastern America, 134; in Europe, 157.

In relation to this, Dr Gray further states that he had already pointed out, in his "Statistics of the Flora of the Northern United States," "*1st*, That a large proportion of extra-European types found in America are shared with Eastern Asia; and *2d*, That no small part of these are unknown in Western North America. But," he goes on, "Mr Bentham was first to state the natural conclusion from all these data—though I know not if he has ever yet published the remark—viz., that the interchange between the temperate floras even of the western part of the Old World and of the New has mainly taken place *via* Asia. Mr Bentham also calls to mind how frequently large American genera (such as Eupatorium, Aster, Solidago, Solanum, &c.) are represented in Eastern Asia by a small number of species, which gradually diminish, or altogether disappear, as we proceed westwards towards the Atlantic limits of Europe; whilst the types peculiar to the extreme west of Europe (excluding, of course, the Arctic flora) are wholly deficient in America. These are among the considerations which suggest an ancient continuity of territory between America and Asia, under a latitude, or at any rate with a climate more meridional than would be effected by a junction through the chains of the Aleutian and Kurile Islands."

So far Mr Bentham; but Dr Gray adds—"The deficiency in the temperate American flora of forms at all peculiar to Western Europe is almost complete, and is most strikingly in contrast with the large number of Eastern American forms repeated or represented in Eastern Asia." "Let it also be noted, that there are even fewer Western European types in the Pacific than in the Atlantic United States, notwithstanding the similarity of the climate."

Now, I pray you to observe, that in Mr Bentham's remarks he is not speaking of identical species—for it will not be denied that the number of identical species found in America, and also in Asia, is very exceptional, and in drawing general conclusions, it is always best, in the first instance, to put exceptional cases out of view—but he is speaking of representative or congenerous species; and although Dr Gray is perfectly alive to the difference between the argument drawn from an identical species and one drawn from a congenerous species, he draws the same inference from congenerous species that he would have done from identical. At one place he says—"The discovery of numerous closely related species, thus divided between two widely separated districts, might not, in the present state of our knowledge, suggest former continuity, migration, or exchange; but that of identical species, peculiar to the two, inevitably would." And yet not half a page distant he says—"That representation by allied species of genera, peculiar, or nearly peculiar, to two regions, furnishes evidence of similar nature, and of equal pertinency with representation by identical species, will hardly be doubted." Now this I utterly and wholly deny. I have satisfied myself, and I trust before I have done I shall be able to satisfy you, or at all events I shall be able to make you understand the grounds which satisfy me, that the distribution of identical species and the distribution of congenerous species are wholly different things, and not necessarily either subject to the same laws, nor necessarily furnishing evidence of similar nature and equal pertinency. My view is, that the identity of a species is proof that it has somehow migrated from one of the places where it is found to the other; but that the presence of a congenerous species is merely the evidence that similar conditions of life, at the period of their creation, prevailed at the spots where congenerous species were created. Given the same physical conditions in all respects at two different places, say Australia and Japan, I hold that the creative product will be typically the same,—not that the species will be identical, but the type will be the same. Of course this does not affect nor take from the value of the inference of *connection* to be drawn from the fact of two places having had similar physical conditions. On that argument Mr Bentham and Dr Gray may be right—probably are right; but I object to the inference being drawn from the existence of congenerous species in different places, as if that, *per se*, indicated anything. It is the cause of these congenerous existences which may be used as an argument, not the existences themselves. Such abstraction from the argument being made, I might legitimately argue that the very reverse of the course of immigration or distribution indicated by Dr Gray and Mr Bentham was the true one—that the connection was between America and Europe, and not between America and Asia; for Dr Gray tells us that the identical Japanese species which occur in Europe are 157; in Eastern America, 134; in Western America, 120. The natural inference from this, if no other facts come to derange our calculation, is, that these plants have come from Japan to Western America *via* Europe—that is, first to Asia, then to Europe, then to Eastern America, and last to Western America. I do not give any opinion as to this, however. I wish merely to endeavour to adjust correctly the principles on which the reasoning is to be conducted.

Another point on which I suspect I differ from Dr Gray is on the origin of species. He does not commit himself to them; but from the terms in which he speaks of the views of Darwin and Wallace I should incline to reckon him a supporter of them. It is an exceedingly interesting and important subject, and well worthy of our devoting a few minutes to see how it stands, which I the more readily do, because it gives me an opportunity of saying a word or two in explanation of the feelings which induced me to accept the honour of being your President, when your kindness put it within my power; for you are not to suppose that I have sat in this chair for the last twelve months without frequent qualms of conscience as to the propriety of so imperfect a botanist as I am occupying it, whilst so many who are much better qualified in that respect sit around me. I assure you that I have not accepted it in the confidence of self-sufficient ignorance. I am perfectly aware of my deficiencies—much more so than you can be who know less of them—but it appeared to me that the science of Botany was so closely connected with the allied natural sciences, that it might tend to the advantage of both were the cords of attachment drawn nearer, by a President more familiar with one department being occasionally chosen to preside over the other. A similar course has at times been followed in our fellow Society, the Royal Physical; and I felt that, with such a Vice-President as Professor Balfour to support and prompt me, I might gratify my own feelings by accepting the honour, and occasionally, perhaps, be of use in bringing zoological facts to bear upon botanical questions. The present is a case in point, and, I think, well shows that, in considering any subject of philosophic moment relating to Botany, Zoology must not be left out of view. The position of the matter is this:—Last year, Sir Charles Lyell and Dr Hooker brought before the Linnean Society certain papers, which, by dint of pressure, they had prevailed upon Mr Darwin to allow them so to use, containing his and Mr Alfred Wallace's views on the origin of species. These papers consisted of an uncompleted essay by Mr Darwin, not originally intended for publication; a letter from Mr Darwin to Dr Asa Gray, the gentleman of whom we are now speaking; and a paper on the same subject by Mr Alfred Wallace, who had, independently of Mr Darwin, come to similar conclusions. These were, that there was no limit to the varieties which might proceed from species; that the breeding of domestic animals had shown the extent to which this might be carried; that these varieties become permanent; and that, under favourable circumstances, the variety might deviate so far as to constitute a new species; and that the mode in which such new species might be supposed to take its ground was not according to Lamarck's hypothesis, that the supposed wants or longing of an animal ended in producing the required or desired structure. To use Mr Wallace's words—"The powerful retractile talons of the falcons and the cat tribe have not been produced or increased by the volition of these animals; but among the different varieties which occurred in the earlier and less highly organised forms of these groups, *those always survived longest which had the greatest facilities for seizing their prey.* Neither did the giraffe acquire its long neck by desiring to reach the foliage of the more lofty shrubs, and constantly stretching its neck for this purpose, but because any varieties which occurred among its antitypes with a longer neck than usual *at once secured a fresh range of pasture over the same ground as their shorter-necked companions, and on the first scarcity of food were thereby enabled to outlive them.*" (Wallace, p. 6.) With a limited number of very curious facts, which I have not space here to notice (but which all appear to me to be disconnected with the theory by the absence of some link), and with an unlimited amount of time, these gentlemen think they have succeeded in giving, in this way, a clue to the origin of species; and, of course, if it is once admitted as possible to a small degree, there is no reason why it may not be extended to the whole. The theory has excited much attention. It is unnecessary to say it is a most important one. Sir Charles Lyell has formally given in his adhesion to it, in a speech which he made at the meeting of the British Association in Aberdeen; and Mr Darwin has in the press a volume treating of the whole subject; for it will be observed that the hints thrown out in these Linnean Society Papers are very brief, and merely indicate their authors' views on one or two points of a great question, leaving the greater part untouched on. I happen to know, however, from a friend who has seen the proof-sheets, that the views entertained and arguments relied on by Mr Darwin in his book are the same as those in his paper, more expanded and better illustrated; and as my objections go to the root of his theory, I may, without waiting for the book, indicate one or two zoological facts which appear to me to be inconsistent with it. In the first place, the theory, if good for anything, must be universal. It must not be merely one of several ways, or one of two ways, of creating species; or, at all events, if it does not apply to genera (though where the line is to be drawn I cannot see), it must be the way which is followed in those cases of congenerous species to which we have been alluding. With them, at least, it must be the sole way, if it is a way at all; and, in truth, Mr Darwin and Mr Wallace do not seem to shrink from this inference; for Mr Darwin says—"Each new variety or species, when formed, will generally take the place of and exterminate its less well-fitted parent. This I believe to be the origin of the classification and affinities of organic beings *at all times*." Assuming, then, the position to be, that this is *the* way in which species are created, or rather developed, if I can point to any instance where a congenerous species exists under circumstances where access to its allied species is morally impossible, I should say the theory must fall. In a paper on an allied subject, now in the press for next number of the "Edinburgh Philosophical Journal," I notice several of such instances. The most striking, and the one which, to my mind, at once disposes of the whole matter, is the existence of species of the same genera of eyeless insects, existing in the vast subterranean isolated caves of Carniola, allied, and exceedingly closely allied, to similar species in the caves of Hungary—to similar but different species in the caves of the Pyrenees—to similar but different species in the caves of Auvergne—and, more than all, to similar but different species of the same genera in the Mammoth Cave of Kentucky. Each of these sets of caves has a different set of species, of the same genera, and all very closely allied. The physical condition of the place being the same, the product has been the same; but not by immigration, nor any means of distribution which we can imagine, can identical species—(for, remember, the theory implies that congenerous species are identical species, or, what is the same thing, their descendants)—be found in caves so widely separated; and it is not the common case of congenerous species found very wide apart, which yet may have traversed the intervening space, because these insects are found nowhere but in the caves, and not in them until you have penetrated far into the interior, usually about a couple of miles. Another instance may be drawn from our own coast. We have a small beetle which lives here between high and low water-mark (*Æpus fulvescens*), between the leaves of shale. A closely allied form, but quite distinct (*Thalasobius testaceus*) is found in like circumstances on the coast of Chili. Here there is like physical condition, and like product. Take another case—although, perhaps, scarcely so isolated as these two. Of late years, ants' nests have been found to contain a considerable number of species of beetles which live with the ants, are often excessively like them, and sometimes are unprovided with eyes. The same peculiarity prevails here—allied species, and nothing but allied species in ants' nests wherever they are. For instance, among the beetles so found is the curious genus *Paussus*. Seventy or eighty species of *Paussus* are now known, and all are inmates of ants' nests, and confined to them. Species have been found in these localities in Spain, in Natal, in Hong Kong, in India, in Australia, and so on. Here, again, like physical condition, like product. I might draw similar illustrations from the parasites in bees' nests and wasps' nests. Further, it were easy to draw abundance of proof of the fact that congenerous species are at all events always found in similar physical conditions of life. Dr Gray allows this, although he applies the fact differently from me. He says—"Whether or not susceptible of scientific explanation, it is certain that related species of phænogamous plants are commonly associated in the same regions, *or are found in comparatively approximate (however large) areas of similar climate.*" But I must not dwell longer on this subject. It is a very suggestive one, and readily leads one away to meet or consider objections or difficulties which will occur to any one who thinks over it; and I would only beg any of you, who may think they see a flaw in my theory, not to take it for granted that I have not an answer for it. Perhaps, when Mr Darwin's book appears, I may examine the matter more in detail in another paper, either here or elsewhere.

Another very interesting topic, closely related to this, is also discussed by Dr Gray in this valuable paper. It is the inquiry into the distribution of the ancient flora of the northern half of the globe, as connected with its present distribution. Starting with the fact, which is now pretty generally admitted, that the present vegetation is not of recent creation, he sketches, in a clear and plausible manner, the probable geological changes which have taken place since the Tertiary Period, tracing the variations or oscillations which the climate, and consequently the ancient flora, would sustain. But for this I must refer you to the paper itself. I do not know whether his views of the antiquity of our present vegetation are accepted to their full extent by botanists in general; I rather think they wait for further information. He seems to rest them chiefly on the investigations of Mr Lesquereux, who conceives that he has identified in the tertiaries and subsequent deposits many of our present trees. For instance, in the tertiaries of Vancouver's Island, he identifies the *Sequoia sempervirens*—a tree now found ten or fifteen degrees further south—and one which grows to as great a size as the *Wellingtonia gigantea.* But I must leave Dr Gray, and hurry on to a conclusion.

Crossing from Japan to North America, we have Capt. Palliser's British North American Exploring Expedition, to which, as already mentioned, our member (Dr Hector) is Geologist and Chief Naturalist. A French gentleman, M. Bourgeau, acts as Botanical collector to the expedition; and two letters, respectively of June and October 1858, from him to Sir W. Hooker, are published in last year's Linnean Society Proceedings. They are not without interest, but I do not find anything of particular novelty. The information, both as to the plants and country, quite corresponds with what we know of them from Jeffrey and other sources. A table of the temperature of the earth and of forest trees, made at Fort Saskatchewan, furnishes data which may be useful to the generaliser.

A vast number of new pines have been described, or rather, I should say, announced under names, during the last year or two. These are chiefly from Mexico; and although many may be new, I have no doubt that a still greater number will turn out to be mere varieties or synonyms. The Botanic Garden here is, I may observe, not only well supplied with the cones and leaves, &c. of the Californian and other pines, but also has an exceedingly good collection of fine, healthy growing specimens. These unfortunately, however, are confined to one or two small plots, which might, perhaps, hold two or three examples of the trees when they reach their full size, but of course are quite inadequate to contain anything like the crowd now packed in them. Space must be had for them; and I do hope that Parliament may, in another year, be concussed into doing something for this most urgent object. But it is obvious that this will only be done through force of concussion and external pressure. Members must remember that the Botanic Garden is not a matter alien to them. Next to the University, they may be said to be the parties who have the greatest interest in its prosperity; and I would remind them, that so long as they choose to continue members of this Society, it is their duty to exert themselves on behalf of the Garden. I scarcely think that the members of societies now-a-days sufficiently consider the obligation which they undertake by joining them. They get themselves proposed and are admitted, pay their fees, and think that that is all their part of the contract—in consideration of which they have the privileges of members, come to our meetings when they see any paper in the billet which takes their fancy, and in all other respects conduct themselves as if they were no more members of the Society than of one at the Antipodes. But I should wish much to get them to look at it in another light. I should like them to think that they are part of the Society, and that the Society is part of them; and that it is not optional with them, but a real matter of duty to push on, support, and sustain it by every means in their power. I am not so wild as to dream of introducing the laws of the Oineromathic—poor Edward Forbes's early chivalrous association—in which everybody was to help everybody, under every circumstance, in purse and person. But it is not utopian to expect members, who feel themselves qualified for it, to take the trouble of giving us occasional papers—and I know several in this Society who might well do it, and do not;—it is not utopian to expect one and all of us to exert ourselves to add to the stores of the Museum—although here, I must admit that this duty is more conscientiously performed; and lastly, and what specially led me to speak upon the subject, it is not too much to expect us, one and all, to clamour loudly and perseveringly, at every fitting season, and at every fitting place, for a more liberal support from Government to the Garden and its Officers.

Gentlemen, I think I have completed the hasty survey of the globe which I undertook, for all that South America has contributed during the last year need not detain us; and in concluding, as the term of my Presidency expires this evening, I have only now to thank you most cordially, in the first place, for having honoured me so highly as to place me in this chair; and in the next place, for the uniform kindness and forbearance which you have extended to me in my imperfect efforts worthily to fill it.

The following communications were read:—

I. *Letter from* Dr John Kirk, *Physician and Naturalist to the Livingstone Expedition, relative to the Country near Lake Shirwa, in Africa.* (Plate VII.)

Senna, May 11, 1859.
On board Steam Launch.

My dear Dr Balfour.—From our former letters you may have heard of the difficulty we found in ascending the Zambezi. With the present steam-boat it is quite impossible; the water is confined when low to a deep, narrow canal, as it passes the hills of Kauvabassa; it is then quite out of the question to attempt passing. Dr Livingstone and I have examined that region on foot, and found many rapids—one of great size, which seemed to be a fall of 30 feet at an angle of 30°. The only hope is at flood; then these rapids, being from 80 to 100 feet under the surface, become smooth; and what seems necessary is a boat with power sufficient to make headway in this deep part, for to pass among the shallows which then exist at the sides would be dangerous from cross currents and rocks. This part of the river is 30 miles in length. Dr L. has applied for another boat; if the Government grant it, we shall try what we can do during the next floods in December or March.*

This delay has been in so far fortunate, at least it has not been lost time. Some of the party are at Tette, working out the coal district. Dr Livingstone and I have had a wandering time; we have been down to the sea; up Meramballa, a mountain near the Zambezi, in sight of Senna, of 4000 feet high, the summit and slopes being a regular botanic garden, where during the ascent you pass from the grassy river-banks to forests abounding in orchids, gingers, balsams, and ferns. As you ascend the vegetation changes; you meet with trees not so tall as those of the base, and Dr Livingstone observed that many were identical with those of the high lands of Londa in the west. We had here the Leucodendron and the common Pteris. On the top there is a great plateau, divided by ridges and peaks, with a varying elevation from 3000 to 4000 feet; it is well watered by springs, and the crops of maize are excellent. Lime trees grow wild in the woods. Here is a fine, cool, healthy climate, within sight of the town of Senna; yet it is doubtful whether the Portuguese ever were there—it is a region quite unknown to them. The river Shire flows on the west side of this mountain; it is a fine river for navigation; we could get no information regarding it. The Manganja people, who dwell near the mouth, have been a complete barrier to the Portuguese, and likewise to those of the interior. The only means of transport by water is in canoes; and the Shire being deep and flowing quickly, with very few eddies of slack currents, it would be difficult to manage the unwieldy canoes of the country; and those in them would be as completely in the power of the people as if they travelled overland. The case is otherwise with us; we pass with ease; no care is needed; there are few shoals, and the natives themselves soon see that their poisoned arrows would be nothing against guns when we are afloat out of range. We land daily to cut wood, and find that if one has no fear of them there is no danger. They have never molested us, as we are the stronger; their poisoned arrows would do very little against rifles and revolvers. They have learned to distinguish between the Portuguese and English, and do not attempt the impositions they practise on the native hunters, such as taking a tooth and half the flesh of the elephants killed.

The Shire flows for 100 miles nearly north, in a plain of about 20 miles wide; there is a district near the middle which is marshy and cut up into islands, overrun by elephants; but the greater part is fine land for the growth of cotton, sugar-cane, and rice. All these are now cultivated, and we can see at once the capabilities of the country. The cotton is of two sorts; one very fine, and of good staple. The sugar-cane is chewed, but the people do not know the art of extracting the sugar.

* We are happy to say that the Admiralty have granted a vessel.

Two crops of maize are obtained each year; and probably many other crops might be grown during the cold season, such as wheat. On either side are mountains; those of the north-east reaching 4000 feet. This would be a healthy position for Europeans. These high lands also yield crops of cotton, sugar-cane, and cereals, with various kinds of pulse, but more care is needed for their growth than in the valley. It seems a great thing to have this healthy region so near the coast, with a rich plain of enormous extent, and a navigable river leading, without obstruction, to the sea.

Dr Livingstone and I started again in April, to explore the region to the north, following the Shire overland, for navigation was checked by a rapid, where it curves from among the mountains. We took with us a strong party of Makololos. so as to be independent of the natives, who will not dare anything unless against the weak. They are great cowards, unlike the Landeens and Kaffirs of the south. We had some idea of preparing the way for reaching the great lake, whence it seems probable the Shire takes its rise. For many days we wandered over a most rugged country. The people gave us no assistance, so that we often made a long road, which, had we known the general features of the country, would have been easy. However, it is only what all first explorers must expect. At length, however, we reached a plain which the river crossed to the east. For the 30 or 40 miles we had passed, the river flows between hills over a rocky bed, and is a series of cataracts, one after another. On reaching the plain, we struck across for a mountain opposite, called Dzomba, whence we hoped to have a view which might guide us in our future course. Here we met with native slave traders who, when they thought us Portuguese, looked on us with jealousy and without much fear; when they knew better, they seemed to expect that we should attack them and take off all the slaves. The English name is known far beyond where Europeans have ever penetrated. It took us long to cross this plain, although only 15 miles across. We were led astray by the people under the influence of these traders. We had in the end to take our own way, as we had done in the former part, and cross the hills opposite. Here we found a high plateau, with a totally new vegetation; a most interesting region, which I hope to explore more fully. The flora of Meramballa was but a slight indication of what we find here. To the east we had another plain, bounded on the other side by blue hills, and in it we could just distinguish a sheet of water. Our course now was for it. The information we received led us to believe that it was of great extent. On the 18th of April we got to the shore, and had before us one of the finest sights I ever beheld; an enormous expanse of water narrowing to the south, but reaching 30 miles in that direction; about 25 or 30 miles across to the north, we had a water horizon like the sea, and even from considerable heights nothing more was to be seen. There are in this lake many islands, with high mountains on them, and inhabited. The people tell us, that in a storm there are great waves, and we could see them breaking against one part of the shore. The water of this lake is bitter to drink; several rivers flow into it, but none out. The Shire never crosses the hills which we had passed, but keeps on the other plain, and is said to come from another lake, which they call the great lake or the Lake of the Stars, "Ninyessi."

This is called "Shirwa," and reaches to the north for at least 50 or 60 miles, being separated there from the "Ninyessi," by a piece of flat land, not many miles across. We waded in until the water reached our waists, in hopes of reaching a point whence we could take observations on the sea horizon, but the grass and reeds extended still farther, and we had to return covered with leeches. We had for guides then some of the slave party, and the people of the country said that they had led us off the proper path which goes to the bank in order to drown us. However, we got back all right; and that evening found it was in lat. 15° 23′ and long. 35° 35′. Having now seen this great lake, we thought we could not do much more at present. Here was a navigable inland sea, leading up to the great lake, of which rumours have for long reached us, and for which Captain Burton is now in search. We were rather anxious, too, for those in the vessel which we had left in the Shire, under the Quartermaster and Second Engineer, who were acting alone this trip.

On our return, we followed a different route, which took us over a high plateau, between 3000 and 4000 feet (the lake was 1800 feet above the Shire). This elevated region came down near to the Shire, and we found the path much easier than that by following up the river.

This seems to be a healthy part. We were out 23 days, and very seldom slept under cover; we were wet every morning with dew, and our clothes dried as we marched in the burning sun. Yet we were never delayed a day by the sickness of any one of the party, although often fatigued by evening with the heat and heavy road. The marches appeared short when we came to correct them by observation; but they generally took us from sunrise to sunset, with only an hour to breakfast, and a rest of a few minutes about noon.

As to the geology of the country, it is all schist rocks, with a few spots of trap and porphyry. The strike is north and south. There is abundance of iron ore, which the natives reduce for knives, spears, and arrowheads. They also trade in hoes for cultivating the soil, with the neighbouring tribes.

The people are all "Manganja;" speak a modification of the language of Tette and Senna. The women are distinguished by the most repulsive of savage ornaments, a ring of ivory or bamboo, like a ring for a table napkin, in the upper lip; the lip being distended round the circumference, and projecting like a duck's bill.

Their religion is pure deism; they believe in a god and in medicine, or the ordeal which he directs as the means of discovering crime; if it cause vomiting, it shows innocence; if it acts by the bowels, crime, and they are put to death. But the doctors have a good knowledge of which to give, for there are different plants used. The only thing coming near to an idol which we heard of was the keeping the soul of their father in a basket, which they bring out when they get drunk with beer; but we could never get them to show it to us. When dead, they turn to lions and other beasts; only witches are made into crocodiles.

On our return the Quartermaster was sick, but beginning to recover; he had been down with fever ever since we left. He is now better.

We are on our way to the mouth of the river to meet a man-of-war, with stores. We hear that the party at Tette have had a good deal of sickness; but the unhealthy season is quickly passing.

Daily exercise is absolutely necessary for health out here.

Dr. Livingstone and I have had fortunate health all along, although constantly in the most malarious districts, such as the Mangrove swamps of the Suabo, or the low lands of Senna and marshes of the Shire; out the whole day in the sun or rain. I believe the exercise more than counterbalances all these. One day when exposed to the sun, dissecting a young elephant, I found I could not stand it at all; had I been walking I should not have felt it.

We are not without our own politics here, even in this outlandish place. The slave-trade goes on briskly from one of the mouths near Quillimane, to supply the demand at Bourbon. Those in power being of the French party, wink at it. The authorities are poorly paid, and have to make it up by other means. Trade is difficult; they lay themselves out for nothing but ivory and gold. They might have cotton and sugar, and that without the use of guano, as is required in Mauritius, and by the very hands they ship off to the French. The whole of Suabo, at the mouth of the river, is splendid cotton and cane land, and in the hands of the Portuguese. Those up the Shire are quite beyond their power; and even at Shupenya, near Senna, they have to pay tribute to the Landeens. They have last autumn finished the war with Mariano, who set himself up as independent; but there is still a great robber within a few miles of the town of Tette, which every canoe must pass on its way to Quillimane. We expect the Governor-General of the Province here immediately; he comes to establish his brother at Tette, as Governor of a new district which they call Zambezia, and which was formerly under that of Quillimane. We shall feel the want of Senhor Tito, the former commandant, who ought to have been made governor; he is the best man for it. We shall have to change our quarters, being at present established in the Residency at Tette.

II. *On the Morphological Import of certain Vegetable Organs.* By CHRISTOPHER DRESSER, Ph.D.

The author gave the results of his investigations into the morphological import of certain vegetable structures, especially those entering into the composition of the flower.

He commences his argument by contending that bud-scales, or *Perulæ*, are in many instances not metamorphosed leaves, but merely flattened petioles. He appeals to examples in *Acer* and *Æsculus*, where not unfrequently the bud-scales are furnished with small laminæ at their extremity, while they themselves remain unaltered. This proves, he considers, that the bud-scales are not metamorphosed or rudimentary entire leaves, but only represent petioles.

The tubercular papilla at the point of the normal bud-scale, and which is the first part that appears in its development, suffers what he terms a quasi-paralysis, or arrest of development; while, in the abnormal examples cited, this arrest does not take place, but the papilla proceeds to be developed into a lamina, as in the true leaf—the so-called transmutation in these instances resulting only from a more or less complete evolution of this papilla.

The author then endeavours to prove that the *Calyx*, in many instances, is a whorl of petioles—laminæ, in these cases, not entering into its composition. He refers, *1st*, to the calyx of lavender, where one of the sepals develops a little lamina, which is more or less completely articulated to it; *2d*, to the calyx of *Mussænda macrophylla*, where one sepal develops a lamina, while the other sepals, which are normal, are precisely parallel to the petiolar portion of the developed one; and lastly, to the monstrous calyx of a rose (which was exhibited), where from the sides and apex of the sepals, leaflets in various states of development were seen to spring, while the sepals themselves retained more or less completely their flat, phyllous, and conical normal form; in this instance the sepals are not *transmuted* into true leaves, but leaflets are developed upon their sides. This mode of reasoning is the same as that by which the *Phyllodium* of the acacia is universally regarded as a leaf-stalk, simply because a compound leaf is sometimes emitted from its apex.

Regarding *Petals*, the author adduces the following:—That petals continually become sepals in monstrous flowers, and this most commonly in flowers whose sepals have most manifestly a petiolar origin, as in roses; again, that in the *Caryophyllaceæ* flowers occur having petals with the most fully developed and clearly defined claws and limbs, while in those plants the leaves are so constantly sessile as to afford a characteristic of the race. From these circumstances he infers that in some cases, probably in roses, the petals result from petioles; whereas in other cases (as in the Caryophyllaceæ) they result from entire leaves. He does not, however, consider that, in these latter plants, the claws and limbs of the petals correspond to petioles and laminæ. "It seems contrary to reason to suppose that all the normal leaves of the plant should be sessile, as well as the leaves composing the outer floral envelope (the sepals); whereas the members of the inner floral envelope (the petals) should be raised upon long stalks."

Regarding the *Stamens*, the author urges arguments similar to those applied to the petals. The stamens may pass through the stages of petals and sepals, so "that whatever is the nature of the petal, such is the nature of the stamen also." Moreover, that in plants with sessile leaves, the filaments and anther cannot correspond to petiole and lamina. He also refers to a monstrous stamen of *Tradescantia virginica*, where one-half of the stamen was converted into a petaloid member, which extended from the base of the filament to the summit of the anther, indicating that here the *whole stamen* corresponded to the sessile petal, and that there was thus no distinction, in this case, into petiole and lamina.

The author inclines to the belief that the carpel is in some cases equivalent to a petiole, from the fact that in certain cases monstrous carpels develop their ovules into rudimentary leaves. He does not, however, insist strongly upon this point, since he does not think it yet proved that ovules may not be true buds.

Professor Balfour read the following letter, which he had received from Sir Thomas B. Hepburn, Bart., of Smeaton:—

I wish to call your attention to what seems to me to be peculiar in the mode in which the *Sequoia* or *Taxodium sempervirens* sheds its leaves.

The leaves themselves do not fall, but the small branchlets drop off as if each branchlet was a pinnate leaf. I have not observed this remarked on in any descriptions of the tree which I have seen. I send a fresh extremity of a branch, and some of the fallen branchlets, which will show you what I wish to describe better than I can do it in words. The tree from which the specimens were taken was planted a small seedling in 1844, and is now about 28 or 29 feet high. Its mean annual growth for the last five years up to December 1858 has been about feet 4 inches. It has not yet blossomed.

8th December 1859.—Professor BALFOUR, V.P., in the Chair.

The following Gentlemen were elected Fellows of the Society:—

As Resident Members.

R. J. B. CUNYNGHAME, Esq.
DYCE DUCKWORTH, Esq.

As Non-Resident Member.

WILLIAM KEDDIE, Esq., Lecturer on Natural Science.

As Foreign Member.

DANIEL JEROME M'GOWAN, M.D., Ningpo, China.

The following Office-bearers for the ensuing year were elected:—

President.

Professor ALLMAN.

Vice-Presidents.

Dr W. H. LOWE.
Dr SELLER.
ANDREW MURRAY.
Professor BALFOUR.

Council.

FINDLAY ANDERSON.
J. G. BOOTH, Jun.
GEORGE S. LAWSON.
Dr JOHN CLELAND.
A. J. MACFARLAN.
THOMAS BARCLAY.
JOHN M. HUNTER.
Dr JOHN SIBBALD.
JOHN ANDERSON.
WILLIAM IVORY.

Honorary Secretary..........Dr GREVILLE.
Foreign Secretary............Dr DOUGLAS MACLAGAN.
Auditor......................WILLIAM BRAND, W.S.
Treasurer....................PATRICK NEILL FRASER.
Artist.......................NEIL STEWART.
Curator......................ALEXANDER DICKSON.
Assistant-Secretary } ....JOHN SADLER.
Assistant Curator }

Mrs Wrench, Mary Cottage, Trinity, sent for exhibition specimens of various seeds gathered in the Hebrides. 1. *Entada scandens* and *Dolichos urens* from Uist; 2. *Guilandino Bonduc* from Eigg. These seeds are used as a charm for cow ailments, being put into the water-troughs. 3. A peculiar seed from Barra, marked with a cross. It is used by the Romanists for devotional purposes, being set in silver and worn round the neck.

Mr Paterson of Restalrig Park exhibited a specimen of *Solanum capsicastrum*, a Brazilian plant, covered with orange berries as large as a small marble. The plant was originally cultivated in the Berlin garden. It does not appear to have poisonous qualities.

The following Donations to the Society's Library were announced:—

Journal of the Royal Dublin Society for October.—From the Society.

Du froid Thermometrique et de ses relations avec le froid Physiologique dans les Plaines et sur les Montagnes, par Charles Martins, Montpellier.—From the Author.

The following Donations to the Museum at the Botanic Garden were noticed:—

From Mrs Professor P. Smyth—Cones of *Pinus Cembra*, from St Petersburg.

From Mr P. S. Robertson, Trinity Nursery—Cones of *Picea Pinsapo*, from Ronda, Spain.

From Dr John Imray—Opalised wood, and fruits of *Sloanca* and *Sterculia*, from Dominica.

From Mr William Gorrie, Bangholm—Rice prepared by the natives at Lake Alabasca from *Zizania aquatica;* also cones of *Pinus Banksiana*, *Abies rubra*, *A. nigra*, and *Larix* sp. (?); all from the neighbourhood of Lake Alabasca.

From Mr Wm. Ramsay Macnab—Pyroxyline, or gun cotton, used in making the collodion employed for surgical and photographic purposes, when dissolved in ether and alcohol; also specimen of *Otiorhynchus sulcatus*, Fab., a beetle, the grub of which has recently been destroying ferns.

The following communications were read:—

I. *On the Anæsthetic Effects of Chloroform, Ether, and Amylene, on Sensitive Plants.* By JOHN S. LIVINGSTON.

After explaining the method employed in performing the experiments, Mr Livingston proceeded to detail such of them as were of a typical character.

The anæsthetic influence it was found proceeded from leaf to leaf invariably in the descending order, and it very rarely happened that the leaf above the one acted on was at all disturbed. This effect was first observed by Professor Marcet of Geneva, and communicated by him in a paper to the Société de Physique. To whatever source this singular phenomenon might ultimately be traced, whether to a susceptibility of the descending sap for transmitting narcotic effects, or to the existence of some yet undiscovered organ which had that power, the fact was, at all events, beyond dispute.

To set aside any source of fallacy, and subject this fact to as severe a test as possible, the rootlets of the sensitive plant (*Mimosa pudica*), were carefully exposed, and doses of chloroform, ether, and amylene given, in order to see whether it was not possible in this way to induce a propagation of the influence upwards. In every case in which any effect was exhibited, it invariably proceeded downwards. When ether and amylene were employed, no effect was produced; but in the case of chloroform, instead of the narcotic influence attacking first the leaf nearest the roots, as one would expect *à priori*, it passed by four of the leaves, and appearing first at the fifth, proceeded downwards till the first was reached.

De Candolle, in his "Physiologie Vegetale" (ii. p. 866), mentions some experiments made by him with sulphuric and nitric acids, on a sensitive plant, by which it was shown that these acids cause a folding of the leaves and a dropping of the petioles in an ascending order. These experiments had been repeated, and found substantially correct. A drop of sulphuric or nitric acid when placed on the lowermost petiole caused all the leaf-stalks to fall much below a right angle.

Of the three anæsthetic agents employed, amylene was found, on the whole, to act most powerfully on sensitive plants. With it the petioles always dropped down to more than a right angle with the stem, while with chloroform that was rarely the case. With both, the petioles dropped gradually and evenly, unlike what they did with ether, in which case the petioles literally fell down to a degree beyond that with amylene and chloroform. The following difference was, however observable:—In the latter two the falling of the leaf-stalks was always accompanied by folding of the pinnæ, while with ether that was not the case, showing that with it the effect was more local. When amylene was employed, the recovery from anæsthesia was very speedy compared with what it was when chloroform or ether was used. Moreover, the pinnæ, when touched with amylene, folded from apex to base with an increasing rapidity, till they sometimes became confused. This was very unlike the regular, and, if we may so call it, deliberate folding that took place with chloroform. With amylene, however, the pinnæ were always closely appressed, while with chloroform they were rarely so. With ether the effect did not show for some seconds, the number of which constantly varied.

II. *On the Primary Use of Ammonia in Vegetable Nutrition.* By Major John H. Hall.

The importance assigned to nitrogen in agricultural chemistry in the present day is a fact well known to all. It has come to be taken as the ultimate measure of the value of organic manures, and an analysis is not considered complete without specifying the quantitative amount of nitrogen which a manure contains. Observation of the avidity or capacity for ammonia which plants universally manifest has no doubt originally led to the conclusion that it contains something which must be highly beneficial in the economy of vegetable life. As ammonia is composed of hydrogen and nitrogen, the selection of the latter ingredient as the measure of value to the disregard of its other constituent, expresses a positive view or theory asto nitrogen being the all important element in ammonia which renders it so essential in the growth of plants. But I have never met with any satisfactory explanation of the grounds on which this estimate of the value and importance of nitrogen rests as an element of vegetable nutrition. I think that the true measure of the requirements by plants of any given substance should be found in the amount in which the substance enters into their composition. Now, an examination of the chemicalc onstituents of vegetable substances shows that nitrogen enters very partially into them. Thus some of the most abundant of vegetable substances are entirely destitute of nitrogen. Cellulose, the structural basis of the roots, stems, leaves of plants, contains no nitrogen. Starch, gum, sugar, wax, oils, resins, some of the most abundant of vegetable products, are also destitute of it. Gluten is almost the only form or combination in which nitrogen occurs in plants, and it exists in them in small and variable quantities—in the seeds and fruits of some, and in the leaves of others; and it occurs for the most part in these plants and their products which constitute the food of man and animals, while the chemical constituents of plants fail to give evidence of their having any very great capacity for nitrogen. On the other hand, chemical experiments show the presence of hydrogen in every kind and form of vegetable matter. Its universality is on a par with that of carbon, and it is a remarkable circumstance, that it preserves a close relation with that substance, and generally follows it in the variations of its proportions in vegetable substances. These considerations led me to the conclusion, that the primary use of ammonia in the vegetable economy must be to supply hydrogen, to form in conjunction with carbon the hydro-carbonaceous material which forms the basis of all vegetable structures and productions, and that this alone can explain the reason why plants manifest such a universal avidity or capacity for ammonia. Not that I would question for a moment the concurrent use of ammonia in furnishing nitrogen to whatever extent the special requirements of particular plants may render necessary; but, looking to the very limited and partial extent in which it is found in vegetable productions, I apprehend it can never account for the universal capacity of plants for ammonia; and it seems to me, to say the least, a transposition and misuse of terms—the substitution of the minor and partial effect for the major and universal one—to regard ammonia only with reference to the constituent which has the least place in the vegetable economy, and to overlook that one which, equally with carbon, constitutes the universal pabulum of the vegetable creation. Major Hall then exhibited two plants of spinage, one of which had been watered simply with the common water of Edinburgh, and the other with a solution of carbonate of ammonia, and pointed out the great size which the latter plant had attained when compared with the former. The effects he endeavoured to trace mainly to the hydrogen in its combination with carbon.

Several members expressed doubts as to the correctness of Major Hall's conclusions, and pointed out the presence of nitrogen in the protoplasm or formative matter of plants as having been overlooked by him. It was stated to be the general belief of vegetable physiologists that no active cell-formation could go on without the presence of nitrogen, and that ammonia, whether in the atmosphere or in manures, was valuable in supplying this.

Dr Balfour exhibited a stem of *Astrapœa Wallichiana*, yielding a large quantity of mucilage. When the stem is cut and put into alcohol the exudation of this mucilage becomes very evident.

Dr Balfour also noticed that some stems of the Banana in the Botanic Garden, when allowed to dry after being cut down, showed a large quantity of white crystals on their surface. These had been analysed by Dr Simpson in the University laboratory, and had been found to consist of chloride of potassium.

Dr Maclagan, Berwick, sent roots of an elder tree, taken from a water-pipe, accompanied with the following note:—"The enclosed production was brought to me by the Superintendent of Works here. When moist it was much more bulky, but the radicles very brittle. It occupied and completely obstructed the main six-inch water-pipe, leading from the reservoir into the town of Berwick. The pipe is eight feet deep, and covered over with clay-puddle, through all which, and through some fissure at a joint, the small rootlet had penetrated. I asked what were the nearest plants, and found that two elders were suspected of being the culprits, and that they had been accordingly eradicated."

12th January 1860.—Professor Allman, President, in the Chair.

The following Gentlemen were elected Fellows of the Society:—

Christopher Dresser, Ph. D., St Peter's, Hammersmith.
John M. Ballantyne, Esq., jun., Dalkeith.
Dr James M'Bain, R.N.
Rev. Robert Hunter, late of Nagpore.

The following Donations to the Society's Library were announced:—

Observations on the Distribution and Habits of Pelagic and Freshwater free-floating Diatomaceæ, by Dr G. C. Wallich.—From the Author.

Siliceous Organisms found in the Digestive Cavities of the Salpæ, and their relation to the Flint Nodules of the Chalk Formation, by Dr G. C. Wallich.—From the Author.

Botany, as an Ally of Medicine, by Dr George S. Blackie, Nashville, Tennessee, U.S.—From the Author.

Lever's Year-Book and Railway and Mining Almanac for 1860.—From the Author.

Journal of the Proceedings of the Linnean Society, Vol. III., No. 12; Vol. IV., Nos. 13, 14, 15; and No. 2 of Supplement to Proceedings.—From the Society.

The following Donations to the Museum at the Botanic Garden were noticed by Professor Balfour:—

From Captain Archer—Collection of Seeds from Barbadoes.

From Professor Balfour—A beautifully-marked specimen of Lepidodendron and Lepidostrobus, from Dalkeith Coal-Measures.

From Andrew Murray, Esq.—Cones, wood, and bark of *Wellingtonia gigantea;* cones of *Pinus Benthamiana*, *P. Lambertiana*, and *P. Murrayana;* cones and wood of *Abies Douglasii.*

The following communications were read:—

I. *Sketches of Caithness and its Botany, with a List of the Phanerogamous Plants and Ferns.* By ROBERT BROWN.

This paper was the narrative of a botanical tour made in the autumn of 1859 in the County of Caithness, the Flora of which is by no means well known.

The author, after giving an outline of the physical geography of the county and sketches of its scenery, proceeded to describe its vegetation. The only indigenous trees of Caithness were stated to be *Populus tremula*, *Betula alba*, *Corylus Avellana*, and *Pyrus aucuparia*, and it was remarked that the specimens of these were comparatively stunted.

The county however appears at one time to have been covered with forests, numerous trees being annually dug up in the bogs. Trees, when planted, require to be protected from the sea breezes. The common crops of the fields (fenced into octagons, hexagons, heptagons, squares, and triangles, by what the geometry of the farmer accounts straight lines of upright flags) are excellent clover, grass, turnips (introduced within the last forty years), barley, bere or big (*Hordeum hexastichon*). Potatoes were only introduced about one hundred years ago; and though now extensively cultivated, were at first, for a number of years, limited to gentlemen's gardens. Before the introduction of potatoes, most of the ground now appropriated to them was devoted to the cultivation of cabbages, which constituted the principal vegetable food of the poorer classes. The common culinary vegetables grow well; but fruit trees, unless protected by a high wall with southern exposure, produce but indifferent fruit. Most of the crops are considerably later in coming to perfection than in the southern counties. For some time after Mr Brown arrived (July 31st), the hedges were pink with the wild roses, the haymakers were busy at their work for about three weeks, and the crops were not begun to be generally cut until the 1st of September. On Dunnett Links, the bent (*Ammophila arundinacea*) is instrumental in preventing the sand from blowing inward as formerly, spreading desolation for a great distance around. Many of the wild plants are applied to economic purposes—for instance, the pith of the common rush as wicks for the oil-lamps of the peasantry; heather for mats, ropes, &c. The number of the wild plants enumerated by Mr Brown was 419, exclusive of those introduced,

&c., and about 29 well-marked varieties; but probably the number might be considerably increased. Mr Robert Dick of Thurso had been examining the Flora for many years, and to him, along with Mr C. W. Peach of Wick, the well known naturalist, the author had to tender his best thanks for the valuable assistance they had given him in drawing up this paper.

The following species are not noticed in Mr Watson's most valuable "Cybele Britannica" (vols. 1–4), as occurring in his "North Highland" province—(Ross and Cromarty, Sutherland and Caithness). Those regarding which further researches would be desirable are marked with a point of interrogation:—Ranunculus bulbosus, Papaver Rhœas, Plantago Coronopus (ballast), Cardamine impatiens (?), Viola odorata, Drosera intermedia, Tilia parvifolia, Hypericum humifusum, Prunus avium, Pyrus Malus (Westfield), Berberis vulgaris (hedges), Ribes alpinum, Saxifraga tridactylites, Ægopodium Podagraria, Valeriana dioica, Hieracium prenanthoides, Hieracium boreale, Antennaria dioica, Petasites vulgaris, Polemonium cæruleum? (outcast), Convolvulus sepium, Veronica polita, Myosotis palustris, Anagallis arvensis, Salsola Kali (ballast), Rumex sanguineus, Potamogeton plantagineus (?), Luzula Forsteri (?), Carex teretiuscula, Alopecurus fulvus, Alopecurus agrestis, Avena pubescens, Arrhenatherum avenaceum, Glyceria distans, Bromus sterilis, Hordeum murinum, Lastrea Fœnisecii, Equisetum umbrosum (common). The following may be also noticed as being species extending far north in Scotland, and not perhaps hitherto recorded in Caithness:—Ranunculus hederaceus, Arabis hirsuta, Barbarea vulgaris, Sisymbrium Sophia, Silene inflata, Lychnis vespertina, Hypericum quadrangulum, Erodium cicutarium, Geranium dissectum, Spartium scoparium, Prunus Padus, Geum urbanum, Alchemilla alpina, Pyrus Aria, Saxifraga stellaris, Sanicula europæa, Chærophyllum temulum, Myrrhis odorata, Sambucus Ebulus, Sherardia arvensis, Tragopogon pratensis (Reay Links), Hieracium vulgatum, Hieracium umbellatum, Carduus heterophyllus, Aster Tripolium (Mr Peach, Wick), Pyrethrum Parthenium, Scrophularia nodosa, Anchusa sempervirens, Pinguicula lusitanica, Lysimachia nemorum, Habenaria bifolia (Peach), Juncus balticus, Carex distans, C. limosa, C. pilulifera, Sesleria cærulea, Kœleria cristata, Festuca bromoides, Cystopteris fragilis, Asplenium Ruta-muraria, Isoetes lacustris.

Besides these there were noticed several other plants, which, though they have no effect in a phyto-geographical point of view, are yet interesting; such as—Draba incana, Vicia Cracca, Rosa canina (*b.* sarmentacea, Woods), Parnassia palustris (very common), Hieracium vulgatum (*c.* maculatum, Gm.), Cichorium Intybus (outcast), Antennaria dioica (*b.* norvegicum, Jacq.), Tussilago Farfara, Arctostaphylos alpina (Ben Shurraii), Menyanthes trifoliata, Nepeta Glechoma, and Ajuga pyramidalis—banks of Thurso River (common), Myosotis cæspitosa, Primula Scotica (very common), Euphorbia Helioscopia, Listera cordata, Potamogeton crispus, Sparganium simplex, Carex acuta, Hierochloe borealis (banks of Thurso River), Asplenium Filix-fœmina, *b.* rhæticum (Roth.), *c.* molle (Hoffm.), Osmunda regalis, Lycopodium annotinum (Dr Thomas Anderson, at Morven). Many of those last have not been published as having been noticed in the county, so little has the botany been attended to by publishing naturalists, although the geology and zoology of the district have furnished valuable additions to the British Fossils and recent Fauna.

The author had not attended particularly to the cryptogamic botany of the county, although this department would reward research. Such lichens as Bæomyces roseus, Parmelia saxatilis, Parmelia physodes, Borrera tenella, Ramalina scopulorum, Lecanora subfusca and tartarea, Lecidea æruginosa, &c., are common.

II. *Notice of a Physiological Peculiarity in a specimen of* Tropæolum majus. By CHRISTOPHER DRESSER, Esq. Communicated by ALEXANDER DICKSON Esq.

The author recorded a phenomenon which he had observed in a plant of *Tropæolum majus* growing in a damp part of one of his greenhouses. A pendant shoot of this plant had by accident become so much bruised and constricted, at a point about twelve inches from its extremity, as to prevent the transmission of sap from the root to the extremity of the branch, the terminal portions being connected with the rest of the plant merely by a fragment of withered bark and dried wood. This terminal portion, instead of presenting the very slight hairiness found in the ordinary state of the plant, had become extremely villous, the leaves being densely covered with white-looking hairs, so as to be quite velvety. The hairs were more densely congregated on the leaves than on the axis, and more so on the distal younger portions than on those nearer the seat of stricture,—this latter circumstance, probably resulting from the hair not being separated by the expansion of growth. The hairs on the petioles measured about $\frac{1}{15}$th or $\frac{1}{20}$th of an inch, being rather longer than those on the laminæ. The hairs were equally distributed over both surfaces of the leaf, and appeared to be a little longer on the veins.

The author alludes to the power possessed by hairs of absorbing dew, &c., and concludes that this portion of the plant had for weeks been nourished by the agency of these hairs; also that these organs were developed specially for the accomplishment of this end, since, in the ordinary condition of this plant, the hairs are extremely small and not numerous.

The author draws the inference that hairs are of little value as furnishing specific characters, since certain plants at least can and do protrude hairs under certain conditions.

III. *Notes on Californian Trees.* By ANDREW MURRAY, F.R.S.E. PART II. Plates VIII., IX., X., XI.

WELLINGTONIA GIGANTEA. The Mammoth Tree.

(Woodcut, and Plates VIII. and IX.)

The history of this long-lived tree has been so fully detailed by the various authors who have noticed it, and more particularly by Dr Seemann, so recently as March last, in the "Annals and Magazine of Natural History," that I should not have thought of including it as one of the subjects of my notes, were it not for the sake of some photographs of the tree sent me by my brother, copies of which will, I feel sure, be acceptable to the public.

It is so far well that the possession of these photographs should have in a measure constrained me to include a notice of this tree in my list, as most certainly notes on Californian trees, without any notice of the *Wellingtonia*, would have been as bad as "Hamlet with the part of Hamlet omitted." But I have little new to say regarding it, and I only offer, as a pendant to the sketches I have given, a short *resumé* of what has been already published by others, and most of which has been collected by Dr Seemann, to whom I offer my acknowledgments for the use I have made of his able paper.

The tree is said to have been first seen by the unfortunate Douglas in his Californian explorations; but this has now been shown to be a mistake. The route by which he travelled is perfectly known, and he never came within a hundred and twenty miles of any of the known examples of *Wellingtonia*. What he saw was *Sequoia sempervirens*, as may be otherwise inferred from the terms in which he speaks of it. The real *Wellingtonia* was first discovered by Mr Lobb, and introduced into this country in 1853, and described by Dr Lindley in the "Gardener's Chronicle" in that year. An ancient Californian tradition, of nearly ten years' existence, ascribes its discovery to a Mr J. M. Wooster, as one of the trees in the Mammoth Grove bears on its bark the inscription of "J. M. Wooster, Ju. 1850." Of course it had been discovered in a literal sense long previously by the Californian aborigines; but as priority of discovery depends upon priority of publication, they must give way; and as Mr Wooster's publication, at the best, can only be looked upon *as a manuscript notice*, we must, under the rules which regulate priority in such matters, hail Mr Lobb as first discoverer, although admittedly he himself was directed to it by general rumour current among the European settlers.

Dr Lindley is still more undeniably the first describer, and the name given by him to the tree (*Wellingtonia gigantea*) has of course precedence over all others. Notwithstanding this, the Americans made a strong effort to change the name into one bearing reference to Washington. As Dr Seemann tells us, "they even commenced in their newspapers an agitation against the adoption of the name *Wellingtonia*, quite ignoring that the savans of their country bow to the same code of scientific laws which govern the conduct of their European brethren, and that no amount of popular clamour could cause the right of priority here at stake to be set aside. When, therefore," says he, "Dr Winslow exhorted his countrymen in grandiloquent language to call the mammoth tree, if it be a *Taxodium*, *T. Washingtonianum*; if a new genus, *Washingtonia Californica*; he simply proclaimed to all the world that he knew nothing whatever of the laws governing systematic botany." Perhaps the reader may like to see a specimen of the style under cover of which Dr Winslow proposed to effect this act of appropriation. It reads more like a speech concocted by Dickens for Mr Jefferson Brick than a real true *bona fide* speech. But I beg to assure them the article is genuine. It is as follows:—

"The name that has been applied to this tree by Professor Lindley, an English botanist, is *Wellingtonia gigantea*. By him it is declared to be so much unlike other coniferæ, as not only to be a new species, but to require description as a new genus. Other botanists of eminence think differently. To this, however, he has seen fit to apply the name of an English hero, a step indicating as much personal arrogance or weakness as scientific indelicacy; for it must have been a prominent idea in the mind of that person that American naturalists would regard with surprise and reluctance the application of a British name, however meritoriously honoured, when a name so worthy of immortal honour and renown as that of Washington would strike the mind of the world as far more suitable to the most gigantic and remarkable vegetable wonder indigenous to a country where his name is the most distinguished ornament. As he and his generation declared themselves independent of all English rule and political dictation, so American naturalists must in this case express their respectful dissent from all British scientific stamp-acts. If the big tree be a *Taxodium*, let it be called now and for ever *Taxodium Washingtonianum.* If it should be properly ranked as a new genus, then let it be called to the end of time *Washingtonia Californica.* The generic name indicates unparalleled greatness and grandeur; its specific name, the only locality in the world where it is found. No names can be more appropriate; and if it be in accordance with the views of American botanists, I trust the scientific honour of our country may be vindicated from foreign indelicacy by boldly discarding the name now applied to it, and by affixing to it that of the immortal man whose memory we all love and honour, and teach our children to adore. Under any and all circumstances, however, whether of perpetuity or extinction, the name of Wellington should be discarded, and that of Washington attached to it and transmitted to the schools of future ages."

Does the reader concur with Dr Seemann in thinking that all that this gentleman, who is so sensitively alive to the feelings of delicacy, shows in this oration, is ignorance of the laws governing systematic botany? With great deference, it seems to me to show an ignorance of something much more important—viz., ignorance of the first principles of common honesty. The appropriation in this instance would have been a double theft, first of the honour or right to his own appellation, which belongs to every sponsor; and next of the happy idea which led Dr Lindley to consecrate this grandest of trees to the grandest of our national heroes. As Messrs Sang and Co., nurserymen, Kirkcaldy, say, in an exceedingly neat and comprehensive account which they have published of the tree and its history, if the Americans want such a memorial for *their* great man, let them discover and describe their big trees for themselves. This attempt at appropriation, however, has failed. The better class of American botanists have repudiated it, and in a few years the name *Washingtonia* will have passed from the memories of men, except as a scientific, or rather *unscientific*, synonym.

Doubts, however, have been cast upon the distinctness of *Wellingtonia* as a genus, which, if well founded, might deprive us of that name. True, Dr Seemann, who is next in priority, has attempted to save it by condemning the specific name *gigantea*, as already preoccupied, and substituting *Sequoia Wellingtonia* for *Wellingtonia gigantea;* and his reasons for holding that the specific name *gigantea* has been already misapplied by Endlicher seem probable enough ; but I trust we shall not require to settle this point. The genus seems perfectly good—as good, indeed, as any genus in this difficult and closely allied group of trees. The authors who have maintained that *Wellingtonia* and *Sequoia* are not generically distinct are Dr Seemann, Dr Torrey, and M. Decaisne. I am not aware that any other botanists have adhered to their views; but they speak with confidence, and would seem to imply that if Dr Lindley, at the time he proposed the genus, had had the materials which we now possess—(the male catkins are, I believe, what is referred to)—he would not have erected the tree into a separate genus; and hence, that we may infer that he now abandons it. They do not say this in so many words, but it is what one would naturally infer from Dr Seemann's expressions. On such a point as the soundness of the genus, it becomes me, a mere amateur in botany, to speak with great diffidence; but there is nothing which I have learned with more certainty from my zoological studies than that, in determining what elements are to be considered of generic value, no one set of characters can be wholly relied on. It is a just appreciation and balancing of the whole which leads the naturalist to a right conclusion. If he rests his views entirely upon one class of structure (whether it be the reproductive, the digestive, the respiratory, the vascular, the nervous, or the osseous systems) to the exclusion of the others, he will fall into error. And it must be the same with the botanist: if he builds his genera solely upon the reproductive organs, neglecting the respiratory (I mean the foliage), as I think has been done by Dr Seemann and Dr Torrey in this instance, I should anticipate that he must fall into error. In *Wellingtonia gigantea* and *Sequoia sempervirens* the difference in the foliage is most marked. Were there no other character to distinguish them, I should hold this to be sufficient. But with a just distrust of my own opinion in such a matter, I have applied to Dr Lindley himself to know whether any change has taken place in his views in consequence of the light thrown upon the subject by the additional materials, and the additional views (whose value I am far from depreciating) thrown out by the gentlemen I have named; and Dr Lindley has had the kindness to inform me, and allows me to inform the reader, that he has seen no reason to change his opinion. His letter is as follows:—

"Acton Green, Turnham Green, London, W.,
"5th January 1860.

"My dear Sir,—Notwithstanding the criticisms of M. Decaisne, Dr Torrey, and Dr Seemann, I adhere to my opinion that *Wellingtonia* is necessarily distinguished from *Sequoia*, unless all the modern dismemberments of the old genera, *Pinus*, *Cupressus*, and *Thuja*, are to be cancelled—a measure in which I should not concur. It has not a little surprised me to find gentlemen who have no objection to offer to *Abies* as distinguished from *Pinus*, *Sequoia* itself from *Taxodium*, *Selaginella* from *Lycopodium*, *Lastrea* from *Aspidium*, *Leskea* and *Neckera* from *Hypnum*, and so on, nevertheless opposing the establishment of *Wellingtonia*. Surely systematical naturalists must allow, that, as structure becomes simpler and simpler, so must distinctive characters be sought in smaller and smaller differences. To apply the method of classification suitable for *Rosaceæ* to such an order as the coniferous seems to me unphilosophical.

"I therefore presume to differ from the authorities just mentioned; in doing which I am rejoiced to find that you agree with me.—Very truly yours,

"John Lindley."

The difference is no doubt not great; chiefly, as above mentioned, in the character of the foliage. The differences in any of the other characters might, I think, in themselves be viewed as only of specific value: the cones, for instance, in *Sequoia* are smaller and more rounded; the male catkins also are more rounded and expanded; but the foliage is the true distinction; and I think we may be very glad to get such a distinction, to break up the tribe of *Cupressus*, which is so difficult and puzzling to distinguish and classify.

Like a great many of the North-West American trees, the *Wellingtonia* seems to be confined to isolated patches. Indeed it is a curious fact (as pointed out by Alphonse Decandolle) that trees, as distinguished from other plants, generally have confined ranges.

The first place where it was found was at a spot called the Calaveros Grove (more recently the Mammoth-Tree Grove), near the head-waters of the Stanislaus and San Antonio rivers, in long. 120° 10′ W., lat. 38° N., and about 4590 feet above the sea-level. There the number of trees still standing amounts to 92. Two other localities are now known, one in Mariposa, and the other in Fresno county. The Mariposa grove contains about 400 trees, and the Fresno grove about 600; and it is from the former that the photographs which have furnished the accompanying plates have been taken. The tree is also said to have been met with in Carson Creek, a few miles to the north of Mammoth-Tree Grove; and Carrières stated that an officer of the French navy brought cones identical with those obtained in California from a latitude about ten degrees north of these localities, but the identity of these cones with those of the *Wellingtonia* has been doubted. It is said also to have been met with in various other parts of the Sierra Nevada; but if so, it does not there attain the gigantic dimensions of those in the groves above mentioned.

The tree is undoubtedly the largest and most magnificent known on the face of the earth. Its ally, the *Sequoia sempervirens*, is not far short of it in size, but still stands a little in the background. The average dimensions of both trees when full grown are about 300 feet in height and 90 feet in circumference. We have great difficulty in realising this immense height, and to assist us we must have recourse to other objects of comparison. To an Edinburgh man we have a very good one. The Gas Company's great chimney, although built in a hollow deep below Nelson's Monument, yet has its top 7 feet higher. Now it is only 329 feet high in all, including its pedestal, which is 65 feet in height; and as we shall presently see, one of these mammoth trees was actually 450 feet high, or nearly a third higher than that tremendous chimney. And Lord Richard Grosvenor, in a recent number of the "Gardeners' Chronicle" (7th January 1860), speaks of one he had just seen as 116 feet in circumference, and 450 feet high. It is taller than St Peter's, and little short of the height of the Pyramids. Another way of bringing home to our sensations an idea of the enormous size of these trees is that used by Messrs Sang. They calculate the quantity of wood in a tree, and its value at a penny per foot of inch deal. The result is L.6250 for a big one. What a nice little provision an acre of *Wellingtonia* would make for a younger son or daughter of the proprietor of an entailed estate!

Mr Lapham, the proprietor of the Mammoth Tree Grove, gives an interesting account, in the Kew Miscellany, of the dimensions of these trees. He tells us that most of the specimens now standing attain the average height of 300 feet; but one of them, known as the "Mother of the Forest," and stripped of its bark to the height of 116 feet for the purpose of being publicly exhibited, actually measures 327 feet in height and 90 feet in circumference. Enormous as these dimensions may seem, they are put in the shade by remembering what those of another tree must have been when in full vigour. This "Father of the Forest," as the specimen has been appropriately termed, has long since bowed his head in the dust, and now lies at length carelessly diffused. He still measures 112 feet in circumference at the base, and can be traced 300 feet where the trunk was broken by falling against another tree; it here measures 18 feet in diameter, and according to the average taper of the other trees, this giant must have been about 450 feet high, and was no doubt one of the loftiest vegetable forms of the present creation. A hollow chamber or burnt cavity extends through the trunk for 200 feet, large enough for a person to ride through. I may run shortly over the dimensions given by Mr Lapham of some of the other trees. "The Miner's Cabin" (for they have almost all received names) measures 80 feet in circumference, and is 300 feet in height. The "Three Graces," growing on one root, are 92 feet in united circumference, and 290 feet in height. The "Old Bachelor," which we are told is a forlorn-looking individual having many rents in the bark, and withal the most shabby-looking tree in the forest, is about 60 feet in circumference and 300 feet high. "Husband and Wife," leaning affectionately to one another, 60 feet in circumference and 250 feet in height. "Hercules," 97 feet in circumference and 325 feet high. "Addie and Mary" are each 65 feet in circumference, and 300 feet high. "Uncle Tom's Cabin," 75 feet in circumference and 300 feet high. They seem all to rise also like solid pillars, without a branch for nearly two-thirds of their height, often with furrowed bark, so as to look like fluted columns. The trees in Mariposa Grove are perhaps more various in point of age, but many of them do not fall much behind those of the Calaveros Grove in dimensions. One of those which I have figured from the photograph was 94 feet in circumference, and the butt, with the man leaning on it, shown in the woodcut placed at the beginning of this article, must have been still more. The smallest tree that could be found was 24 feet in circumference, and that of the next tree about 42 feet, and I shall tell the reader how I know.

My brother, last autumn, desired to obtain some seed of the *Wellingtonia* to send home. Now, this is not an easy thing. In the first place, the trees are greatly too high to allow of getting up them by any contrivance. I suggested flying a kite over them, and by that means getting a rope up the one side and down the other. Let any one fancy such an experiment being made over the Gas Company's chimney, and let him also fancy that after the rope was across, that he was the person to go up. I rather imagine he will not think it necessary for me to prove the inapplicability of my plan, unless, indeed, on the principle of hiring and sending out Steeple Jack (and he, poor man, I believe is dead, and has left no successor in his business). To cut down a tree was not impossible. It had been done already by speculators more than once to get a section for exhibition. I remember that in 1854 (shortly after the discovery of the tree), my brother was asked to get a slice of it (not less than 30 feet in diameter) for exhibition in the Crystal Palace, and between L.300 and L.400 were placed at his disposal for this purpose. He found, however, that such a slice could not be got for the money—more particularly one of the *Wellingtonia*, because it was far inland, and the expense of getting it down to the coast would have been tremendous. The *Sequoia sempervirens*, however, grows in some places down to the water's edge, and this might have been more easily managed, and indeed was managed by some speculators, who exhibited at Philadelphia a section 12½ feet in diameter, taken 25 feet from the ground, which formed the basis of Dr Asa Gray's calculations as to the age of the *Wellingtonia*, and misled him regarding it, first from its being the *Sequoia sempervirens* instead of the *Wellingtonia* ; and, second, from the heart of the slice having been burnt out or removed, probably for the purpose of lightening the weight in carrying it about. Another section, or rather semidiameter, truly of *Wellingtonia*, was examined by Dr Torrey, 11½ feet in semidiameter —*i.e.*, 25 feet had the section been complete. Dr Seemann quotes an account of the taking of these sections, which is worth re-quoting, were it for nothing else but the impression which it leaves of the enormous size of the trees:—"The earliest account of the mammoth tree," says he, "which reached Europe were coupled with the sad intelligence that a piece of Vandalism had been perpetrated in Upper California unexpected in our enlightened days. One of the finest trees of the grove, we were informed, had been felled for the purpose of being publicly exhibited. This individual was 96 feet in circumference at the base, and solid timber. The work of destruction commenced by boring with augers, and sawing the spaces between—a labour engaging 25 men for five days. But when this was done, the tree was found to stand so nearly perpendicular that it would not fall; and it was only by applying a wedge and battering-ram, during a strong breeze, that the trunk was finally upset. In falling it convulsed the earth, and by its weight forced the soil from beneath it, so that it lies in a trench; and mud and stones were hurled near 100 feet high, where they left their mark on the neighbouring trees. A section of 2 feet long taken from the stump, also a portion of the bark, were both exhibited. The success with which the public exhibition of those specimens in San Francisco, New York, and Paris had been attended, induced, in 1854, another speculator to strip a second magnificent tree, the 'Mother of the Forest,' already mentioned, up to a height of 116 feet, of its bark, fortunately without affecting by this ruthless process the vitality of the tree. It required the labour of five men 90 days. During this time, a person had a fall of 100 feet from the scaffolding, and, curiously enough, escaped with a broken limb. The bark was removed in sections 8 feet in length, and each piece marked and numbered, so that it could be put up in precisely the same position that it occupied on the tree. It was then, after being carted 80 miles overland, shipped down the river to San Francisco, and thence on a clipper vessel round Cape Horn to New York, where, after being exhibited for a season, it was transmitted to London, and was for the first time on view (April 1856) in the Philharmonic Rooms, and afterwards at the Adelaide Gallery. But both of these localities were too low to admit of the whole sections of the stripped bark being put up, nor indeed was there any other available building in the British metropolis which could serve this purpose. Fortunately, the Crystal Palace at Sydenham possessed the necessary height; and ever since the autumn of 1856 the whole of the bark, to the height of 116 feet, has there been exhibited."

These quotations sufficiently show that, if one chose to be at the requisite labour and expense of cutting down a tree bearing cones, seeds could be thus obtained; but an obstacle to this mode of procuring them exists in the care that is now most properly taken to protect the trees and prevent their being exterminated. One would think that the difficulty of felling them would in itself have been a sufficient protection; but it was not thought so. Dr Seemann says—"It was at one time feared that not many years would elapse before the last vestige of the mammoth trees would be destroyed. It was the 'New York Herald' which first pleaded for their protection. In Europe the danger in which the trees were placed was viewed with equal apprehension, inducing a correspondent of the 'Gardener's Chronicle' to suggest that a petition of the scientific men might be sent to the American Government, praying for the protection of this eighth wonder of the world. Fortunately, the authorities were fully alive to their duty, by prohibiting the removal of any tree under any circumstances whatever, and thus, by throwing the sanctity of the law around the hallowed grove, preserved to North America an object quite equal in grandeur to the famed Falls of Niagara, the Mammoth Cave of Kentucky, or the Natural Bridge of Virginia."

The result of this is, that the only way of procuring seeds is to shoot down the cones with rifle bullets, or to break off small branches in this way; and my brother succeeded in getting Mr Patrick Black, a young Irish gentleman admirably fitted for such work, to undertake the task of procuring some seeds for him. A first-rate shot, a keen sportsman, full of energy, whom nothing delighted more than the exhilarating life of a hunter camping out for weeks in the open air, Mr Black was quite the right man in the right place. Well supplied with ammunition, he took his departure for the Mariposa Grove, which is a long way in the outer world—not that it is without its own inhabitants, its own hotel (kept by an old hunter), nay, even its own authorities, as Mr Black had nearly found to his cost. He took up his quarters with the old hunter, who may rather be said to have kept *open house* than a hotel, as the sky was the only roof he had—a roof, apparently, not yet being considered essential to the comforts of a hotel in these parts, although one might have thought that it would, seeing that the forest is 6000 feet above the level of the sea, and there was frost every night while Mr Black was there.

He visited the grove daily, shooting down a cone or two to see that they were ripe before beginning to make his collection. He soon found, however, that it would take a battery of ammunition and an army of sharpshooters to make even a moderate collection of seeds. The seed is exceedingly small and thin, a mere scale, and the cone is also small (not much larger than the cone of an ordinary Scotch fir, and containing still fewer seeds), so that the product of a whole week's shooting might be held in one's waistcoat-pocket. Mr Black soon tired of this, and seeing one or two trees of less size than the others, and being apparently a man of a logical turn of mind, came to the conclusion, first, that it would be easier to fill his wallet by cutting down a tree than shooting down the cones; secondly, that it could be done; and, lastly, that as it could be done, it should be done; and being apparently also a man of a practical as well as of a logical turn of mind, he, boldly putting behind him the fear of the anathemas of the "New York Courier" and of the "Gardeners' Chronicle," as well as the nearer terror of the local authorities, at once, with the assistance of his host and two Frenchmen (that the three most civilised nations in the world might all be represented in the perpetration of the sacrilegious deed), proceeded to put his intent into execution. They first selected the smallest tree which they could find in the grove; it was 24 feet in circumference, and took Black and the hunter three days' hard work to level with the ground, one cutting on each side of the tree. Increase of appetite growing by what it fed on, another and another shared the same fate, until they had actually cut down four of these magnificent trees, the last and largest being 42 feet in circumference, which took a week to cut, and fell before the two Frenchmen; not, however, before the echoes of their axes reached the ears of Judge Lynch, who soon stopped the fun, and in simple but unmistakeable language gave him to understand that it would be "dangerous" to try it again. In plain English, the authorities interfered; and although they did not lynch Pat (which would not have set the trees up again), they told him that they would, if he cut any more. The time occupied in cutting down these trees would seem to indicate that that required to get the section of the tree at the Mammoth Tree Grove was either exaggerated, or unnecessarily long. Being twice the diameter, it might require four times the work; but twenty-five men for five days gives more than eight times the work. It also shows—what we see from the specimens of the wood itself—that the wood is extremely soft, very light, and easily worked, and not unlike the cedar-wood used for pencils; when freshly cut it is white, but speedily acquires the cedar hue. It is so *frush* (I am obliged to have recourse to a Scotch word to express my meaning, the English word brittle, which is nearest to it, scarcely conveying the full sense)—it is so frush, that one of the trees in falling snapped in three places before it reached the ground, carrying away whole forests of silver firs and pine before it; and we see from the figures of the trees which we already possess, as well as from the photograph of the group now appended, that a great proportion of them have been broken off near the top, so that if they had continued growing in the same proportion, they must have been nearly a third higher. But if the wood is frush, the bark is not. Our friends found it a great deal worse to cut through than the wood. It is tough and stringy like coir or the husk of a coco-nut, and is from a foot to a foot and a half in thickness. We have here one of those beautiful adaptations of structure to purpose which delight the mind to trace. It is obvious, that if the *Wellingtonia*, being so fragile, were coated with bark of only a common thickness and ordinary consistence, it could never live to be a tree; it would be snapped across by the first wind that blew, so soon as it reached a sufficient height to give the wind a hold upon its branches; but with a coating of bark so thick, so tough, so stringy, so spongy, and so elastic, it is kept in its place, and protected from its own fragility. It is the same principle which is adopted by ourselves in packing and supporting any thing that is fragile; and, as has been pointed out to me by my intelligent friend Mr Bryson, this support is given in the way which modern science has ascertained to furnish the greatest amount of strength with the least waste of substance. The bark is constructed on a different plan from that of most other trees,—it is on the plan of the corrugated roof, running longitudinally round the tree; the corrugated layers are composed of harder texture, and the interstices are packed with an elastic spongy substance.

Another adaptation of structure exhibited in this tree is the great gnarled expansion of its trunk at the base, which may be seen in the plate and vignette, thus supporting it against the wind by what may be styled a circle of buttresses.

I leave the reader to imagine the mingled feelings of dismay, chagrin, and satisfaction with which my brother greeted his triumphant emissary on his return (the *mens conscia recti* beaming on his face); and he now knows how I come to be able to give so accurately the dimensions of the *smallest* trees in the Mariposa Grove; as the lawyers say, "*causa scientiæ patet.*" The quantity of seed obtained, however, was by no means correspondent to the sacrifice made to obtain it. The cones on the trees would appear to have been comparatively few; and, as I believe is the case with other cypresses, the amount of light seed vastly preponderates. The whole quantity, good and bad, only amounted to between six and eight pounds; but as there are 50,000 seeds in a pound, the expedition has probably done more good than harm after all.

Another circumstance to be noted is, that the cone itself (that is, the woody part of the cone which envelopes the seeds) seems to be largely charged with a dark garnet or crimson-coloured gum. My brother, in sending me home the seeds, sent them carelessly cleaned, and a good proportion of what appeared to be seed was fragments of the cone itself; but in addition to that, there was no less than one-third part of the whole weight composed of this garnet-coloured substance, which had exuded from and had been rubbed off these fragments. My friend Dr Cleland has been kind enough to test it for me, and he informs me that it is entirely soluble in water; gives, with protosulphate of iron, a blue-black precipitate; with sesquimuriate of iron, a gray precipitate; and gives a precipitate with gelatine. It is thus a form of tannine, and may be called a sort of kino.

The portion of wood sent home by my brother gives me the opportunity of testing the calculations which have been made as to the age and rate of growth of the tree. It appears to have been taken from the exterior part of the tree, and contains 26 annular rings in an inch, in this respect nearly corresponding with the number recorded by Dr Torrey, as found by him in the outer part of the section he examined, where he found 20 annular rings in an inch. In his section the rings at the heart were found to be nearly twice as broad as they afterwards became. The first rings he found to be 6 in the inch, the last 20 in the inch; but immediately before the last 20, the rate was only 9 in the inch. The result to which Dr Torrey came was, that the tree was about 1200 years old, instead of 3000, as was at first improperly assumed, from reckoning only the outward rings, and taking it for granted that all the rings were of the same breadth. The tree, however, is obviously a fast-growing species, and has been shown by Mr Reed of Peterborough to make its growth between the hours of 6 P.M. and 6 A.M., and more rapidly or more slowly according to the warmth of the night. It is perfectly hardy in Britain, and has already reached the height of 14 feet at Martyr Castle, near Cork, and not much short of this both in England and Scotland, and has borne ripe fruit at Thetford in England. We may therefore reasonably hope that we shall ere long be independent of the sacred giants of the West for a sufficient supply of good seed. In the meantime we have the satisfaction of knowing that we can make plants by cuttings with the greatest facility; and what is most important in the great majority of cases, they grow erect and readily form leaders. Indeed, to any but a nurseryman's eye, it would often be difficult to distinguish between a seedling and a plant from a cutting of the same size. Should any of my readers like to be knowing on the subject, I would recommend them to compare the spread of the lower branches in the one with that in the other; it is not the cutting which usually has them broadest; but even this is a fallible test, depending greatly upon the kind of slip out of which the young plant has been made. This willow-like readiness to grow by cuttings is well seen, not only in the familiar fact above mentioned, but in various of the incidents which are to be observed in the Mammoth Tree Grove. Turning to one tree, the "Mother of the Forest," already mentioned as stripped of its bark to the height of 116 feet, we see it still flourishing, as we are assured by Dr Seemann. But I am inclined to think that the *Wellingtonia*, notwithstanding all its greatness, has no special exemption from the evil effects of girdling, and that by and by she will suffer from that fatal cause. But beside her lies her murdered lord, the "Father of the Forest," who we are told put forth several young shoots after he had been felled for some time; and there are few of her descendants standing around her in which great cavities (one as large as 17 feet across and 40 feet high) have not been burnt (either in consequence of fire raging through the forest, or kindled by Indians), and yet the trees do not seem to have suffered.

Dr George Lawson, in a paper which he read before the Edinburgh Botanical Society in March 1854, on the anatomical structure of coniferæ and other gymnosperms, noticed the microscopical structure of the *Wellingtonia gigantea.* He stated that he found it to present a double row of opposite discs, which, as well as their central dot, were elliptical. I have been enabled to verify Dr Lawson's observation through the kindness of Mr Bryson, who has made sections of the wood now received, and carefully examined them. He says, "I find the structure on the transverse section resembles very much the *Taxodium distichum* (deciduous cypress), although the reticulations are larger. The radial longitudinal section exhibits the coniferous discs perhaps better than any other wood I have examined. The discs lie side by side, and do not alternate as in the Araucarias; they are more oblate than in the true pines, and seldom occur in double rows; on an average 28 rows of discs occur between the walls of each cell. In *Taxodium distichum*, 20 rows obtain on an average." In *Sequoia sempervirens* the discs are round and not oblate.

Sequoia sempervirens, Lambert.

The incidental remarks which I have made upon this tree in contrasting it with the *Wellingtonia gigantea* have anticipated most of what I had to say regarding it. It was first discovered by Menzies in 1796, and is found as far south as the Santa Cruz mountains, near Monterey, as well as considerably to the north of San Francisco. The character of the tree is well described by Douglas, in the passage which has been supposed to indicate that he saw the *Wellingtonia.* "The great beauty of Californian vegetation," he says, "is a species of *Taxodium*, which gives the mountains a most peculiar—I was almost going to say awful—appearance, something which plainly tells us we are not in Europe." This of course refers to a tree so common as to give a tone to the general scenery of the country, which we know *Wellingtonia* is not, while the *Sequoia sempervirens* is. As already mentioned, it is nearly as large and tall as the *Wellingtonia.* One tree, called by the settlers the "Giant of the Forest," is 270 feet high, and 55 in circumference at 6 feet from the ground. It is known to the settlers as the red-wood—a name which I find appended to the *Wellingtonia* by Dr Seemann, but this is obviously an error, or a mere extension of the name, for the wood of the *Wellingtonia* has probably never been used for economic purposes by the settlers, while the other is largely used. It is of a beautiful red colour, fine and close grained; but light and brittle, like the *Wellingtonia.* It is good for purposes where it is exposed to water, as some of our own soft woods are, and is said never to be attacked by insects. Its bark is thick, and even in the young tree is soft and spongy.

There is another point regarding it worthy of being noticed—viz., its great probable age; I do not mean the age of the individual trees, although that is by no means contemptible—a slab of the wood deposited by Dr Fisher in the St Petersburg Museum, measuring 15 feet in diameter, and showing 1008 annual rings—but I refer to the age of the species. M. Lesquereux, who has paid much attention to the subject, conceives that he has identified this tree among the fossil remains of the tertiary deposits of Vancouver's Island. The idea that it gave a character to the landscape in these bygone ages, long before the eye of man was present to take cognisance of them, cannot fail to excite a feeling of interest even in the least poetic.

PINUS INSIGNIS, Dougl., *and* PINUS RADIATA, Don.

A suspicion has been gaining ground among botanists that—like many other pines which in their extreme forms look very distinct—*Pinus insignis* and *Pinus radiata* may be found to be synonymous. Hartweg seems to have had this in his mind when he named *Pinus radiata*, *Pinus insignis macrocarpa.* Mr Gordon, however, who in his recent valuable work on Coniferæ (the Pinetum) shows little inclination to spare doubtful species, decides in favour of their both being good; and as he does in this instance what he has usually abstained from doing, viz., gives a reason for his judgment, we are enabled to form an opinion for ourselves as to the correctness of the result to which he has come.

He says of *P. radiata:* "This beautiful pine resembles *P. insignis* in some respects, but differs very much in foliage and cones; the leaves of *P. insignis* are much longer and stouter than those of *P. radiata*, while the cones of *P. radiata* are nearly three times the size of those of *insignis* and with the scales much more elevated." Now, unless the difference in the length and stoutness of the leaves be very marked (which is not the case here), I think we can hardly attach much importance to this as a character. So much depends upon the health of the plant, the part of the tree whence the leaves are taken, &c., that the most different degrees of length and stoutness of leaf may be observed in the same tree. As to the cones, they certainly differ widely. I have received and presented to the Edinburgh Royal Botanic Garden Museum a branch encircled with a cluster of five cones, three of which are of *P. radiata* and two of *P. insignis*, each typical of the extreme form characteristic of the two so-called species—the only exception being that they are here both of the same size—about 4 to 4½ inches in length, instead of the *P. insignis* being 3½ and the *P. radiata* 6 inches in length, which are said to be their usual dimensions.

Both varieties are found in the same district (the Monterey district, to the south of San Francisco) and their general appearance and the colour of their foliage is the same. This we would perhaps not find out from Mr Gordon's description, because he calls the one deep grass-green, and the other deep green, a discrepancy in describing the same thing which must have escaped him, for he afterwards refers to Hartweg's description of the beauty of the "deep grass-green" of the foliage of the one which he had just described as deep green. It is very essential for a describer to take care that he always uses the same term or phrase to designate the same thing. I could point to many who actually go out of their way to find another word to express the same quality, intending thereby to escape the harshness of constant repetition. But people do not expect euphony in scientific descriptions; what they want is clearness, and how can that be obtained when different terms are used to express the same thing?

The specimen mentioned already as having been presented to the Botanic Garden will, I imagine, satisfy every one that these two names are only synonymes of the same tree, indicative of the different states in which it is found, owing probably to difference of soil, climate, position, &c.

Regarding, as I have done, *P. insignis* and *P. radiata* as one species, I may state that this tree has now been cultivated for a considerable time in Britain, and is greatly admired for its lovely green hue and soft foliage. Gordon says it is perfectly hardy. In the south of England it is undoubtedly so. It is a great favourite in Devonshire, where trees may be frequently seen between 30 and 40 feet high; and I believe there is a specimen in the garden of Messrs Lucombe, Pince, and Co., nurserymen, Exeter, which is nearly 50 feet high. It has not yet, however, been satisfactorily established to be hardy in Scotland. By care and protection it has been reared to a considerable height, but some sudden spring frost seems always sooner or later to cut it off at a time when all danger has been thought past, and all that remains of the care of years is a pile of rust-coloured leaves in place of the tender green which yesterday delighted the eye.

The finest plant with which I am acquainted near Edinburgh, is one in Mr Samuel Hay's lawn at Trinity Lodge. It is a beautifully shaped conical tree, nearly 13 feet in height. The next in height, perhaps, is one at Mr George Logan's of Duddingston, which is about 11 feet.

Mr Humphrey Graham, of Belstane, in the Pentland Hills, from whom I have received much valuable information regarding pines (although of too practical a nature to be introduced into this Journal), under the disadvantage of an almost subalpine climate 800 feet above the level of the sea, promised to be more successful in rearing them than any other person in the middle or northern district of Scotland with whom I am acquainted, but even he had all his plants but two swept off by the frost in 1856. He is not discouraged, however, and he reports to me that he is still satisfied it will succeed in Scotland, if tolerable care be taken.

The timber is not good. I remember my brother telling me when he was last in this country that it was useless. It would appear, however, that a use has now been found for it.

In a recent letter he writes, "the street planking here (San Francisco) used to be done with Oregon lumber, but now it is being superseded by the Monterey lumber (most likely *P. insignis*) for the reason that it is very resinous, and stands the wear and tear of such a purpose better."

PINUS JEFFREYI, Oreg. Com. (Plates X. and XI.)

This pine was discovered by Mr Jeffrey, who was sent out in 1850 to collect seeds in North West America by an association of gentlemen which originated in this city, and was principally composed of Scotchmen, although it also numbered in its body many noble and eminent subscribers from the sister kingdom, chief of whom I should mention, His Royal Highness the Prince Consort. That association still lives in its embers, and I trust that an effort now making to revive it may be successful, and that it may yet make as many discoveries in Japan as it did through Jeffrey in Oregon and California. Some subscribers to the association remembering only that the third and last year of Jeffrey's engagement terminated unsuccessfully, and that they had just reason to be dissatisfied with his conduct during that year, sometimes speak of his expedition as a failure. But it is unjust so to term it; and if they would only remember the quantities of novelties which were discovered and introduced through his means, they would rather treat it as a great success, which only assumes the aspect of a partial failure from the knowledge that, great as it was, it ought to have been, and might have been, greater still. No one could have worked more conscientiously and more perseveringly than Jeffrey did during the first two years of his employment, and bearing in mind the fact that Menzies and Douglas went to a virgin country, his collections do him no discredit, even as compared with theirs. He discovered several new pines, six of which were described by Professor Balfour, along with figures by Dr Greville, in one of the Reports of the Oregon Committee, and two or three more still remain undescribed. The Report of the Oregon Committee having been only issued to its shareholders, cannot, perhaps, be strictly said to be published, at least I understand that some scientific purists so maintain, although I am not sure that they are right, since I see little difference between a printed report to an association sent to its subscribers, and a printed book (published by subscription) sent to its subscribers. But be that as it may, Mr Gordon has published the description of this pine in his work, and its name and identity are thereby secured. He has not, however, given the figure of the cone, which is one of the most perfectly beautiful I have ever seen.

As I have received a sketch of the tree itself, taken by Mr Peebles, which I have caused to be lithographed for this paper (Plate X.), I have thought it desirable at the same time to reproduce the figure of the cone (Plate XI.)

Jeffrey found the tree in Shasta Valley, North California, lat. 41·30°. It has also been found in Scots Valley; and Mr Black, whom I shall have presently to mention, found it near Mariposa. It is a fine tree, 150 feet in height, and 4 feet in diameter. It has not yet been found near enough any of the cities to allow of the economic value of its wood being ascertained.

PINUS MURRAYANA, Oreg. Com.

This is another of the species discovered by Jeffrey, and described by Professor Balfour in the Report of the Oregon Committee. Mr Gordon, however, disallows it, placing it as a synonyme of *P. muricata*, but without stating the grounds on which he has come to that opinion. It appears to me very distinct; and although I have, as in the case of *P. radiata* and *P. insignis*, the advantage of additional and better material to form a judgment upon than probably was in Mr Gordon's hands, I can scarcely acquit him of hastiness in coming to the conclusion he has arrived at. He gives a correct account of the locality where the true *P. muricata* was found, viz., in the mountains of Monterey, mountains not higher than 3000 feet, and situated near the sea, and south of San Francisco; and also states correctly where Jeffrey had found, what the Oregon Committee called *P. Murrayana*, viz., on the Syskyon Mountains, far north of San Francisco, at an elevation of 7500 feet above the level of the sea; and the tree is described as being at both of these places about 40 feet high. Now, one of the facts with regard to the distribution of conifers in California, which must have struck any one who has studied the subject, and with which Mr Gordon cannot fail to be familiar, is that, taking San Francisco as a point, the pine vegetation to the north and south of it, making a certain allowance for transitional portions, is essentially distinct. In the latitude of San Francisco, we have the *P. Sabiniana*,—to the south of it, *P. Coulteri*, *P. insignis*, *P. muricata*, *P. bracteata*, &c.; while to the north of it we meet with *Picea nobilis* and *grandis*, *Pinus monticola*, *P. tuberculata*, *P. Jeffreyi*, &c. The very circumstance, therefore, of the one pine being found at an elevation of 7500 feet, so far north as the Syskyon Mountains, and the other growing near the sea, at an elevation of 3000, so far south as Monterey, ought to have put Mr Gordon on his guard against confounding them.

Without going into minute detail as to the differences between the two, I shall only observe, that the cone of *P. muricata* is 3 inches in length; while a pretty extensive series of those of *P. Murrayana* enables me to say, that its dimensions are from 1½ to 2 inches in length. Again, *P. Murrayana* has a very peculiar long spine, or rather prickle, from 1 to 2 lines in length, sticking outwards and backwards from the middle of each scale; while *P. muricata* has only "a slight ridge running across the scales near the top, terminated by a short, straight broad prickle in the centre." In the specimens of *P. Murrayana* which were received from Jeffrey, these spines were broken off, and the cone is so figured, and Mr Gordon is not responsible for the error thence arising; but they are well marked in specimens since sent, more than once, by my brother, and now in the Museum of the Botanic Garden, and in that of Messrs Lawson.

Mr Gordon says, that it is the Obispo or Bishop's Pine, and perfectly hardy. This is only half true. The *P. muricata* is the Bishop's Pine, and the *P. Murrayana* is perfectly hardy. That the *P. muricata* is hardy, is more doubtful.

There is another pine known to horticulturists as *P. M'Intoshiana*, which Mr Gordon considers synonymous with *P. contorta*, Don, but which I think is more likely to prove synonymous with *P. Murrayana*. In the young state they are undistinguishable; but I have not seen the cone of *P. M'Intoshiana.*

Mr Black, an English engineer who had occasion, in the performance of works entrusted to him in California, to make use of various of the country woods, informs my brother, that *P. Murrayana* is the best wood in the country for railway sleepers, sluice-heads, and purposes where a hard and durable wood is required; but being of a small growth, and more knotty than some of the others, is not so good for planks, and what is technically known by the term lumber. He also mentions as a peculiarity in it, that the rings are more concentrated at the outside than at the heart, which he says is just the reverse of the others,—only of some of them however,—for we shall find that this is also the case with *Wellingtonia gigantea.* He suggests that it may indicate a rapid growth when young, and slow afterwards, owing, perhaps, to the scantiness of the soil in the rocky regions where it grows.

9th February 1860.—Professor BALFOUR, V.P., in the Chair.

The following gentlemen were elected

Resident Fellows.

Mr WILLIAM GORRIE, Bangholm.
Mr P. S. ROBERTSON, Nurseryman, Trinity.

Associate.

Mr WILLIAM RAMSAY M'NAB, Botanic Garden.

The following donations were presented to the Library:—

Transactions of the Tyneside Naturalists' Field Club, Vol. IV., Part II.—From the Club.

Transactions of the Royal Scottish Society of Arts, Vol. V., Part III.—From the Society.

The Flora of Weston-super-Mare, and Flora Bristoliensis.—From Mr C. B. Dunn.

Report on the plants collected during Mr Babbage's expedition into the North Western interior of South Australia in 1858, by Dr F. Mueller, Victoria.—From the Author.

The following donations were noticed as having been presented to the Museum at the Botanic Garden:—

From Mrs Haynes, Exeter—Specimen of the Fruit of *Ochroma Lagopus*.

Captain Archer—Fruit of Sandbox tree, ornamented gourd, and a large species of *Polyporus*, from Canada.

Mr Andrew Murray—Specimen of *Scirpus lacustris*, from California, 15 feet long.

Professor Balfour announced the following donations to the University Herbarium:—

From Colonel M'Cleverty—A Collection of Ferns from the ranges of hills round Wellington, in the Northern Island of New Zealand, including *Cyathea dealbata*, *C. medullaris*, *C. Cunninghami*, *C. Smithii*, *C. squarrosa*, *C. antarctica* or *pilosa*, and *C. lanata*, *Todea pellucida*, and various species of *Hymenophyllum*, &c.

Captain William Allan—About seventy species of Ferns, collected in the higher parts of Jamaica.

M. Planchon, Professor of Materia Medica, Montpellier—A specimen of *Clypeola gracilis*, Planch.

The following communications were read:—

I. *Biographical Notice of the late Dr Gilbert M'Nab of Jamaica.* By Professor Balfour.

It is our melancholy duty this evening to record the death of Dr Gilbert M'Nab, one of the Fellows of this Society. The sad event took place at St Ann's in the island of Jamaica on the 21st January last. Dr M'Nab was a son of the late and brother of the present superintendent of our Botanic Garden. He was born in the parish of St Cuthbert's, Edinburgh, on the 26th November 1815. After prosecuting his elementary studies, he became a student in the University of Edinburgh, and devoted his attention to medicine. He graduated here in 1836 along with 122 other medical students, and he wrote a thesis "on the Botany of the Coast of Forfarshire." After his graduation he became an assistant in Dr Christison's laboratory. Here he acquitted himself to the entire satisfaction of the Professor; and he became a favourite with all his companions. He was fond of botany, and he prosecuted the science with great zeal and success. He was one of the 21 (of whom 12 remain) who met on the 8th February 1836 to institute the Botanical Society; and on the 27th March of that year he was enrolled as one of the original members. He rendered important services to the Society; and I find that on 13th April 1837 the thanks of the Society were given to him for valuable services and unwearied exertions in conducting the distribution of the specimens of 1836–37. Dr M'Nab made many excursions in Scotland, and communicated the results of his observations as well as specimens to the Society. An account of his botanical tour in Forfarshire was given in his Thesis. He visited also the county of Galloway and the Orkney and Shetland Islands. Among some of the rare plants collected by him and presented to the Society, I may mention the following:—*Arenaria norvegica*, from Serpentine Hill, Unst, Shetland; *Cerastium latifolium*, var., from Shetland; *Ajuga pyramidalis*, Orkney; *Allium oleraceum*, near Montrose; *Asplenium germanicum*, Dunkeld; *Calamagrostis Epigejos*, Braemar; *Hieracium umbellatum*, Clova; *Rhinanthus major*, Sands of Barry.

An opportunity for engaging in practice having opened at St Ann's, Jamaica, he left Edinburgh on 9th January 1838. Before his departure the members of the Society testified their regard for him by inviting him to a supper in Barry's Hotel, on 27th December 1837—Professor Graham occupying the chair, and Professor Christison acting as croupier. Every one felt regret at the loss of his valuable assistance in conducting the affairs of the Society.

After being at St Ann's for some time he was called to Kingston to act as assistant to Dr M'Fadyen, an eminent medical practitioner as well as a good botanist. Dr M'Nab aided Dr M'Fadyen both in his practice and in drawing up his Flora of Jamaica, of which unfortunately only one volume has appeared. Amidst the arduous duties of practice in the warm climate of Jamaica, Dr M'Nab did not neglect the pursuit of botany, and he contributed largely to the Society's Herbarium. The plants which he transmitted are incorporated with the University collection, and many of them have been transmitted to Dr Grisebach, who is now engaged in a work on the West Indian flora. Dr M'Nab also contributed largely to the museum at the Botanic Garden. Some of the specimens he has sent are very valuable and instructive. The difficulty of transmission prevented him from forwarding many large specimens of palm stems, &c., which he had secured for the museum with much trouble and expense.

In January last, he was attacked with inflammation of the kidney, accompanied with a cervical abscess, which appears to have burst internally, and caused sudden suffocation. His remains were interred in the church of Ochro Rois, St Ann's.

A writer in a local paper, in recording his death, says:—"There are few men in Jamaica whose demise will cause more sincere or more general regret than that of Dr M'Nab, who united to eminent skill as a surgeon and general practitioner one of the kindest and most amiable of dispositions. He practised for many years in Kingston—first, in partnership with the late Dr M'Fadyen, whose botanical tastes found a large sympathy in the cultivated acquaintance with that charming science which Dr M'Nab had acquired from his earliest associations—and subsequently on his own account, in the course of which he made numerous friends, all of whom will deplore his early death."

Dr M'Nab communicated a paper on the *Nelumbium luteum*, and he was the first to introduce the *Victoria regia* into Jamaica.

II. *On the Phytotype or Archetype of the Flowering Division of the Vegetable Kingdom.* By J. Birkbeck Nevins, M.D. (Lond.), Fel. Bot. Soc. Ed. Communicated by Dyce Duckworth, Esq.

The author commenced by describing the theory of Morphology as announced by Goethe, and mentioning the principal facts upon which it is based. He spoke of the advance in botanical knowledge which had resulted from the discovery of the law of Morphology, and the obligation under which botanists lay to the illustrious poet. He then alluded to the objections naturally felt to the theory in the form in which Goethe propounded it—viz., "that every part of a plant was a modification of a leaf." He mentioned plants which have no leaves, but consist entirely of stem or flower; and pointed out the comparative non-importance of the leaves, whose functions were frequently performed by the stem; and on the other hand the essential importance of the reproductive organs, the stamens and ovaries; so that it appeared unphilosophical to consider an essential organ as a mere modification of a non-essential one. A leaf also, in ordinary language, was well understood to mean an organ more or less green, and possessing other characters popularly well known; and it seemed erroneous to talk of a part like a stamen or an ovary, both equally distinct and well defined with a leaf, as a mere modification of such an organ. He therefore proposed to see if there were not some simpler and more elementary type upon which the various parts of a plant were constructed; and he conceived that this would probably be found in an internal structure, rather than in a mere external form, such as that of a leaf. Such a type the microscope would probably have revealed to Goethe had it been in common use in his day, and such a type he now proposed to bring before the Society.

The most elementary form of the type was likely to be met with in a simple rather than in a complex organ; and in searching for the simplest part in a perfect flowering plant, the so-called *abortive* stamens of the Erodium, the Stork's bill, were selected as being the most likely, from their extreme simplicity; for they consist of nothing but a delicate tapering filament, which is so thin as to be rendered transparent by the slightest pressure between two pieces of glass. When examined under the microscope the entire structure was found to consist of a single central spiral vessel, surrounded by long tapering cells. Here, then, was an entire organ of a perfect flowering plant, which consisted of nothing but a *spiral vessel surrounded by cells;* a structure which was probably, therefore, the simplest form of the type upon which flowering plants are constructed. On examining more complex organs the same typical form was met with under various modifications which were easily traced. Thus the stem of the Dodder, which is in fact the entire plant for the greater part of the year, was found to consist merely of two or three spiral vessels running parallel with each other, and surrounded by two rows of rectangular instead of tapering cells. The corolla of the lily of the valley presented six separate spiral vessels running parallel with each other, but connected by delicate cells, which formed the expanded portion of the corolla. As this flower belongs to the endogens, a ternary arrangement might naturally be looked for; and the typical form of "a spiral surrounded by cells" was found to be repeated in it twice three times. In like manner the single style of the hyacinth (also an endogen) was found under the microscope to consist entirely of three separate spirals, running parallel with each other, but connected by surrounding delicate cells. In the tube formed by the united filaments of the nine stamens in the Leguminosæ, there were nine separate spirals, each terminating in an anther, but connected by very delicate cells where they form the tubular sheath of the ovary. A young leaf of the Callitriche, which was also rendered transparent by pressure, differed from all the foregoing in the circumstance that the spiral vessels were ramified, and looped like the veins of an exogenous leaf generally, and that the cells were filled with green pigment; but in every other respect the same typical form was present—viz., a spiral vessel surrounded by cells.

The next subject for investigation was to ascertain at what period in the life of the plant this structure makes its appearance; for the ovules are at first merely cellular bodies, and the pollen grains contain no spiral vessels. A large number of embryos were examined, including the pea, the mustard, the melon, castor oil, the almond, wheat, nux vomica, and others, but in *no single instance could any trace of a spiral vessel be discovered before germination commenced*, although they became apparent in every case after the embryos had begun to sprout. The order of their appearance in the plumule and radicle was not perfectly uniform, but very nearly so. In almost every instance the spiral vessels were first observed in the radicle, and only at a later date in the plumule, and the exceptions were so rare as to leave no doubt that the *law of development is that the spirals are first formed in the radicle, and afterwards in the plumule.* The spiral vessels were always traced with ease into each of the rootlets into which the radicle divided in forming a root; but they continued unbranched and separate throughout their course. In the plumule, on the contrary, there was at first a single undivided spiral vessel running up the centre of the cotyledonary leaf; and as this increased in development the spiral became multiplied, though still unramifying; and at last it ramified after the manner of the veins in an ordinary exogenous leaf. In the plumule of endogens the spiral became multiplied as growth advanced, but the vessels continued parallel with each other and unramifying.

As the seedling progressed still further toward maturity, the cells surrounding the vessels underwent various modifications requisite for the purpose they were eventually to serve. Thus they became filled with green pigment, and lost their transparency in the strong deep green permanent leaves; in the stem of herbaceous plants they were elongated and tapering in some cases, and in others elongated and rectangular; in the delicate petals and still more slender stamens they were of corresponding delicacy, and were either colourless or filled with the colouring pigment of the organ; whilst even in the earliest stage of the dense, hard, woody embryo of the acorn, the cells were so thick, strong, and opaque, as to render division by a sharp instrument necessary before they became even semi-transparent; and even then they obscured the spiral vessels so much as to make it impossible to trace them without interruption. The conclusion, therefore, at which the author arrived, was the following—viz., that instead of regarding all parts of a plant as modifications of an organ so well known and so strongly marked by its external character as a leaf, they must be regarded as modifications of a simpler internal structure or typical form, which he designated as the Phytotype; and the law of morphology will then assume the following form, "that every part of a flowering plant is a modification of an archetype, which consists of a *spiral vessel surrounded by cells*—the *spiral being simple*, or *multiplied and branching, and the cells being of various forms and strength, according to the purpose they have to serve.*"

III. *Notice of Ferns from Old Calabar, sent by the Rev. W. C. Thomson to William Oliphant, Esq.* Communicated by Professor Balfour.

The following is an extract from Mr Thomson's letter:—

"Ikoneto, Old Calabar, October 29, 1859.

"I write chiefly on account of the inclosures, and to mention that I hope you will get from Glasgow a bottle containing living specimens of the water fern, an exquisite little water moss, a Lentibulariaceous plant, and one or two other kinds. The fern is the principal specimen. It seems to be *viviparous*. I found it not many days ago, while up the Odot Creek in our neighbourhood on business. There were to be seen here and there a plant or two, floating amid sheets of the little moss near the banks, in parts where the current ran less rapidly, its aerial fronds with their narrow revolute segments rising aslant above the surface, while the natant leaves spread out their broad segments a little beneath, being submersed rather than natant. What is novel in it to me is its mode of multiplication, the species being propagated not by the usual spores, but by axillary and occasionally marginal buds becoming perfect plants on the parent frond. The pressed portions inclosed exhibit the two forms the fronds assume, on one of which the little marsupials are shown in various stages of growth. A minute roundish leaf is the first produced, others following with gradually increasing dimensions, but of the same form, till a genuine frond is unrolled, the little plant having in the meanwhile shot out several roots vertically into the water, and laterally along the surface of the parent segments. The aerial fronds of this plant are much divided into narrow segments, which have their margins rolled back upon themselves, so as to make them look narrower still. The segments of the submersed leaves are broad. The embryo plants thrive equally well with their leaves above or below water, and separation takes place only by the decay of the mother frond."

The aquatic fern referred to by Mr Thomson is *Ceratopteris thalictroides*, (Brongn.) It is found in the tropical parts of the Old and New World, and has been figured in Hooker's "Exotic Flora." Its viviparous character is well known. The specimens sent are very characteristic. An *Asplenium* sent by Mr Thomson is not easily determined. It is possibly only a form of *A. Trichomanes*. In the Grevillean Herbarium, there is a fern from New Holland very much resembling it, but unnamed. The rhizomatous fern of Mr Thomson is a *Davallia*, probably a form of *D. Canariensis*. In many respects it resembles *D. bullata*, which is found in Assam and Nepaul, as well as *D. pyxidata* of the southern hemisphere. The segments of the frond are rather broader and longer than those of the ordinary form of *D. Canariensis*.

IV. *On the Palms of the Feejee Islands*. By Mr William Milne. Communicated by Professor Balfour.

Mr Milne stated that after the departure of the Herald for Sydney on 28th October 1856, he examined the palms of the Feejee Islands, and the following are those which he observed:—1. *Cocos integrifolia*. 2. Dwarf Coco-nut Palm, which seldom exceeds 12 feet in height. 3 and 4. Two species of *Areca*. He also noticed several forking varieties of palms as occurring on the islands.

V. *On the Indian Woods that have been tried for Engraving*. By Alexander Hunter, M.D., Madras.

It may interest the Society to know that the results of the experiments commenced in the School of Arts at Madras in 1858, to improve the illustration of the literature of India, attracted considerable attention in London, Edinburgh, and Glasgow, where specimens of the woods and of the engravings upon them were exhibited. For several years the attempts were very feeble and indifferent, although much on a par with the early efforts at illustration in England about sixty years ago. Rewards were offered for the best kinds of wood produced, and the following were the results:—

The Guava (*Psidium pyriferum*) was found to be close-grained and moderately hard, with a thin bark and pretty uniform texture of both the outer and inner parts of the wood when cut across the grain. It cut easily and cleanly like firm cheese, and gave delicate lines; but being a little softer than boxwood it did not stand the pressure of printing, though it yielded very good impressions with a burnisher. The art of printing from woodcuts being in its infancy for illustrating literature in India, many of the early impressions were spoilt from too heavy pressure. For four or five years the guava was used, and answered well for bold engraving, or for cutting blocks for large letters; attempts to cut small letters upon it for a Tamil alphabet proved a failure, though the large Tamil and English alphabets succeeded very well, and were useful for several purposes, as printing large school and diagram letters, stamping on cloth and clay to get letters or numbers for use in schools. The guava-wood was found to vary very much in texture, the large trees yielding a soft, coarse wood, while the small wood from hilly districts was hard and fine in the grain. Samples that had been sent to England, and tried for engraving, were pronounced to be too soft, and inferior to English boxwood.

The Satinwood of Ceylon (*Chloroxylon Swietenia*) proved to be hard, but uneven in the grain, coarse in the pores, and, like many woods of a large size, harder and denser in the centre than near the bark. Under the graver it was found to splinter, and not to cut sweetly or turn over in curls as it ought to do. This wood was condemned as unsuited for wood-engraving both in Madras and England.

The Palay (*Wrightia tinctoria*). The native name is a very vague one, being applied to a number of woods that have a milky juice. The wood, however, is better known to the public as one from which native toys are frequently turned. It is a pale, nearly white wood, close and uniform in the grain, but too soft to stand printing. It cuts smoothly, but does not bear delicate cross-hatching. It was pronounced unfit for wood-engraving in England, though well suited for turning, carving, and inlaying with darker woods. A kind of indigo is *obtained* from the leaves of this tree.

Veppaley or *Wrightia antidysenterica*, was found to be very hard in the centre, but soft in the outer portions, and liable to the attacks of insects. On examining this wood under the microscope it gave promise of being suitable for the purpose, from the closeness of texture and the polish left by the chisel in cutting it across the grain, but the uneven quality and the softness of the outer parts showed that it was not fit for engraving. Its chief use is for posts and rice-beaters.

Sandalwood (*Santalum album*) proved to be the nearest approach to the boxwood in working quality, hardness, and durability under pressure. This is a moderately-sized wood, with thin bark, which is usually a criterion of fine even grain. It cuts smoothly, the chips curl well under the graver, and the oily nature of the wood seems to preserve it from splitting when wet. There are considerable differences in sandalwood, according to the locality from which it is procured, the small, dark coloured wood of 5 inches diameter, grown on dry rocky soil, being the best. Many hundred engravings have been executed upon this wood, and it has been found occasionally to equal boxwood, though it is not quite so hard. It is an elastic wood that hardens on exposure to the air, and stands a good deal of rough usage in the press; some blocks have yielded upwards of 20,000 impressions without being worn out. The large pale saudalwood is not so good as the small dark kinds. This wood was not tried in England, as its price was thought to be too dear, but on comparing it with boxwood, which sells in England for one penny the square inch, it was found to be cheaper in India than boxwood in England, though it is ten or twelve times the price of any of the other woods that were tried.

The Beyr-fruit tree (*Zizyphus Jujuba*) gave good promise under the microscope, but proved to be a soft, spongy, light wood, that did not stand cross-hatching or pressure. It is used for native sandals.

The wood of the wild orange (*Citrus Aurantium*) bears a strong resemblance in appearance to box in working qualities, and is often as hard, but, like the sandalwood, the small old trees from the hilly districts yield the best wood for engraving. It has a very thin bark, a bright yellow colour, and a very uniform and close texture. The cultivated or garden orange has a coarse wood with a very uneven texture, produced in some cases by a curious mode of propagating the trees—viz., by splitting down the parent stem and planting every piece that has a root attached; a barbarous and primitive mode of culture, but thought by the natives to improve the fruit.

It was reported that a kind of boxwood was common in the gardens about Madras, but on procuring a specimen of the flower and fruit of the tree for examination, it proved to be a species of China orange, the *Murraya exotica*, with a very small fragrant fruit little larger than a pea. On trying the wood for engraving, it proved to be like the wood of many of the Aurantiaceæ or orange family, hard and close in the grain near the centre, but softer near the bark. The cross section of this tree is very irregular, being deeply indented, from the same mode of propagation as is followed with some of the garden orange trees. The result of this is that both the wood and bark of the tree are impaired, though the flowers and fruit are not. The flower of this plant is used by brides'-maids instead of the true orange blossom, which it resembles.

A wood that disappointed the expectations that had been formed of it from the first trial was coffee (*Coffea arabica*). The first piece of this that was sent to the School of Arts was very hard, uniform and close in the grain, but small. Some pieces of old trees, about 6 inches in diameter, were afterwards procured, but they proved to be soft, uneven in grain, and not fit for engraving, though the wood is well adapted for ornamental carving or inlaying. We should be glad to hear more about this wood, and to receive other specimens of young and old wood cut when fresh. The specimens sent us were old trees that were past bearing, and that had been pulled up, left on the ground for a few weeks, and then dried near the cook-room fire for some days; a great mistake, as woods for engraving ought not to be too dry. This wood works beautifully on the turner's lathe, and cuts very sharply under the chisel, gouge, or graver; it is deserving of more attention for ornamental carving and inlaying. It harmonises well in colour with the orange and with the wood of the *Inga dulcis* or Corookapoolee. It approaches in colour and grain to walnut, but is too coarse for engraving, though fit for gunstocks and cabinet work.

The only other woods tried for engraving were—1. A *very* close-grained fine and uniform wood which was sent from the Neilgherries under the name of iron wood, used for turning and for making walking-sticks; it worked well under the graver and on the turning lathe, but the piece sent was too small to print from. 2. A piece of *Fustic* (*Maclura tinctoria*) that had been grown in the Horticultural Gardens at Madras, but this proved to be too soft and coarse for engraving, though a rich-coloured bright yellow wood, suited for inlaying.

About two years ago, it was reported that true boxwood was discovered in the North-West Provinces, and a log of it was kindly procured for the Madras School of Arts by Captain Maclagan, of the Roorkee College, and forwarded to Calcutta for despatch to Madras; but it seems to have been appropriated for use in the School of Arts in Calcutta, where a prize of 500 rupees was offered for the best substitute for English boxwood fit for engraving. We do not yet know if the prize has been awarded, but we heard from a friend who had lately visited the School of Arts in Madras and Calcutta, that a good deal of boxwood has been sent to the latter school, and our log is one of those probably. We should think the prize of 500 rupees too large for such a discovery in Madras, as we have collected all the above-named woods, and used some of them for engraving and illustrating scientific and educational books, reports, and many of the advertisements in the Madras newspapers, and all have been the result of a reward of 10 rupees offered to Captain Puckle who sent us the best collection of woods, and who liberally handed over the reward to the natives who collected the specimens. We have to deplore the loss of the services of our best wood-engravers in Madras. Mr Garrick, who was at the head of this department, has been tempted away from us to Calcutta with the offer of a high salary. Mr J. Duarte, Mr Sharleib, and many others who used to render us valuable aid, have obtained more remunerative employment for their talents than we could afford to give, and we are reduced to one intelligent deaf and dumb native lad, who promises as well as any of the above named.

We have still got a good staff of engravers and etchers upon copper. This style of work was pointed out to us in England as one in which the natives of India were calculated to excel, as it admits of a free and flowing kind of line which cannot be easily imitated in wood engraving. We wish our former teachers and pupils every success in after life, and should be glad to see them trying to aid in the extension of a taste for the fine arts, or for illustrating literature in Southern India. A good many lads began to learn wood engraving in Madras, but few of them had the perseverance to carry it on, chiefly, I believe, on account of its difficulty, and the time and labour required to be expended on its study.

8th March 1860.—Professor Balfour, V.P., in the Chair.

The following donations were announced to the Herbarium:—

Specimens of *Tephrosia toxicaria*, var. *Schiediana* (Sch.), from Dr W. H. Campbell, Demerara. The plant had been sent to Dr Campbell as being used by the negroes in one or more cases of poisoning, which had lately occurred near Georgetown, Demerara.

Specimens of *Cuscuta Epithymum*, from Penmanshiel, sent by Mr James Hardy. Mr Hardy says—"It was confined to one spot in a field which is under tillage for next year's crop, so that it may disappear. The soil was originally reclaimed from a state of nature; and whether it was attached to the wild thyme or heather that once grew there, or has been introduced with cloverseeds, I cannot ascertain. The dodder is a new plant to

Berwickshire, for the specimen mentioned in Dr Johnston's Flora was found on the lower range of the Cheviot Hills in Northumberland."

The following donations to the Museum at the Botanic Garden were announced:—

From Messrs P. Lawson & Son—Cones of *Cedrus Atlantica* and *Cupressus macrocarpa;* also specimens of *Juniperus tetragona.*

Dr Macfarlane, Montego Bay, per Dr Douglas Maclagan—Hammock and ropes, prepared from fibres of lace bark tree (*Lagetta lintearia*).

The following communications were read:—

I. *Contributions to Microscopical Analysis.* No. 2. Celastrus scandens, Linn., *with Remarks on the Colouring Matters of Plants.* By George Lawson, Ph.D., Professor of Chemistry and Natural History in the University of Queen's College, Canada. Communicated by Professor Balfour.

Two years ago, viz. on the 10th December 1857, I read to the Botanical Society the first of a series of papers on the Microscopical Characters of Vegetable Substances. My intention was to bring before the Society, from time to time, such of the more important drugs and articles of food as had escaped the notice of other histologists, as well as to supply from observations such omissions, and correct such inaccuracies as seemed to obscure previously published descriptions. My departure from Edinburgh interrupted the continuation of the series. I now propose to resume it. Instead, however, of selecting substances from the British markets and the Botanical Museum, I shall rather give the results of a histological examination of some of our more important Canadian plants, especially those species whose properties render them useful in medicine or the arts.*

On the present occasion, I select for remark one of our

* An abstract of my former paper on this subject will be found at p. 25; also in the "Edin. New Phil. Jour." vol. vii., new series, p. 315.

most ornamental Canadian plants, *Celastrus scandens*, Linn., chiefly on account of an interesting structure observable in the colour-substance of the arillus, which presents a very distinctive histological character. This is one of the most conspicuous plants which attract the attention of autumn visitors to the Falls of Niagara; for although its flowers are small and greenish, the fruit-clusters are large, and showy in their colouring. The fruit is globose, of a very bright orange colour, and opens (usually by three, sometimes two or four valves) to display a deep scarlet-coloured pulpy mass, consisting of the arilli, in which the large brown seeds are enveloped.

There is a good description and figure of the plant in Gray's "Illustrated Genera of United States Plants," vol. ii. p. 185, plate 170. See also "Persoon, Synops.," i. p. 242; "Hook. Fl. Bor. Am.," vol. i. p. 120; "Torrey and Gray, Fl. N. Am.," vol. i. p. 257; and "Gray's Man. Bot. N. States," p. 81. The plant goes under the common names of climbing staff-tree, Virginian wax-work, and shrubby bittersweet. It was introduced into England from America, so long ago as the year 1736, by Peter Collinson (Col. MSS. in "Hort. Kewensis," 2d edit. vol. ii. p. 26).

In regard to its properties, the seeds of this species are said to be narcotic and stimulating (Gray, *l. c.*); and most authors agree in attributing emetic and purgative properties to the bark (see "Balfour's Class Book," p. 794.) It must be confessed, however, that a certain amount of dubiety attends some of the published statements of the properties attributed to this plant. The fullest indication which I meet with is perhaps that contained in few words in "Lindley's Vegetable Kingdom," 3d edit. p. 587, and that indication is by no means so satisfactory as could be wished. After observing that the seeds of the European species of *Euonymus* (which also belong to *Celastraceæ*) are nauseous, and said to be purgative and emetic, that sheep are said to be poisoned by them, and that an ointment was formerly prepared from them for the destruction of pediculi in the head, Dr Lindley proceeds to state, that "similar qualities have been found in the bark of *Celastrus scandens*," &c.

We know that many plants of the order *Celastraceæ* are by no means inactive, and this circumstance ought to induce a more careful examination of the properties of the one before us. Royle states that an active principle has been detected among the Indian species, which acts with more or less activity; several yield an oil which is used in burning. *C. paniculata*, Willd. (*Malkungnee*), yields oil which is both useful for burning and in medicine. It is highly valued by the native practitioners in India, and is employed in the disease called *Berri-berri*; it is described as having a bitter and acrid taste. I find oil in the cells of the copious albumen of the seeds of *C. scandens*. The beautiful light-yellow inner bark of *Euonymus tingens* is said to be useful in diseases of the eye, and to be used also to mark the tika on the forehead of Hindoos; its use as a dye has been suggested. I also find it mentioned by Lindley and others, that the leaves of *Catha edulis*, the kat or khât of the Arabs, have stimulant properties, which, it is said, cause in those who eat them extreme watchfulness, so that a man may stand sentry all night long without drowsiness. The Arabs are fond of these leaves, and have faith in them as an antidote to the plague; Botta says that, when fresh, they are very intoxicating. The species of *Elæodendron* yield a drupaceous fruit, which is in some cases eatable, as in *E. Kubu*, whose drupes are so used by the colonists of the Cape of Good Hope, while the fresh bark of the root of *E. Roxburghii*, rubbed with water, is employed by the natives of India to allay swellings; it is, says Roxburgh, a very strong astringent. The wood of plants belonging to this order also has its special uses. That of *Celastrus serratus* is charred in Abyssinia for cannon gunpowder (Richards), whilst that of *Euonymus europæus* is used for the same purpose in France; the charred young shoots find a more peaceful application in the artist's hands.

As I have already indicated, the chief point of interest in the histological structure of *Celastrus scandens* is found in the tissue of the arillus, which presents a kind of colouring matter of which we as yet know but few examples in the vegetable kingdom. That we may fully appreciate this peculiarity, let us, in the first place, refer to the conditions under which colouring matters usually exist in plants. The green colouring matter (chlorophyll) of leaves and other green parts, occurs almost, if not quite, constantly in the form of insoluble granules, which are usually well defined, and most commonly more or less globose. The yellow colouring matter of flowers also frequently exists in the form of granules, but often also dissolved in the cell-sap. The red and blue colouring matters on the other hand are almost always diffused in a state of solution in the cell-sap. But while all this is true as a rule, exceptions occasionally present themselves. If, according to Mohl, the reported presence of green-coloured cell-sap in plants is due merely to imperfect observation, we at least know that amorphous chlorophyll does occur, and it likewise seems probable that in many cases the apparently large and well-defined granular aspect of chlorophyll is dependent upon the association with it of starch granules. Exceptions to the usual character of the red and blue colouring matter in flowers occur in the case of *Salvia splendens* and *Strelitzia Reginæ.** In the latter plant, both the blue and yellow colouring matters are peculiarly interesting, of which I recollect to have exhibited preparations to the Botanical Society some seven or eight years ago. This is one of the few plants in which we have striking examples of the occurrence of colours belonging to both the xanthic and cyanic series in one flower. We have here a peculiarly rich blue, or violet blue, associated with a peculiarly rich orange-yellow. But it is the histological condition of the colouring matter that I wish especially to refer to. In the blue parts of the perigone, the colouring matter in the cells consists entirely of spherical granules of an intense blue or violet-blue colour; occasional cells contain similar shaped granules of bright crimson or rose-colour. The granular character of the colouring matter is quite constant, but is apt to be overlooked if the fully expanded or old flowers are selected for examination. It is best seen in the tissue, long before the expansion of the flower. The spathe containing flower-*buds* should therefore be cut open so soon as it is perceived rising up from the rhizome, at the base of the leaf-stalks; even at that stage, before they have been exposed

* See "Mohl's Principles of the Anatomy and Physiology of the Vegetable Cell," Henfrey's Edition, page 44.

to light, the parts of the perigone will be found to have acquired their deep golden and azure hues (although they are not so brilliant as they afterwards become), and the globular granules are seen distinctly in the cells, the edges of which present the peculiar crumpled appearance so common in the colour-cells of flowers. When the flower attains maturity, the cell usually becomes completely filled up with granules, which then present the aspect of a dense homogeneous mass of opaque blue matter, in which the granular character cannot be distinctly seen: this effect is heightened when some of the granules become broken up. Even in the mature flower, however, some cells may usually be found containing fewer granules, and in these the granular character of their contents may be observed without difficulty.

In the yellow parts of the perigone, instead of spherical granules, we find the colouring matter in the form of *filaments*, which are spirally twisted and rolled up in various ways in the cell, resembling, to some extent, in their twisting the delicate spiral fibres in the cells of the aërial roots of epiphytal orchids. But the fibres are in many cases very short, and form small round coils, which, under a low power of the microscope, give the outline of globular bodies, resembling the nuclei of many plants.

To these examples of abnormal colouring matter I have now to add the pulpy arillus of *Celastrus scandens*, which, although of a different colour, strongly reminds me, in its histological characters, of the yellow parts of the perigone of *Strelitzia*. In the *Celastrus* the arillus consists of more or less elongated oblong cells, whose membranes are colourless and quite transparent. The colouring matter is contained in these cells, and presents itself in the form of numerous minute elongated granules, exhibiting well-defined outlines; they present considerable uniformity both in size and shape. They are slender, between linear and laneolate in form, and either acute or more or less acuminate at both ends. They are for the most part straight, but in some cases curved, more or less perfectly, into a crescent, and, more rarely, the curvature is so great that the two extremities meet, and then the granule assumes the form of a ring. These granules are all of a uniform bright scarlet colour. They are frequently aggregated in masses in the cells. Usually, however, they are quite separate, and lie without order in the cell, crossing each other in various directions. In narrow, elongated cells, whose diameter is less than the length of the contained granules, the latter are usually arranged conformably, lying in the longitudinal direction of the cell, just as we find in the case of the raphides which occur in elongated special cells in endogenous plants. On an average, the colour granules measure the two-thousandth part of an inch in length, by the twelve-thousandth part of an inch in breadth, being thus about six times as long as broad. The cells in which the granules are contained are somewhat variable both in size and form. When quadrangular, and not much longer than broad, they measure about the six hundred and seventieth part of an inch in diameter; but in cases where they are much elongated, their breadth is proportionately decreased, as is usually the case in parenchymatous tissues.

Under a low power (as, for example, the lowest power of Nachet's microscope), the seed of *Celastrus scandens* also presents a characteristic aspect in its minutely embossed surface, of a fine fawn colour. On increasing the power, it is found that the embossed appearance is dependent upon the slightly elevated surfaces of the cells, which are compact, regular-sized, and sufficiently distinctive of themselves to lead to the discrimination of the tissue from most other vegetable tissues. A cross section of the membrane forming the seed-covering (readily obtained by making a thin horizontal slice of the whole seed), presents a peculiar striated appearance, which is also characteristic enough. The cells of the albumen contain oil.

My remarks on the colouring matters of plants have extended to a greater length than I anticipated; but that they are not foreign to the main subject, viz. the Microscopical Analysis of Commercial Substances, will appear in the course of succeeding papers. Our knowledge of the chemistry of these colouring matters is still very imperfect. Chlorophyll is not known in a state of purity, and the changes of colour which it undergoes have been only partially explained. By Fremy and Cloez the colouring matters of flowers are referred to three distinct substances, two of which are yellow, while the other is of a blue or rose colour. The blue or rose colour is produced by a compound which has been termed *Cyanine,* the blue tint becoming red when exposed to the action of an acid. The yellow matter, which is insoluble in water, is termed *xanthine,* and that which is soluble has received the name of *xantheine.* These bodies, however, have not been isolated in a pure condition; and some of the facts above recorded indicate at least a probability that three such bodies are insufficient to account for all the observed phenomena of flower-colouring.

II. *On Trichotomous Arrangements of Plants.* By Mr William Mitchell, Associate of the Botanical Society.

Mr Mitchell remarked that in the classification of natural objects, of which our knowledge is limited, it is desirable to have the divisions capable of embracing all that the progress of discovery may make known. This advantage, however, we cannot easily gain unless it is in our power to make use of the number, position, presence or absence, of parts or organs as essential characteristics in our comparison of the objects in question. But on glancing over the more common classifications of plants, we find cases admirably illustrative of scientific tact in seizing hold of such leading characters as render the divisions all-embracing in their own provinces; and singularly enough these divisions generally come out in threes. A principle of arrangement was thus struck out, which was partially employed by Ray; but clearly enunciated by Jussieu, when he ushered in that grand and ever-memorable ternary of the *Dicotyledonous, Monocotyledonous,* and *Acotyledonous* plants. He could now pass at once to the flowering plants, and produce another trichotomous arrangement in the same manner; which he did in his *Polypetalæ, Monopetalæ,* and *Apetalæ.* Mr Mitchell then proceeded to illustrate his remarks by various instances of trichotomy in the vegetable kingdom.

III. *On Disease of the Nutmeg Trees in Singapore.* By Mr Andrew T. Jaffrey.

Mr Jaffrey has recently examined the nutmeg plantations of Penang and Singapore, and states that "there is a real possibility of ruin staring the proprietors of the plantations in the face, and the chances are that, unless remedial measures are adopted to arrest the present deterioration of the trees, which is almost universal, there is a probability that there will be the extinction of a valuable article of commerce. It was perfectly evident, when visiting the islands a few months ago, that some fatal malady had seized upon the trees. The cause of this effect may be difficult to discover, but, judging from appearances only, the conclusion come to was that the disease was *local,* and not *constitutional;* therefore there was a hope that it would be overcome." There was a yellow sickly appearance of the foliage, the branches here and there showed symptoms of decay, and the fruit dropped off before ripe. Mr Jaffrey considered that the disease arose in a great measure from the system of using green manure, which caused the development of fungi on the roots of the plants.

Mr Burnett exhibited branches of hollies gathered at Killarney, exhibiting great variation in the forms of the leaves. The specimens were so different that they might have been regarded as distinct varieties, and yet most of the variations occurred on the same tree.

12*th April* 1860.—Professor Balfour, V.P., in the Chair.

The following donations were announced to the Society's Library and Herbarium:—

"Acantho Fiat Justitia"—From Dr Kelaart, Ceylon.
A collection of Plants from Kurrachee—From Dr E. Dubuc.

The following donations to the Museum at the Botanic Garden were noticed:—

From Dr Fayrer, Professor of Surgery, Calcutta—Fruit of Mangosteen (*Garcinia Mangostana*).
Mrs Eccles—Fruit of *Ochroma Lagopus*.
Dr G. W. Balfour—Roots of *Aconitum heterophyllum*, used as a tonic in India.
Archibald Hewan, Esq., Old Calabar—Vegetable used for smoking at the Gaboon river, also seed used for a spice there.
Mr George A. Wright—Specimens of *Vaccinium Vitis-Idæa* attacked by a fungus.

The following communications were read:—

I. *Notes on Californian Trees.* By Andrew Murray, Esq., F.R.S.E. Part III.

This was a continuation of the papers on Californian trees, two of which have been already published. The most interesting trees noticed on this occasion were *Pinus Lambertiana*, an enormous pine of the Weymouth section, growing 200 feet in height, and bearing long pendant cones from 1 to 2 feet in length. It was first discovered by Douglass, who gives an interesting account of the occasion on which he met with it. He was in the neighbourhood of hostile Indians; but, notwithstanding the risk of bringing them down upon him by the sound of firing, he could not pass the magnificent cones without making an effort to procure them. He shot down a couple, but, the Indians immediately appearing, he had to scamper off, thankful that he had got even these. From some beautiful photographs of Californian scenery, which were shown by Mr Murray, in which this tree is recognisable, it appears to form a most striking object in the landscape, stretching its arms far out horizontally over the tops of smaller trees. It is quite hardy in this country, and is now pretty generally introduced. Its timber is one of the most valuable in California. It is more accessible than *Pinus Monticola* or *Pinus Murrayana*, which are most used when they can be reached, and has the advantage of growing to a great size, with a straight bole 60 to 100 feet without a branch, and a great deal of timber is thus got from a single tree. From this tree a peculiar matter exudes, which is sweet to the taste, and has caused the tree to be known in California by the name of the sugar pine. Certainly a fir tree appears the last thing from which one would dream of extracting sugar, but Professor Lyon Playfair has had the kindness to analyse the sugar sent from this tree, and finds that it is in all respects the same as the sugar of the sugar-cane. *Pinus Monticola* is another beautiful tree of the Weymouth class, which is now so well known that a description is unnecessary. The wood is magnificent timber; nothing can be better. It grows at great elevations, being the last timber on the tops of the mountains, and the greater the elevation the bigger it grows, attaining 4 feet in diameter. A very fine example has produced cones in the Keillor *Pinetum* in Perthshire for several years past.

Abies grandis.—Very considerable doubt is felt as to which is the true *grandis*, horticulturists having got three or four young plants very near each other, which have given rise to much uncertainty. There is the true *grandis*, the *amabilis*, the *lasiocarpa*, and another with a well-marked cone, sent home by Jeffrey, but apparently not described. We find all these in their turns bearing the name of *grandis*, and it will be some time before we can satisfactorily allot the young plants to the typical species originally described under the above names. They are all lofty trees, 150 to 200 or even 280 feet in height, but the quality of the wood seems doubtful. Speaking of *amabilis*, Mr Murray mentioned that his brother says that it is a coarse and useless wood. The species brought by Jeffrey appearing to Mr Murray to be distinct, he described it under the name of *Picea campylocarpa*. The cone is larger and much longer than that of *A. grandis* (about seven inches in length), and usually distinguished by a bend or elbow in the middle (whence the specific name). The leaves are short like those of *P. nobilis*, and have the same curl which is the character of the leaves of that pine. A large importation of seed of this pine has been reared by Messrs Low of Clapton, who have issued them as *P. amabilis*.

Cupressus Lawsoniana (Murr.)—A coloured drawing of this most beautiful of all the cypresses, taken by Mr Peebles on its native soil, was exhibited by Mr Murray. It is figured as standing on the edge of a waterfall, from which a hint may be taken as to the best position in which to plant it. It is quite hardy, and a plant was exhibited by Mr M'Nab, bearing fruit, although it was only introduced in 1854.

Taxus Lindleyana (Murr.)—A figure of this yew was exhibited. It showed a wide-spreading open-branched tree, and anything more unlike our preconceived notions of the characters of a yew cannot be imagined. The wood is very hard, and has been successfully made use of for wood-cutting. *Juniperus Californicus* has also been tried for this purpose, but was found not suited for anything but coarse work. It grows to a considerable height (forty or fifty feet), and has an umbrella top, which contrasts well with the spire-topped trees, which are a marked feature in Californian scenery.

II. *Remarks on the Vine Disease as it has been observed at the Cape of Good Hope.* By S. J. MEINTJES, Esq.

The author gave an account of the ravages of this disease among the vines at the Cape, and stated that it had been traced to the presence of the fungus called *Oidium Tuckeri*, drawings of which he exhibited. The disease had been referred to a long continuance of damp weather. The chief remedy employed was sulphur, either alone or in combination with lime.

III. *On Sarcina ventriculi*, Goodsir. By JOHN LOWE, M.D., Edinburgh.

The discovery of *Sarcina* by Professor Goodsir, in the frothy vomit occasionally met with in severe cases of stomach disease, has given rise, at one time or other, to no little conjecture: 1*st*, As to its real nature; 2*d*, As to its source; 3*d*, As to its pathological relation to the affection in which it is found to occur; and 4*th*, As to the reason of its continuing to flourish in a locality so evidently unfavourable to the development and nutrition of a vegetable organism.

That the structure is of a vegetable nature was clearly shown by the discoverer—its peculiar form and fissiparous mode of propagation, and its action under reagents, clearly set this point at rest; but then came the question, To what group does it belong? Its general resemblance to the *Desmideæ*, and its quaternate arrangement of parts, caused it to be ranked amongst the *Algæ*.

So far the subject advanced, but it still remained to discover the source from which the plant had its origin.

Is it taken into the stomach with the food, and, if so, with what part of it? The solids or fluids? That it obtained entrance with one or other of these seemed probable.

At one time I discovered in some stagnant water the counterpart of *Sarcina ventriculi*, and imagined that I held the key to the problem. This idea I relinquished on recollecting that it had been found in the kidney and lung as well as in the stomach. Since that time, further investigation has proved to me that there is nothing improbable in the supposition that it is occasionally imbibed with water into the stomach, having existed in the algal form in that fluid. Its occurrence in the lung and kidney I shall attempt to account for presently.

The merit of first suggesting the actual origin of sarcina is due to Mr Berkeley, who stated in the "Gardener's Chronicle" (1857, Aug. 29), that he had made experiments to prove that it belonged to one of the common fungi, Penicillium or Aspergillus. This he was unable to do; but the discovery by Mr H. O. Stephens of quaternate cells on a yellow fungus found growing on bones, rendered it highly probable that the view was a correct one.

In a communication read before this Society in 1857, I showed that parasitic fungi were derived from the two abovementioned genera; and singularly enough, following upon that we have the discovery, by Dr Tilbury Fox,* of sarcina in a case of parasitic skin-disease. Then, in September of the present year, I found most perfect specimens of sarcina in a phial in which I had some months previously placed a quantity of crystals of cholesterine obtained from a hydrocele.

We have thus acquired a series of links in the chain of evidence towards establishing the truth of Mr Berkeley's surmise, which, if not amounting to positive demonstration, is nevertheless so strong as to leave little doubt of the accuracy and justice of that gentleman's observation.

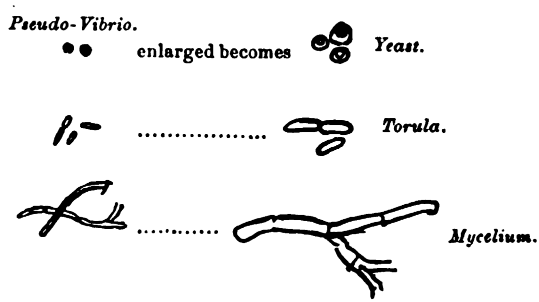
The fact is not a little interesting, inasmuch as we have now very good grounds for believing that there is no fungus which infests the human body, nor, I believe, any animal body, which is not referrible to one of the common genera, Penicillium, Aspergillus, and Mucor.

We may now consider by what means sarcina obtains ingress to the lungs and kidneys. There can be little doubt that the spores of the fungi above named are carried into the pulmonary passages during inspiration and there undergo development, and that according to various modifying agencies they give rise to a mycelium which may or may not produce aërial fructification. Of the conditions which seem to be requisite for the production of sarcina, I shall speak by and bye. To account for its occurrence in the kidney we must look for another mode of conveyance, as it is scarcely probable

* On the Identity of Parasitic Diseases, &c.—*Lancet*, September 10, 1859.

that the spores of a fungus could enter the bladder and pass along the ureters; for to effect this against the stream of urine, presupposes a locomotive power either in the spore or in the epithetial lining of the passages. We do not find either the one or the other. We must then believe that the fungus finds entrance through the circulating system, and this I regard as neither impossible nor improbable; but we have to inquire, in the first place, how the fungus obtains admission into the circulation, for it is evident that this cannot be effected in the form of sarcina, nor yet as the spore, both of which have a diameter as great, or greater, than that of blood-cells. I shall then briefly notice the means by which I think this is brought about, reserving a more extended notice which so important a subject deserves for a future occasion, after a more careful observation and investigation of facts. About two years ago, whilst examining some specimens of fungi which I had undergoing development, I found one which presented a hitherto unknown appearance. On the cork of a phial containing some ropy mushroom catsup, I observed a number of globular yellowish-white bodies about the size of pins' heads. Placing one of them under the microscope, I was surprised to find that it consisted of an innumerable quantity of non-nucleated cellules, most of which had a diameter of 7000th to 10,000th of an inch; some few being twice as large. The most minute search failed to render apparent anything like a common investing membrane. On examining the fluid in the bottle, it was found to contain a vast number of similar bodies in various stages of development. Thus, while the majority bore the same features as those on the cork, others were found to be considerably enlarged, and contained a nucleus; others, again, had assumed an oval form, and had begun to form gemmæ; whilst some had already acquired a distinctly tubular or mycelial aspect. The smallest of these cellules exactly resembled the nuclei of old yeast-cells, or what are termed by Turpin "*Globulins seminifères,*" which are found in such abundance in beer at the commencement of fermentation.

I have little doubt, indeed, that they have their origin from the liberated nuclei of common fungi, capable, under certain conditions, I believe, of undergoing division indefinitely, and of retaining the same form, but reverting to their original conformation so soon as they are placed in suitable pabula. There is nothing very improbable in this supposition, when we consider that yeast is also propagated indefinitely by gemmation and nucleation, retaining the form of yeast only whilst it remains in a saccharine fluid, but advancing to the stage of mycelium whenever the sugar is exhausted. The first change noticed from the globular form is to the oval, then to the filamentous condition. Now, just the same changes are to be observed in the progress of the cellules under consideration; they are first spherical, then oval, then linear. Increase in magnitude may go on at any of these stages. Thus the spherical may, with proper food, revert to the condition of yeast, the oval to that of the torula, the linear to that of the mycelium (*see figures*). It will be remembered that these cellules



were first found on a cork, where they had doubtless taken their rise from a single nucleus. They are capable, then, of growing aërially, and thus, from their minute form, can be wafted into the air in myriads. If we examine the white powder found on old beer-barrels and on wooden utensils, wherever decaying organic matter is present, we shall find that it consists entirely of these minute bodies, which have been frequently noticed and figured as Vibriones, but which in reality are of vegetable origin. Their diameter, as before mentioned, is about $\frac{1}{10,000}$th of an inch, and some even smaller than this—not small enough to pass through a membrane, but finding access probably through slight lesions of the capillaries or veins of the mucous surfaces. Whether this hypothesis will be found to hold good remains to be proved. I merely throw out the suggestion as one most likely to yield important results. The importance of the subject, indeed, is one which cannot be over-estimated; for if we reflect that myriads upon myriads of these minute objects are constantly floating about in the atmosphere; that they are capable of entering through the finest conceivable apertures; that their agency is purely zymotic; that bodies very closely resembling these, if not identical with them, have been found in the blood and kidneys of patients affected with typhus; if, I say, we bear in mind these facts, we must admit that there is still a great deal to be learned before we can be said to know the entire history of these apparently trivial agents.

Whether they enter the body by the channels I have pointed out, or whether by the most improbable route of the ureters, I regard it as most likely that these give rise to sarcina in the kidney; and it appears to me far from unreasonable to suppose that various zymotic diseases, if not originated, may be accelerated by the presence of these minute cellules in the blood.

Having considered the nature and origin of sarcina, we may say a few words about its relation to the disease in which it occurs. Is it merely of accidental occurrence, or is it a morbific agent in the diseases in which it is found? That there must be pre-existing disease before the parasite can be developed in the stomach, is, I think, indisputable; for in the healthy stomach, the gastric juice would certainly be sufficient to destroy any such growth. When, however, the secreting power of the stomach is impaired, or in a great measure lost, by reason of ulceration, &c., then the fungus finds a nidus amongst the diseased tissues, and in all probability tends greatly to increase the irritation of the viscus; at any rate it does so indirectly, if not by immediate contact, and this by virtue of its power of exciting fermentative decomposition, the products of which, by distending the stomach, and by their irritant action, cause frequent efforts at vomiting, and give rise to the yeasty appearance of the ejected contents.

Finally, as to the reason of the plant continuing to grow in what appears at first sight to be an unsuitable locality. This, I have already stated, is in a measure owing to a previously vitiated state of the lining membrane of the stomach; but there is evidently some special food which it meets with, and which it finds in but few other localities, serving to retain it in the state of sarcina. Indeed, I regard it as essential to its development, that this peculiar pabulum should pre-exist. In what, then, does this peculiarity consist? The specimen of cholesterine crystals in water, which gave rise to sarcina, I found to be most intolerably fetid, from the disengagement of hydrosulphuret of ammonium. Mr Stephens finds his specimen of the plant on bones. In other cases it occurs on diseased tissues, the decomposition of which would yield some such gas as the above. May not this, or a similar gas, be the food requisite for the production of this peculiar form of the plant? It seems to me to be not improbable, and that on the exhaustion of this supply it returns to its pristine form, just as yeast acts, after the failure in the supply of sugar.

However far these suggestions may be found to hold good, it admits now of scarcely a doubt that sarcina is neither more nor less than an algal condition of a common fungus. Mr Berkeley, indeed, speaks of it as being the spore of the plant. With much diffidence, I venture to express an opinion at variance with that of so excellent a mycologist.

It seems to me that the term spore is often loosely and vaguely applied to small cryptogamic cells, whose origin and purpose seem to be obscure. The term ought, I think, to be confined entirely to those bodies which are the result of a true reproductive process. There is, so far as I am aware, no observation to prove that sarcina is so produced; and we ought therefore to avoid giving it an appellation which is calculated to originate an erroneous impression of its nature. We have much to learn as yet regarding the reproduction of fungi, and it will, I believe, be found eventually, that the fact of cells undergoing segmentation is entirely opposed to the view of their being spores or true reproductive cells. Looking at it in this light, it seems quite contrary to experience, and all our ideas of sexual reproduction, to imagine that the ovum may go on dividing itself into millions of other ova, each capable of producing the mature plant. We should thus have, as in the instance of yeast, many millions, nay, even millions of millions of plants arising from a single ovum. From the analogy observable in other cryptogamous plants, we may, I think, assume it as a fact, that each true reproductive cell can give rise to only a single mature individual, but that a single plant may give rise to endless gemmations. And, as a corollary to this, I would add, that where gemmation, or, what is the same thing, fissiparous division, exists, there is no reproductive process, and *ergo*, the results are not true spores.

From this it follows, that yeast is nothing more than a gemmation of the fungus. True, it is derived from the so-called aërial spores of the penicillium, &c., but these are, I believe, in reality gemmæ, just as the *spores* of a fern are. The true reproductive organs exist in the mycelium. So with sarcina, whose fissiparous division is nothing more nor less than mere budding. And so with other fungi, which are propagated in like manner.

These views on so obscure a subject are not put forth dogmatically, but merely to excite inquiry into a subject which is surrounded by much that is interesting. That they will bear investigation, however, I fully believe, since there is no statement made which is not borne out by analogy in other cryptogamic families.

IV. *On the Poison Oak of California.* By Dr Colbert A. Caulfield, Monterey. Communicated by Andrew Murray, Esq.

The "Poison Oak" is one of the great plagues of California. The plant is widely diffused, and numerous cases are constantly occurring in every district of persons suffering severely from its effects. Many antidotes and remedies have been published, though still there is a demand for more information on the subject. In the woods and thickets of California, as well as on the dry hill-sides, and in fact in every variety of locality, may be found a very poisonous shrub—the "poison oak" or "poison ivy," the *hiedra* of the Spanish people. The plant belongs to the natural order *Anacardiaceæ*, and is *Rhus varielobata* (Steud.) or *R. lobata* (Hook.) It is very similar to the poison ivy of the Atlantic States, *R. Toxicodendron* (Linn.), both in its appearance and its poisonous qualities. This poison is the cause of a vast deal of misery and suffering in California, and there is scarcely ever a time in any little town or neighbourhood where there are not one or more persons suffering from cutaneous disease in consequence of coming in contact with the plant. The remedies in use for the effects of the poison oak are various, and some of them will cure the milder cases. Of all the common remedies, the warm solution of the sugar of lead has, within my experience, been productive of the best results. The water of ammonia, warm vinegar and water, the warm decoction of the leaves of *Rhamnus oleifolius* ("Yerba del oso" of the Californian Spanish), or even pure warm water, are sufficient sometimes to produce a cure. All these remedies are, of course, applied externally by way of washes to the parts affected. But the only remedy that I have found invariably successful as an antidote for this poison is an indigenous plant growing very abundantly in this vicinity (Monterey), and in other parts of the State. It is a tall, stout perennial, belongs to the composite family, and looks like a small sunflower. It is from one to three feet high, has bright yellow flowers in heads one or two inches in diameter, and, as I have said, like small sunflowers flowering from June to October. Before flowering, the unexpanded heads of buds secrete a quantity of resinous matter. The whole plant, when growing on dry hills, is stiff and rigid, with narrow thin leaves; but in damp localities it is more robust and succulent, with wide fleshy leaves. Its botanical name is *Grindelia hirsutula* (Hook. and Arn.) The mode of using it is as follows:—The fresh herb may be bruised and applied by rubbing it over the parts affected; or, boiling it in a covered vessel, make a strong decoction of the fresh or dried herb, with which to wash the poisoned surfaces. Its remedial properties appear to be contained chiefly in the resin or balsam-like juice of the plant, which is particularly abundant on the surface. One application is sometimes sufficient for a cure; but if the disease has been of long duration, several days will elapse before relief is obtained. This plant is a remedy for the poison oak, used originally by the Indians of this vicinity, and by them its virtues have been communicated to the Spanish-Californian people, who are now commencing to use it. It may not be amiss to say, in conclusion, that the *Grindelia* is used also by the people of the country as a remedy for other cutaneous diseases which are characterised by heat and itching, such as nettlerash.

Sir William Jardine, Bart. stated to the meeting that the winter had proved very severe on the plants at Jardine Hall, which is 260 feet above the sea, and about 11 miles from it as the crow flies. He had lost *Buddleia globosa*, *Weigela rosea*, *Leycesteria formosa*, and many other similar plants. *Cupressus M'Nabiana*, and *Larix Griffithii* had been destroyed, and the small tips and shoots of *Abies taxifolia* had been injured. *Taxodium* had not suffered. The other plants from Oregon had been untouched, and none of them were protected. *Abies Pattoniana* was strong and hardy.

10*th May* 1860.—Prof. ALLMAN, President, in the Chair.

The following candidate was balloted for and duly elected a Resident Fellow:—

ROBERT ANDERSON, Esq., 41 St Andrew Square.

The following donation to the Society's Library was announced:—

The Botanists' Companion: a Direction for the use of the Microscope, and for the Collection and Preservation of Plants, with a Glossary of Botanical Terms, by Professor Balfour — From the Author.

The following donations to the Museum at the Botanic Garden were noticed:—

From Dr Greville—Roots of an Alder-tree, as taken from a pipe at Didlington Park, Suffolk.

Dr Christison—A piece of the Stem of the Fortingall Yew.

Mr Hardyman, Howard Place—Diseased Branches of Gooseberry, caused by insects.

Dr Thomas Anderson, H. M. Indian Service—Pods of *Bauhinia Vahlii.*

The following communications were read:—

I. *On Some Peculiarities in the Stem of the Ivy.* By G. Ogilvie, M.D., Aberdeen.

The points specified in the paper were principally the following:—The complete fusion of the stems of the ivy, when strongly pressed together in the course of growth—the structure of the aërial rootlets or claspers—the abundant deposit of starch in the woody fibres. The fusion was shown to be at times of the most intimate nature. All the layers of bark are continued in a uniform sheet over the line of junction, and can be freely peeled off both stems at once, indicating that the cambium layer passes uninterruptedly from the one to the other; and the woody cores appeared in many cases to be as closely compacted as if they had been a single stem. It was observed that when the axes nearly coincided the outer layers of wood formed a continuous envelope over the two stems, but when they were very divergent in direction, the woody tissue was confused at the line of junction, the fibres abutting irregularly against each other. Maceration had no effect in separating the concrete stems, nor had desiccation in many cases, though occasionally cracks formed along the lines of junction from each stem shrinking to its own centre. Such fusion contrasts strikingly with what occurs in other woods, when stems are anyhow compacted together by the force of growth. The bark in such cases never peels clean off over the line of junction, but insinuates itself between the stems in a morbid and degenerate condition; nor is the woody tissue fused, but injured and stopped in its growth at the point of pressure, in one or both stems. Twisted osier stems perhaps make the nearest approach to such fusion, but the union of substance is always imperfect, as becomes very apparent on drying. In regard to the claspers, it was stated that their structure, though undeveloped, was essentially that of rootlets, and that they originate in the same way in the cortical layer—pushing outwards, on the one hand, a free extremity, and on the other, connecting themselves with the woody tissue, generally at the emergence of a medullary ray, the central cells of which appear to become condensed into a fibrous prolongation inwards of the rootlets. The occurrence of starch granules in the wood-cells was noticed as a character which, though not unknown in other cases, might still be regarded as an exceptional arrangement, to the extent at least to which it prevails in the ivy, where the deposit is most abundant, in the woody fibres both of the alburnum and duramen.

The paper was illustrated by microscopical preparations and drawings, and by specimens of stems which had coalesced in the way described.

II. *Experiments on the Effects of Narcotic and Irritant Gases on Plants.* By JOHN S. LIVINGSTON, Fellow of the Royal Physical Society, Edinburgh.*

Several years ago, the effect of narcotic and irritant gases on plants was made the subject of a joint series of experiments by Dr Christison and the late Dr Turner, whose evidence was called for in a case then pending before one of our law courts, in which damages were claimed for destruction of trees and deterioration of property, said to be caused by the exhalations from a black-ash manufactory that had been established in the vicinity. The question, then, of the effects of gases on plants is of more than a purely scientific interest, and claims attention even from those who look on every scientific inquiry as valueless unless it have some immediate and obtrusive bearing on human concerns.

The experiments which I now proceed to detail are many of them repetitions of those performed by Drs Christison and Turner, with a view to test their accuracy; with this difference, that the *proportions* of the gases employed in the experiments of Christison and Turner have been purposely avoided. Some of the gases, however, have been experimented with by myself only; nor are all, or nearly all, of my experiments detailed, but only such as seemed most illustrative.

The *modus operandi*, when large quantities of the gases were to be employed, was simply to collect the gas in the usual way into stoppered bottles of known cubic capacity, and to allow it to diffuse under bell-jars covering the plants. These bell-jars were rendered perfectly air-tight, by causing their edges to rest on a bed of glazier's putty, pressing the jars down tightly, and securing against any crevice by puttying the outer edge. When the quantities to be used were small, by means of a hole bored in the table we could inject, with a graduated glass syringe, with perfect accuracy, any quantity of the gas, from four cubic inches to the $\frac{1}{20}$th of a cubic inch.

* This paper was given in as an essay in the Botanical Class of the University of Edinburgh, and gained the prize offered by the Professor.

I. Sulphurous Acid.

1. A young Laburnum and Psoralea were introduced into a jar of the cubic capacity of 2000 inches, along with 4½ cubic inches of the SO_2. or in proportion of 1 to 444⅘. No change was remarked until the plants had been exposed to this atmosphere for six hours, when the leaves began to shrink. They were then left overnight, and, when examined next morning, or after an exposure of twenty-two hours, the Psoralea was found to be perfectly dead, lying flat on the earth, with its leaves all shrivelled and discoloured. The Laburnum was also so much affected as to be to all appearance likewise dead; the leaves drooped, and were of a yellowish brown colour. The main stem still continued succulent to a certain extent, but the plant had been so powerfully acted on as to be beyond recovery.

2. Into a jar of 2000 inches cubic contents was introduced a young Laburnum, with the fourth of a cubic inch of the gas, or 1 in 8000. In twenty-four hours the cotyledons had become discoloured at their junction with the stem, and in forty-eight hours they were dry, shrivelled, and the leaves drooping. At the end of seventy-two hours no farther change had taken place, except that there was a slight inclination of the petiole to droop. On the fifth day of exposure the drooping had become decided, but as yet no discoloration had shown itself. On the sixth day no further change had taken place, but, on the seventh, the edges of some of the leaves had become of a fawn colour, and the leaflets had folded on themselves.

3. Another Laburnum was placed under a jar of 200 inches cubic capacity, with four-fifths of a cubic inch of SO_2, or 1 in 250. In twenty-four hours, no effect of the gas had taken place. In forty-eight hours, a slight tendency to curling of the leaflets had set in; and by the third day the leaves had drooped considerably. On the fourth day the summit leaves exhibited a decidedly withered appearance. By eight o'clock of the seventh day, the cotyledons had dropped off; and by two o'clock P.M. of the same day, the plant, in some of its leaves, became completely discoloured, and hung down as if dying. The plant was then removed, and ultimately recovered, but not without first shedding its leaves.

II. Hydrochloric Acid.

Though, as we have seen, SO_2, in very small proportions, acts powerfully as an irritant poison on plants exposed to its influence, hydrochloric acid will be found to be even more injurious.

1. A Laburnum was placed under a jar containing 2000 cubic inches of air, with $4\frac{1}{2}$ cubic inches of hydrochloric acid gas, or in proportion of 1 to $444\frac{4}{9}$. In forty minutes, the plant had assumed a greenish gray hue. In twenty-two hours the cotyledons had become quite brown, dry, and shrivelled—the leaflets had likewise become shrivelled, and of a dark olive colour.

2. Into a jar containing 200 cubic inches of air, 24 cubic inches of HCl, or 1 in $8\frac{1}{3}$, were introduced, along with a Balsam. In half an hour the plant had begun to droop, and exhibit discoloration on the margins and tips of the leaflets. In one hour and a half the drooping had become very considerable, and the plant had a flaccid appearance. In twenty-two hours it was quite dead, the leaves had become quite brown, and their tissue had so little tenacity as to go to pulp when handled.

3. Into a jar containing 84 cubic inches of air were introduced four-fifths of a cubic inch of HCl, or 1 in 105, along with a Psoralea. In ten minutes it had shrivelled considerably, and in one hour and a half some of the leaves had become discoloured, and the whole plant had a flaccid appearance. In twenty-two hours very many of the leaves had become half discoloured, and several wholly, while most of the petioles hung down.

4. One-fifth of a cubic inch of this gas was passed into a jar containing 2000 cubic inches of air, or 1 in 10,000, along with a Balsam. In half an hour one of the cotyledons had become discoloured on the edge, and a tendency to droop, though slight, was visible. By the time it had been exposed one hour and a half, the drooping had become most decided, and a tendency to shrivel had exhibited itself. In twenty-four hours the leaves were hanging down, and in forty-eight hours they had become brown at tips and edges, the cotyledons were dry and withered, and even the main stem drooped a little. When taken out, the cotyledons and three of the leaves

fell off. The plant was transferred to a hothouse, where it recovered, but parted with all its leaves; young ones were however soon put out. It was not a little curious to observe that many of these were withered at the tips, from the leaf, in its very young state, being subjected to the withering influence of the gas; but the plant still possessing vitality sufficient to develop the entire leaf and leaf-stalk, the traces of the violence done it in the bud continued, and would continue, to present themselves during the life of the plant.

III. Chlorine.

1. A young Laburnum was put into a jar containing 2000 cubic inches of air along with 4$\frac{1}{2}$ cubic inches of chlorine gas, or 1 in 444$\frac{4}{9}$. In an hour and twenty minutes a very slight tendency to browning of its leaves took place. In twenty minutes more, the tendency to discoloration had become decided. For the next few hours the gas showed its effects less rapidly, as no great increase of the discoloration took place; but in twenty-four hours the leaves had completely lost colour and were seemingly dried up and drooping. This plant, which was also removed, as in the former cases, shed its leaves, put out new ones, and became as vigorous as ever.

2. Into a jar containing 2000 cubic inches of air another Laburnum was introduced, with 12 cubic inches of chlorine, or 1 in 166$\frac{2}{3}$. In less than an hour some of the leaves had become completely discoloured—all of them more or less so; but as yet no drooping had taken place. In less than two hours many of the leaves were quite blanched, and only one had entirely resisted the action of the gas. We observed that the blanching invariably began at the tips of the leaves, and gradually crept along to their base. By the time twenty-four hours had elapsed, the plant was completely blanched, *with the exception of the terminal leaf-bud*, which remained apparently unaffected—both in this and the preceding experiment—probably because the leaf being undeveloped, it had not begun to aid in the respiration of the plant, and so had not imbibed any of the noxious vapour. In both these experiments the stem remained green and succulent, and the plant

ultimately recovered, with only the loss of its first crop of leaves, from a violence that to all appearance seemed likely to prove fatal to it. It soon, however, put out a new and vigorous foliage.

IV. Sulphuretted Hydrogen.

1. Into a jar of the capacity of 2000 cubic inches a young Laburnum and Balsam were introduced, along with $4\frac{1}{2}$ cubic inches of sulphuretted hydrogen, or 1 in $444\frac{4}{9}$. In twenty-two hours no change of colour had ensued, but both plants were drooping—the Balsam very considerably, and the Laburnum slightly. In twenty-seven hours the drooping in the Laburnum had increased, but no change of colour had taken place; the Balsam was hanging its leaves quite perpendicularly, but, like the Laburnum, had not been in the least discoloured. The plants were removed, and at first seemed to be likely to recover, but of a sudden they drooped, and died completely down.

2. Two similar plants were introduced into a jar containing 200 cubic inches of air, along with 7 cubic inches of the gas, or 1 in $28\frac{4}{7}$. In twenty-four hours the Balsam had drooped only slightly, and the Laburnum scarcely at all. In twenty-seven hours, the Laburnum drooped not only its leaves, but even one of the petioles; but no discoloration was observed. The Balsam drooped much, some of the leaves falling off in removing it from under the bell-jar, but it was not otherwise affected, continuing as green as when introduced. This result is a curious one, as seeming to show that a large volume of the gas affects the plants, to all appearance, less than the smaller quantities.

3. Into a jar containing 130 cubic inches, a Balsam was placed, with four-fifths of a cubic inch of the gas, or 1 in $162\frac{2}{5}$. No effect was visible on the plant after exposure to its influence for twenty-four hours, but in twenty-seven hours it drooped. When removed after that time, though the plant survived, it never after seemed healthy. It may be remarked, in all the above experiments with HS, there was along the margin, and on the tips of the leaves, a copious deposition of drops of water.

V. Ammonia.

1. A Balsam was next introduced into a jar of the cubic capacity of 180 inches, along with 2 cubic inches of ammonia, or 1 in 90. In twenty six-hours the plant had drooped considerably, but not a trace of discoloration of the leaves had taken place.

2. A similar plant, placed in 85 cubic inches of air, along with one-fourth of a cubic inch of ammonia, was not affected in twenty-six hours beyond a very slight drooping. No discoloration was remarked, the plant being as green and succulent as when put in.

VI. Protoxide of Nitrogen (NO) or Nitrous Oxide.

1. Into a jar of cubic capacity 2000, was placed a Balsam, with 24 cubic inches of protoxide of nitrogen, or 1 in $83\frac{1}{3}$. In half an hour the plant had drooped considerably. In nineteen hours the drooping had not increased, but one of the leaves had shrivelled, and a cotyledon lay on the ground. Two of the leaves had their tips covered with mould, but they were as green as at first. In forty-three hours no change seemed to have taken place, farther than that now the other cotyledon and a leaf had fallen off. In sixty-eight hours no effect was remarked beyond what had already shown itself, and the plant was removed, but rapidly died down.

2. A Balsam was introduced under a jar containing 200 cubic inches of air along with 26 cubic inches of NO, and in half an hour the plant drooped, though slightly. No increase of the drooping took place in nineteen hours; but two of the leaves were covered with mould, and were lying on the ground. The plant was allowed to remain exposed to the influence of the gas for three whole days, but showed no symptoms of having been further affected. When removed after that time, it died quickly down.

VII. Carbonic Oxide.

1. Into a jar of cubic capacity of 130 inches, a Balsam was placed, with $4\frac{1}{2}$ cubic inches of CO, or 1 in $28\frac{8}{9}$. In nineteen hours there was evident drooping and a slight shrivelling of

some of the leaves. One leaf had fallen off, while the bottom of the pot was covered with patches of mould, but no discoloration took place. The effect of the gas did not show any increase in forty-eight.hours, except that now two leaves had fallen off. The plant was removed, but died rapidly down.

2. A Balsam was introduced into a jar of cubic capacity of 185 inches, with 7 cubic inches of CO, or 1 in 26$\frac{3}{7}$. In nineteen hours the plant had drooped much, and a deposit of mould had taken place in the pot. Though allowed to remain for three days, no further effect was produced, beyond the falling off of one of the leaves. The plant died speedily after removal.

VIII. Coal Gas.

1. A Laburnum was introduced into a jar containing 85 cubic inches, along with 4 cubic inches of coal gas, or 1 in 21$\frac{1}{4}$. In twenty hours its leaves drooped. In twenty-five hours the apex of the main stem had also drooped. The plant, after being left for four days, did not droop further. The cotyledons fell off in the act of removing the plant from under the bell-jar; it however recovered.

2. Into a jar of similar capacity, 50 cubic inches of gas were introduced along with another Laburnum. In twenty-four hours the plant drooped decidedly. It was then removed, and also recovered.

3. A Laburnum and Balsam were placed in a jar containing 180 cubic inches, along with 25 cubic inches of coal gas, or 1 in 7$\frac{1}{5}$. In twenty hours no perceptible change had taken place. On the fourth day of their exposure to the gas nothing particular was observable. The plants seemed fresh, with the exception of a slight drooping in the stem of the Balsam. Both these plants recovered.

4. Into a jar containing 200 cubic inches, a Laburnum and Balsam were introduced with 4 cubic inches of the gas, or 1 in 50. In twenty hours the cotyledons of the Balsam became slightly curled, while the Laburnum remained unaffected. No further change took place till the fourth day, when the cotyledons of the Balsam were observed to have become much paler and shrivelled, the leaves to have become dry and yellow

at the tips, and to hang down languidly. In the Laburnum, the apices of the leaves had become paler, and fell off when touched in the most gentle manner. Both these plants recovered. These experiments with coal gas seemed to show that, just as we found with sulphuretted hydrogen, when the proportion is large, the effect on the plants appeared to be less than when the proportions were smaller.

To conclude, then, it will be evident from the preceding experiments that gases divide themselves into two classes as regards their action on plants—viz., into narcotic and irritant gases. This distinction, to whatever cause traceable, is as real in the case of plants as in that of animals. When subjected to the influence of a narcotic gas, the colour, it was observed, never became altered, and the plants looked as green and succulent at the end of the experiment as at the beginning. Whenever the plant began to droop, though removed to a forcing-bed, and watered, in no instance did it recover, but died down even more speedily than it would have done if left to the continued action of the gas. In one word, narcotic gases destroy the life of the plant. With irritant gases, on the other hand, the action is more of a local character. The tips of the leaves first begin to be altered in colour, and the discoloration rapidly spreads over the whole leaf, and, if continued long enough, over the whole plant; but if removed before the stem has been attacked by the gas, the plants always recover—with, however, the loss of their leaves. In a short time they put out a new crop, and seem in no way permanently injured; but, of course, if repeatedly subjected to an atmosphere of irritant gas, the plants were destroyed.

III. *On the Poisonous Qualities of* Lathyrus sativus *in India.* By Dr George Buist, Allahabad.

Dr Buist observed that the *Lathyrus sativus* had caused extensive poisoning among the inhabitants of Allahabad. The use of its seeds as food appeared to give rise to a severe form of paralysis, which in many cases proved fatal.

Mr Giles Munby, from Algiers, stated to the meeting that this plant was used extensively for food by the inhabitants both of the south of Europe and of the north of Africa, and that he had never seen any bad consequences from its use.

IV. *On the Effects of the late Severe Winter on Vegetation in the Edinburgh Botanic Garden.* By Mr James M'Nab.

During the past winter, considerable damage has been sustained by some of the plants cultivated in the Botanic Garden. In many places roots were frozen up for four months. We need not, therefore, be surprised if the full extent of the mischief done will not be thoroughly ascertained before midsummer, particularly with deciduous trees and perennial herbaceous plants; while with evergreen trees and shrubs every day seems to tell more and more upon them.

Several species of coniferæ have suffered where the soil is heavy and damp, while other specimens of the same species growing in dry soil have suffered less. Those species which are totally killed, and which were growing in heavy, damp soil, are the *Pinus muricata, Dacrydium Franklinii, Cupressus Knightii*, and *Cupressus Goveniana*. With the exception of the Dacrydium, all the others have stood untouched for four or five years. Of those partially injured, the most conspicuous at the present time are *Taxodium sempervirens* (particularly in damp soil), *Cupressus macrocarpa, C. funebris, Cryptomeria japonica* (only in damp soil), *Pinus insignis, P. radiata, P. Edgariana, P. flexilis, Saxegothæa conspicua, Fitzroya patagonica*, also *Larix Kæmpferi*, and *L. Griffithii*. Of the recently introduced coniferæ which have stood uninjured during the past winter, both in heavy and light soils, are *Pinus tuberculata* (Jeffrey's variety), *P. Craigana, P. Jeffreyii, P. Balfouriana, P. Murrayana, Picea Nordmanniana, P. grandis, P. amabilis, P. lasiocarpa, Abies Mertensiana, A. Pattoniana, A. Hookeriana, A. Cilicica, Wellingtonia gigantea, Cupressus Lawsoniana, C. M'Nabiana, C. Lambertiana, Thuja gigantea, T. Craigana, Libocedrus chilensis*, and *Thujopsis borealis*. With deciduous trees, little will be observable till the full foliage season arrives. With evergreen shrubs the chief damage is amongst the Rhododendrons, most of the Bhotan varieties and many of the Sikkim sorts having fallen victims. Large plants of *Rhododendron lancifolium* are completely killed, as well as many plants of *R. ciliatum* and *R. glaucum*. Many of the hybrid rhododendrons are seriously injured, particularly the sorts raised by crossing *R. campanulatum* with *R. arboreum;* also those between *R. maximum* and *R. arboreum;* likewise between *R. ponticum* and *R. arboreum;* while the varieties raised between *R. Catawbiense* and *R. arboreum*, as well as those between *R. caucasicum* and *R. arboreum*, do not as yet show any symptoms of injury. If we should experience a continuance of hot suns without moisture, I fear others may yet give way. Besides rhododendrons, several Andromedas, *Garrya elliptica, Erica australis, E. arborea*, and *E. mediterranea*, have been considerably damaged. *Phormium tenax* is very much injured, and several plants of *Yucca gloriosa*, with stems two and three feet high, and fifteen inches in circumference, were laid prostrate during the winter. Several of these, however, assumed their upright position when the frost disappeared, while others are still procumbent, and require support, in order to keep their heads off the ground. Wall exotics have also been much cut down, particularly the New Holland species of the genera *Acacia, Eucalyptus, Bossiæa, Indigofera, Sida, Metrosideros*, and *Leptospermum;* also *Aloysia citriodora*, myrtles, and double wallflower. Herbaceous plants having roots more or less fleshy are considerably damaged, as *Momordica Elaterium, Exogonium Purga, Phytolacca decandra, Anemone patens*, and *A. alpina*. The Pampas grass appears to be totally killed in damp soil, while plants of it growing in dry situations seem as yet uninjured. *Tritoma Uvaria* is also killed in damp soil, and uninjured in dry; while *T. Burchellii* has suffered in both. Amongst biennial plants, stocks, antirrhinums, *Linaria biennis*, *Erysimum Perofskianum*, *Onopordon Acanthium*, *Carduus marianus*, and *C. eriophorus* have been killed. Beds of *Veronica Andersonii*, *Francoa ramosa*, and *Vittadinia triloba*, which have stood uninjured for several years, have likewise perished.

Mr M'Nab laid on the table flowering plants cultivated under the respective names of *Orobus flaccidus*, *O. vernus*, *O. elegans*, *O. venosus*, and *O. cyanus*. Also a series of seedlings, raised from each of these so-called species or varieties. Many of the seedlings are similar to each other, a few only of some of the varieties partaking of the parent type.

The seedlings raised from *Orobus flaccidus* during the year 1857, although similar to each other, differ widely from the parent plant, each having linear leaves, with stems somewhat procumbent, and producing small pale flowers. Those raised during 1858 are all narrow-leaved, more or less procumbent, producing also small pale blossoms, and flowering freer than the seedlings raised during 1857. This, however, may be accounted for by their being confined in small pots. Of the seedlings raised during 1859, although most of them have narrow leaves, a few show a tendency to the typical form. One peculiarity in these seedlings is, that they flower fully one month later than the plants which produced the seed. The seedlings now shown in flower were forced for the purpose of exhibiting them along with the parent plants. Seedlings raised from *Orobus vernus* during 1858 have not yet flowered; all have narrow leaves, instead of broad, which is the character of the parent plants.

Seedlings of *Orobus elegans* raised during 1858 are all narrow-leaved and somewhat procumbent. The original plants of this variety have also a tendency to vary, but only in the breadth of leaves, as shown by the plants exhibited. Seedlings of *Orobus venosus* raised during 1858 present a more varied tendency, the proportion with broad leaves being about one in eight. Seedlings of *Orobus cyanus* raised during 1858 are nearly equally divided between the broad and narrow-leaved varieties. Mr M'Nab stated that his attention had been mostly directed to the seedlings of *Orobus flaccidus*, being one of the finest of the spring flowering varieties. In order to prevent impregnation with other species, the plants selected for the seeds have been grown for many years in front of the hot-houses in the Botanic Garden, at a distance from the general collection of *Leguminosæ*. All the parent varieties here enumerated are upright growing, and all early flowering, and therefore past before the other species come into flower, so no impregnation with inferior varieties could possibly take place. Some tendency to vary had also been observed amongst seedlings raised from some of the late flowering species of *Orobus*, also with seedlings raised from the genera *Vicia* and *Lathyrus*, but these have not yet been tested.

Mr M'Nab exhibited growing plants of *Lastrea dilatata* having the stipes of each frond branched, and each division producing perfect fronds. He likewise exhibited seedlings raised from these plants during the spring of 1859, all presenting the same branching appearance, and although the fronds are not yet three inches in length, they are covered with perfect sori.

14*th June* 1860.—Prof. ALLMAN, President, in the Chair.

The following donations to the Society's Library were announced:—

"Fragmenta Phytographiæ Australiæ," Nos. VIII., IX., X., by Dr Mueller.—From the Author.

Transactions of the Philosophical Institute of Victoria, Vol. IV., Part I.—From the Institute.

The following donations to the University Herbarium were noticed:—

From Dr Thomas Anderson, H. M. Indian Service—Collection of Indian Plants.

Professor Dickie, Belfast—Arctic Plants from Port Kennedy, the winter quarters of the "Fox" (M'Clintock), collected by Dr Walker, surgeon, in the summer of 1859.

Mr Spruce—Additional Collection of South American Plants.

Dr Clay—Rare English Plants.

Rev. C. Hope Robertson, Killarney—Specimens of *Viola odorata*, var. *alba.*

The following donations to the Museum at the Botanic Garden were announced:—

From Dr James Hector—Japanese Tobacco, and Models of Sledges made of Birch, used in America about the Rocky Mountain districts.

Professor P. Smith—Sections of *Agave americana*, from Cape of Good Hope. Also, Printed Calling-Card made of Birch-wood.

Mr Davson—Fruit of Snake-nut.

Mr Andrew Murray—Piece of Wood showing how the abortive branches of a tree form knots in the trunk.

Mr James Russell—Leaves of Pitcher plant, ferns, Lycopodiums, &c., from Borneo.

Dr Thomas Ainslie, Hong-Kong—Skeleton Leaf of *Ficus religiosa*, with coloured figures on it.

Mrs Terrot—Fruit of *Physalis edulis*, or Cape Gooseberry.

The following communications were read:—

1. *Abstract of Experiments with Anæsthetic Agents on Sensitive Plants.* By Mr WILLIAM COLDSTREAM.

In this paper I have given an abstract of some experiments performed in the summer of 1859 on various sensitive plants, with the view of ascertaining the effects of anæsthetic agents on vegetable irritability. The subject was suggested by Professor Balfour, who offered a prize for it in his class.*

The experiments were conducted under most favourable circumstances, as far as the state of the plants was concerned. When a warm temperature was required, as in the case of the *Mimosa sensitiva* and *M. pudica*, accommodation was provided in the hot-houses at the Royal Botanic Garden. The agents employed were chloroform, sulphuric ether, amylene, and chloric ether.

The chloroform was used both pure and dilute. In the narration of the experiments, where not otherwise specified, pure chloroform is to be understood. Where the vapour of these substances was required, the plan taken was as follows:—

The bell-glass under which the plant or flower was to be placed was inverted and the necessary quantity dropped in; then, being quickly reversed, it was placed over the subject of the experiment.

In other cases, a piece of blotting-paper moistened with the required quantity was pushed under the edge of the glass, raised for an instant to receive it. Communication with the external air was prevented by the glass being placed on moist leather; or, when it stood on a wooden board, as was the more usual way, a rim of putty was put round its edge.

Experiments were first tried to discover the effect produced by the *actual contact* of the anæsthetizing agent with the sensitive leaves of the *Mimosa pudica*. Professor Marcet's observations on the subject, in vol. xlvi. of the Edinburgh New Philosophical Journal, were taken as a basis for these, but the results obtained were not satisfactory—no true anæsthesia being produced.

We now proceed to give the results of experiments made with the vapour of chloroform and amylene inhaled by the plant. These varied very much, according as the quantity of the agent mixed with the air surrounding the plant was great or small. Every result, varying between absence of all effect

* Mr Coldstream's Essay was rewarded with the Prize then offered.

and speedy death, was obtained, as will be seen by the experiments to be detailed.

Anæsthesia has been manifestly induced in a very limited number of instances; a very common effect when the vapour was weak was, a total or partial closure of the folioles when first exposed to it, followed in a short time by complete expansion, as if they became accustomed to the action of the chloroform. This is paralleled by an instance recorded by Desfontaines, who relates that, as he carried a sensitive plant one day in a carriage, the jolting of the vehicle caused at first contraction of the folioles, which after some time expanded, as if habituated to the movement.

In cases in which this re-expansion, while still exposed to the vapour, took place, diminution in sensibility was never observed on removing the glass. The vapour was then apparently (though sufficient to act as an irritant) not sufficient to produce an anæsthetic effect. But even when strong enough to cause the continued contraction of the folioles, either completely or partially, insensibility was far from an invariable effect. When, however, it did occur, it was usually in those cases where the folioles remained in a half contracted state.

Exp. 13. A plant was exposed in a jar of 185 cubic inches capacity to the vapour of five minims of chloroform. In two minutes the leaflets began to close slowly. The closure was only partial. In five minutes the glass was removed, the leaflets continuing half closed; when irritation was applied, the sensibility was found somewhat diminished. In this experiment, the proportion of chloroform was one grain to thirty-seven cubic inches of air.

Exp. 14. A plant was exposed in a vessel of 185 cubic inches capacity to the vapour of two minims of chloroform, being a minim to 92½ cubic inches. In ten minutes the folioles were all partially closed. In half an hour many still continued so, while others opened; and on removing the glass jar, the sensibility of those which were open was apparently slightly diminished. The plant soon recovered.

Exp. 15. A plant was exposed in a vessel of 185 cubic inches to the vapour of two minims of chloroform. In two minutes some of the folioles began to close, some reopened, others continued half-shut. In fifteen minutes the glass was removed, and the sensibility was found slightly diminished. The plant soon recovered.

Exp. 17. A plant was exposed in a vessel of 345 cubic inches capacity to the vapour of two minims of chloroform, mixed with methylated spirit, in the proportion of one to two. In four hours and ten minutes, slight anæsthesia was observed in the youngest leaves. The plant regained its sensibility.

Exp. 18. A plant was exposed in a vessel of 345 cubic inches capacity to the vapour of two minims of chloroform. In five hours the plant was removed, the leaves being then closed. On being examined the next day, the leaflets were found expanded, and the plant apparently healthy; but on applying irritation, it was seen that the sensibility of most of them was quite gone. On the third day they recovered.

Exp. 19. A plant was exposed in a vessel of 345 cubic inches capacity to the vapour of one minim. When removed in sixteen hours, the leaflets were found all open, and the plant apparently healthy, except that the leaf-stalks were slightly depressed. When irritation was applied, however, it was seen that they were quite insensible. The next day, the anæsthetic effect was still marked. On the third day they had recovered much of their irritability.

Exp. 23. A plant was exposed in a vessel of 185 cubic inches to the vapour of five minims of amylene. It was removed in one hour, when the tender upper leaflets were half-closed, the lower ones expanded. The upper leaflets were quite insensible to touch; the excitability of the lower ones was also greatly diminished. The leaflets were long in recovering. In half an hour the half-closed leaflets were still insensible to touch, and the lower ones very partially so. The complete recovery of this plant is uncertain.

Exp. 24. A plant was exposed in a vessel of 345 cubic inches capacity to the vapour of 17 minims of amylene. In ten minutes the pinnæ had begun to close with a jerking motion. In fifteen minutes all the upper leaflets were tightly closed, the lower ones being still expanded. These latter showed no diminution of sensibility when the plant was now removed. In a short time the upper ones began to open, and when half expanded, it was seen that their contractibility was lost, and that they had assumed a somewhat shrivelled appearance.

Exp. 25. A plant was exposed in a vessel of 344 cubic inches capacity to the vapour of two and a half minims, being nearly one minim to 135 cubic inches. It was allowed to remain fifteen hours and a half. Being removed at the end of that time, it was found almost completely insensible to touch. The upper leaflets seemed least affected, and soon regained a large measure of sensibility, but the lower ones continued perfectly insensible, while, at the same time, fully expanded, and to all appearance healthy. This state continued for three days after, when the folioles of the lower leaves began to drop off.

The results obtained by exposing the irritable stamens of the *barberry* to the action of chloroform, amylene, &c., have furnished by far the most satisfactory proof of a true anæsthetic condition in plants. Two species were experimented on —the British *Berberis vulgaris* and an American one. The character of the results was most interesting, and their uniformity remarkable. Immediately after exposure to the vapour, the irritative action, as in man and animals, first set in; that is to say, the irritable stamens of the flower sprung towards the pistil. This action was instantaneous; but almost immediately they began to move slowly back to their former position, till in a few minutes they were seen to be again appressed to the petals. If now removed from the bell-glass, the stamens were found to be *destitute of irritability.* Irritability was never lost until the stamens had thus sprung; and in the case of flowers, some of whose stamens only were thus irritated, it was found that those which had *not* sprung showed undiminished sensibility, while the others had lost every trace of it. Here was true anæsthesia; for if the flowers were now taken and exposed to the warm sun, they were, with very few exceptions, restored to their original irritable condition. They were exposed in bunches of from two to six, so that by one exposure many experiments were, in reality, tried. One bunch of strong young flowers of the *Berberis vulgaris* was exposed four successive times to the action of chloroform vapour, losing its sensibility in each exposure, and then recovering it in the sunshine. In the experiments with barberry the exposures were usually short, and the vapour employed comparatively strong.

I. *Chloroform.*

Exp. 27. Flowers were exposed to the vapour of one minim in a vessel of 13 cubic inches capacity. All irritability was lost in the course of three minutes. It was completely restored twenty minutes after being removed from the vessel.

II. *Amylene.*

Exp. 30. Flowers were exposed in the same vessel to the vapour of three minims, being one minim to 3½ inches, nearly. In ten minutes there was decided diminution of irritability. It was soon restored.

Exp. 32. Flowers were exposed in a vessel of 6·69 cubic inches capacity to the vapour of one minim. In twenty minutes insensibility was produced. They recovered within ten minutes.

Exp. 33. Flowers were exposed in the same vessel to the vapour of two minims, being one mimim to 3·34 inches. In seven minutes the sensibility was destroyed. It was restored in fifteen minutes.

III. *Sulphuric Æther.*

Exp. 34. Flowers were exposed in a vessel 19 cubic inches capacity to the vapour of five minims of sulphuric æther, being one minim to 4 inches nearly. Not affected in five minutes.

Exp. 35. Flowers were exposed in the same vessel to the vapour of five minims. In half an hour their sensibility was completely deadened. They recovered in twenty minutes.

Exp. 36. Flowers were exposed in the same jar with ten minims, being nearly one minim to 2 cubic inches. In half an hour completely deadened. They recovered only partially.

IV. *Chloric Æther.*

Exp. 39. Flowers were exposed in a vessel of 11·5 cubic inches capacity to the vapour of one minim chloric æther. They were not affected in twenty minutes.

Exp. 40. Flowers were exposed in the same vessel to the vapour of ten minims. In half an hour their irritability was gone. They partially recovered.

A *resumé* of the experiments made with barberry is given in the tables attached. Numerous other experiments of the most satisfactory character might have been quoted, but it is believed that what have been given are good average specimens, and that any accession to their number would only have confirmed the facts which they illustrate.

Similar experiments were made on the irritable stamens of the *Helianthema* and the column of the *Stylidium*, but no true anæsthesia was marked in the case of either. The *irritating* effect of the agents was abundantly manifest, but this was succeeded either by the speedy death of the flower, or its recovery in a short time, without having passed through any state which could be safely considered as really one of anæsthesia.

Tables of Experiments with Barberry.

I. *Chloroform.*

Minims per 10 cub. in. of air.	Length of exposure. h. m.	How affected.	Result.
·37	0 2	Not at all	...
·26	0 6	Sensibility diminished	Recovered in 20 minutes
·52	0 4	Irritability almost gone	Do.
·76	0 3	All sensibility lost	Do.
·86	0 3	Do.	Do.

II. *Amylene.*

Minims per 10 cub. in of air.	Length of exposure. h. m.	How affected.	Result.
1·9	0 2	Not at all	...
2·8	0 10	Sensibility diminished	Recovered
1·5	0 20	Total insensibility	Recovered in 10 minutes
2·9	0 7	Do.	Recovered in 15 minutes
6·6	0 18	Do.	Did not recover

III. *Sulphuric Æther.*

Minims per 10 cub. in. of air.	Length of exposure.	How affected.	Result.
	h. m.		
2·6	0 5	Not at all	...
2·6	0 30	Completely anæsthetised	Recovered in 20 minutes
5·2	0 30	Do.	Partially recovered
4·7	0 20	Do.	Recovered in 10 minutes
4·7	0 7	Do.	Recovered in 10 minutes

IV. *Showing the Comparative Action of the different Agents.*

Agent.	Minims per 10 cub. in. of air.	Length of exposure.	How affected.	Results.
		h. m.		
Chloroform	0·37	0 2	Not at all	...
	0·76	0 3	Sensibility lost	Recovered in 20 minutes
Amylene	1· 9	0 2	Not at all	...
	2· 9	0 7	Sensibility lost	Recovered in 10 minutes
Sulphuric Æther	2· 6	0 5	Not at all	...
	4· 7	0 7	Sensibility lost	Recovered in 10 minutes
Chloric Æther	0·95	0 20	Not at all	...
	9· 5	0 30	Sensibility lost	Partially recovered

II. *Account of a Trip to Clova, with Pupils, in August* 1859. By Professor BALFOUR.

The party, consisting of Dr Balfour, Mr M'Nab, Dr Pougnet, and Messrs A. Graham, Linton, John Rutherford, Le Déaut, Labonté, T. Pougnet, Branch, Corlett, and Bell, left Edinburgh on 12th August 1859, and proceeded to Kirriemuir and Clova, where they took up their quarters for about a week. They were afterwards joined by Mr Barclay. The use of the hall at Clova was kindly granted by the Hon. Donald Ogilvie. The party examined Glen Dole, Glen Fee, the banks of the Dole, and White Water, Little Gilrannoch, Loch Brandy, and the various mountains in the vicinity; and some of them proceeded afterwards to Ballater and the banks of the Dee. Among the rare plants collected may be noticed the following:—*Cherleria sedoides, Lychnis alpina, Astragalus alpinus, Oxytropis campestris, Dryas octopetala, Potentilla alpestris, Saxifraga nivalis, Erigeron alpinus, Gnaphalium supinum, Mulgedium alpinum, Saussurea alpina, Azalea procumbens, Veronica alpina, V. saxatilis, Salix lanata, S. Lapponum, S. reticulata, Betula nana, Gymnadenia albida, Malaxis paludosa, Juncus castaneus, Luzula spicata, Carex aquatilis, C. atrata, C. pulla, C. rariflora, C. vaginata, C. Vahlii, Alopecurus alpinus, Phleum commutatum, Poa alpina* and var. *vivipara, Polystichum Lonchitis, Pseudathyrium alpestre, P. flexile, Isoetes lacustris, Lycopodium annotinum, Splachnum mnioides.* On the banks of the Dee, near Ballater, which is 700 feet above the sea, *Aquilegia vulgaris* was gathered; near Monaltrie, *Linaria repens;* and near Pannanich Wells, abundance of *Mimulus luteus.* The Serpentine hills of Coial were visited, and on them were gathered *Armeria maritima,* alpine form; *Silene maritima,* alpine form; *Anthyllis Vulneraria,* in a very small state; *Arabis petræa,* and a peculiar form of *Saxifraga hypnoides.* On Lochnagar *Saxifraga rivularis* was gathered. At Loch Muick, which is 1200 feet above the sea level, the holly was found growing well. In many places the peculiar twisting of the wood of the Scotch fir was noticed. On the island in the loch of Kinnord, *Conium maculatum* and *Digitalis purpurea* were seen; and in the lake, *Lobelia Dortmanna, Nymphæa alba, Nuphar lutea,* and *Littorella lacustris.* In the same district *Radiola Millegrana* was seen. It was remarked that many plants were flowering a second time.

A specimen of the Kola nut from Sierra Leone (*Sterculia tomentosa*) was exhibited, which had been transmitted by Mr Baillie from Mr George Thomson. In the note accompanying the nut, Mr Thomson says—"It is held in great estimation by the natives in the neighbourhood of Sierra Leone, especially by the Mohammedans, who call it the 'blessed Kola,' and consider it to be the veritable forbidden fruit. In the interior of Africa, where scarce, it is so much prized that five Kolas are said to be equal to the price of a slave. I understand that it is much used as a substance for chewing, and is said to possess the property of keeping away the craving of hunger to such a degree, that a man can travel for many days without anything more than a single Kola. It will be observed how curiously the two halves of the bean lock into each other. This peculiarity is noticed in the following African fairy tale. A Criffy, or one of the genii, who has married a young and interesting lady, having occasion shortly after their happy union to go on a long journey, separates a Kola, retaining the one-half to himself and presenting the other to his spouse, with strict injunctions to keep it carefully, and threatening some fearful doom, should she on his return be unable to produce it. She is consequently very careful for a time, but is ultimately deprived of it by an envious sister; and you may easily imagine the dismay of the poor girl on discovering her loss, there being no possibility of obtaining any other half Kola that will tally with the one in possession of her lord."

Colonel Maclean, Royal Artillery, sent for exhibition sixty-seven drawings of Chinese plants, executed under his directions by native artists at Hong-Kong.

Mr M'Nab placed on the table plants of *Lychnis alpina* exhibiting marked variations under cultivation; also a hybrid plant of *Papaver*, betwixt *P. nudicaulis* and *P. alpina.*

Mr Robert Brown exhibited a piece of wood taken from the supports of the mud-barge at Granton Harbour, pierced by *Limnoria terebrans*, a sessile-eyed crustacean. It seems also to be attacking the piles which support the Chain Pier at Trinity up to high-water point. Though it does not bore deep, yet, by disintegrating the wood on the outside, it exposes the structure to the action of the waves, so that the supports of the Chain Pier, by this means, are in some places, notwithstanding the iron sheathing, almost eaten through. Its effects are also visible at Granton. Its ravages are thus dangerously destructive, and, from the small places into which it can insinuate itself, more dangerous than either Teredo or Pholas.

12th July 1860.—Professor BALFOUR, V.P., in the Chair.

The following Candidates were elected Resident Fellows :—

JOHN BAYLDON, Esq., Edinburgh.
CHARLES HENRY FOX, Esq., Bristol.

The following donations to the Museum at the Botanic Garden were announced :—

From T. C. Archer, Esq., Director of the Industrial Museum—Stem of a Twining Bauhinia; Stem of Huaco or Guaco, the famous antidote for snake bites, from Belise; a root, called Hipo, from Belise.

From Dr Traill—Milky Juice of the Cow Tree (*Galactodendron utile*).

From Dr C. Knox Ord—Sleeping Mat and Post Bag, made from palm leaves split up and woven together, used by the natives of Zambesi, in Africa; Rope made from a species of Hibiscus called "Milato," at Zambesi; Palm Leaf; Water Jar made from fruit of *Strychnos Nux-vomica;* and Moniliform Pod of *Pursætha.*

From W. S. Milner, Esq., Surgeon, Prison, Wakefield—Ropes, Mats, &c., made by the prisoners from *Macrochloa tenacissima*, called Spanish grass. The plant is the Spartum of the Romans and the *σπάρτον* of the Greeks. Livy refers to it as being used in Spain for the cables and ropes of ships, "Vis magna sparti ad rem nauticam congesta ab Asdrubale," Liv. xxii. 20; and in Homer we have *σπάρτα λέλυνται*, Il. ii. 135.

From Mr Dyce Duckworth—Specimens of Seeds (perhaps of a Carapa) imported from Ceylon for the purpose of dyeing.

The following additions to the University Herbarium were announced :—

From Dr Hooker and Dr Thomson—A large Collection of East Indian Plants.

From Mr R. Spruce, per Mr Bentham—Additional Collection of South American Plants.

From Dr Thomas Anderson—Specimens of Indian Plants.

From the Rev. W. C. Thomson—Plants from Old Calabar.

From Dr Hooker—Plants collected by Bourgeau, during Palliser's Expedition to the Rocky Mountains.

From Dr W. A. F. Browne—Specimens of *Trientalis europœa* from the neighbourhood of Aberfeldy; also specimens of *Cotyledon Umbilicus* from North Knapdale, Argyleshire.

The following communications were read:—

I. *Vegetable Morphology—its General Principles.* By Dr Macvicar, Moffat, N.B.

The forms of plants in general, the plant-form, why is it what we find it to be, and not otherwise?—that is a question which science has not yet answered. Philosophical botanists have indeed shown that all the more perfect plants may be regarded as consisting of an axis with its appendages; and that all these appendages, however varied in their forms and functions, are either leaves or transformations of leaves. They have also shown that all the special organs of plants have their uses, uses often manifold, and always good, and that the whole vegetable kingdom is beautiful, and calls upon every beholder that possesses sensibility to adore the Creator. But it has not yet been shown why the forms and organs of plants are what they are, and not otherwise; why the typical plant consists of an axis tending to spread out and radiate upwards and downwards into branches and root, the former tipped by the foliage and fruit, the latter by the rootlets and spongioles; why plants consist of the matter of which they do consist, and not other matter; and why they are so highly coloured and so fragrant. For all these features of the vegetable kingdom, and others of the same order, it has hitherto been possible to assign, not physical and physiological, but theological and moral reasons only. It has been possible to refer them only to the will of the Creator that they should be as we find them. Now, this is no doubt the ultimate reason; and for moral purposes, and for men in general, it ought to be sufficient. But to the man of science it is simply equivalent to saying, "God knows;" for the man of science is not at liberty to forget that whilst the Creator is the absolute Will, He is also the Supreme Reason, and as such has implanted in the soul of man the instinct of Philosophy, whose calling is to lay hold of Nature and wrestle with her for light as to the reasons of things, and whose word to Nature ever is, "I will not let thee go except thou bless me."

Doubtless there is a sufficient reason why the plant-form is as it is and not otherwise; and it is for the philosophical botanist to discover if he can what that reason is. To this inquiry there is in fact a moral and a theological, as well as a purely intellectual stimulus. Thus the forms of plants, at first sight at least, seem to exist in violation of all wisdom; they seem to be the very counterpart of those forms which pure intelligence, contemplating excellence of form as such, points to as the best—the very counterpart of those which geometry and dynamics sanction. Thus, though they be so useful and so beautiful, they are of all things the most fragile and fading; they are the sport of every blast. Other beautiful products of nature, gems, for instance, or pearls, may be set in gold, and stored up or worn by many wearers without being worn out. They preserve all their charms for many generations. But the most beautiful flower, the most fragrant nosegay, is faded before the evening be over. Now, why is this? Constant observation of the fact may indeed have so familiarised us with it that we may never think of inquiring, or even deem it needless or strange to ask. But there can be no doubt that if, in perfect ignorance on our part of the fate of flowers, a lily or a rose were presented to us, we could not in the first instance feel grateful enough to him who had given us such an exquisite production of highest art, yet, as soon as we saw how it was going with it, our gratitude would soon give place to a still stronger indignation, that he had merely mocked us with the possession of a thing so fading as to seem worse than the want of it. Now, why is it so? Why is the plant-form so fleeting? I answer, because it could not be more solid or more lasting than it is, if the vegetable kingdom is to take its place in nature, and to fulfil its mission there—that is, to intercede between and unite in harmony the fickle fleeting air and the fixed earth. Plants do not exist in disregard of the laws of a pure morphology—that abstract doctrine of form and structure which geometry and mechanics teach, and which the forms of the heavenly bodies, and of all stable structures exemplify. Plants realize those very forms which are most stable and cosmical up to the full measure that is compatible with their place and calling in nature, and the end they are appointed to serve.

But here it may perhaps be thought that all this is no more than an affectation of mystery, a raising of difficulties where none exist. That the forms of plants should be fragile, it may be justly said, so far from being a fault in their construction, is the very circumstance on which their usefulness depends; for, to the very extent that they are easily destructible, they are suitable as food for animals, a class of beings higher in the scale than plants, beings possessed of sensibility, beings such that a state of physical wellbeing in them is a state of enjoyment to them, and so teeming in multitude, and so worthy of existence, that for their sakes it may be said, in a high sense, that, next to the glory of the Creator, creation exists, yet beings such that they are all in want of food, which ultimately the vegetable kingdom alone can supply, and which it does supply well in the very degree that it is fragile and easily destroyed.

Now, against all this I have nothing to advance. I desire rather to appreciate it to the full. But I maintain that we have not reached all the reasons, or even the primary reason, why an object is as it is in all its details, and not otherwise, when we have discovered its economic use whether to ourselves or to other animated beings which are denizens of the world along with us. Such interpretations are good so far as they go; but the vastness of nature, and the multitude of its relations, demand a larger view. Thus, as to the point in hand, if we regard the vegetable kingdom as fashioned solely so as to form the best food for animals, we are thrown aback and silenced as soon as we are called upon to turn round and mark the abundance of uneatable and poisonous plants in nature. We are obliged to confess that our explanation is good only so far, but not adequate to account for the whole.

The truth is, that we must keep constantly in mind that creation is a manifestation of other attributes of God as well as His goodness, and specially of His unity and immutability—in one word, His perfection. Hence in nature a pervading unity of structure, and an universal harmony or homology of form; and hence, on the part of the student of nature, the indispensable necessity of a doctrine of general homology, as well as of specific utility. With regard to the forms of the vegetable kingdom, for instance, besides their relation to animals as food, they exist in many other relations; and we may be sure that as plants existed before animals, there will be an antecedent, a more general, and a more purely intellectual, geometrical, or dynamical reason for them—a reason which will be as satisfactory to angels as to men, satisfactory to those who have no need of victuals, and who possibly may have but little sympathy with creatures who lay such stress upon victuals as we inert and gravitating mortals on the surface of this planet are obliged to do. Nor let the discovery of such more ample reasons be despaired of. The wonderful, the beautiful fact is, the number of ends, each great in its own sphere, which are obtained, nay, as it were, spontaneously fall out, through the fulfilment of a single law, when the position of that law is supreme. It is the same in the moral world; but that by the way.

What I desire now to affirm is, that in reference to the vegetable kingdom, as in reference to every realm in nature, there is a supreme law; and that in so far as it is purely determinative of form, it is purely morphological, purely mathematical and dynamical. The properties of form and structure, viewed in the light of pure intelligence contemplating a system, a unity, expanded or to be expanded in space and time, are never, either here or elsewhere, violated for the convenience of the individual. Universal order is never sacrificed to private advantage. Euclid of old, when he was inquiring into the first lines and properties of form, and composing his immortal work in the light of abstract intelligence, and so that it should culminate and close in the discussion of the five regular bodies, was paving the way, the only way, for the right understanding of nature. And alas! after more than two decads of centuries, we have now to take up the subject very much where Euclid left it.

The supreme law to which I now refer is this, that every individualised form in nature shall tend towards that which intelligence gives as the most perfect of forms, and shall attain to that form so far as is compatible with the nature and environments of the form-possessing object, as being also something else and something more than merely a form.

That such a law has every *à priori* argument in its favour, will not be denied. And let it not be denied or set aside at once by the fact, which may be alleged, that the forms of natural objects are just what the physical forces make them to be. I am prepared to show that the physical forces are themselves not only the subjects of this law, but the very instruments appointed to realise it in nature. It is only for its own misery that modern science, in the heads and hearts of so many of its cultivators, tends so often to rest in the physical forces as a last word. The physical forces are creations of pure intelligence and representatives of it, and they do nothing but in fulfilment of its behests and in execution of its designs. To rest in the physical forces, and to look to them as the first of things that we as men of science have to do with, is to consent to an ill-understood multiplicity of agents at the fountainhead, instead of a perfect unity. It is consequently to disregard the highest aspirations of the logical faculty, and to be intellectually miserable. Unless, as naturalists, we are free to trace creation up to that Unity to which it owes its being, and to seek at least, if not also to find, manifestations of the attributes of that Unity all down the stream of being, natural history renounces its title to a place among philosophical pursuits.

But what is that form which intelligence declares to be the most perfect as form, and in which I maintain that the first lines, the most general features of a truly scientific morphology are to be sought and found? To this I answer, that were it not that demonstration is needless, because it has been demonstrated so often before, it might be demonstrated here, that that form is the sphere.

But it is here to be remarked, that of spheres considered as realised in matter, two kinds are possible. There is *first* the solid sphere, or sphere commonly so called; and there is *secondly* the hollow sphere, or spherical superficies, or sphere properly so called. And of these two it is to be remarked, that while, viewed as composed of material particles (each particle a centre of attractive and of repulsive force), they both possess mechanical stability in a high degree, yet as to contents each is curiously the complement of the other. Thus the solid sphere is the form under which any given quantity of matter displaces least of the surrounding matter, and under which, consequently, any given quantity of matter can be stored up in the least bulk. It is therefore the fittest form for being chosen as a deposit of precious matter, when that matter is not in use. The hollow sphere, on the contrary, is the most capacious vessel into which a given quantity of matter can be fashioned without breach of continuity. It is the form by constructing which most can be made of the material employed. Its mechanical strength also, in relation to pressures and other disturbing forces, whether without or within, is a maximum. Between them both, these spheres fulfil, to a wonderful extent, the conditions of perfection of form.

Now I maintain that these two are the forms which it is the primary office of the physical forces to develop, so far as circumstances do not forbid their development. The proof of this I cannot enter upon here in detail; but this may be here remarked with regard to these forces, that however manifold their names, they are all of the nature of attraction or repulsion. Now attraction, as has been demonstrated since the days of Newton, and might have been inferred from the first morning that a dewdrop was observed, has for its first function to fashion all individualised portions of matter into solid spheres. Repulsion, again, has no less obviously for its first function to expand these solid into hollow spheres; so that between the two they constitute a complete apparatus for the development of these most perfect, most generalised forms, and for rendering them the forms of universal culmination. Nor is this all: if attraction and repulsion be not co-ordinate in extent and force,—if attraction be appointed to rule on the great scale and at first, and repulsion on the small scale and at last,—then these two forces not only give a contour to natural objects, they give also a course to nature. They prescribe as a rule, that an object shall be first constructed as a solid sphere; and that then, after being as such the representative of the prevalence of attraction, its particles shall tend to expand, and its form to develop, so as to distribute themselves in a spherical superficies, the object thus becoming the representative of the prevalence of repulsive power, or heat.

Now, in these facts and inferences an account of the first lines of vegetable form and life is to be found.

In keeping with what has been said of the solid sphere (that it is the fittest shape for a deposit or store of such matter as it consists of), it is seen to be the choice of Nature for the form of the vegetable being when deposited anew in the soil, when on its travels from one locality to another, when housed in winter quarters, and, generally, when the aim of Nature is to store up as much living matter as possible, so that it shall displace least of the surrounding matter and expose itself least to external injury. So far as the mode of nutrition and the type of the species permit, and as often as there is unity in the organ, the solid sphere is the culminating form of fruits, seeds, spores,* tubers, buds, &c. Nor is this all the verification which our theory derives from the phenomena. In accordance with its doctrine (that the course of subsequent action consists in the expansion of the material constituting the solid sphere into a hollow sphere, so far as the conditions of existence permit), the germination and evolution, the growth of the plant is but the protrusion and development of the contents of such solid spheres or spherules as have been named, with assimilation of surrounding matter. That the reproductive forms of plants are more dense than their other living forms generally, is matter of common observation. Vegetable matter in general floats, but seeds sink, and in fact their economic value is usually estimated by their density. They have invariably contents which they tend to protrude.

Moreover, the limit of form towards which growth tends is nothing else but the hollow sphere! In consequence of the extreme difficulty of constructing this form, it is indeed, when

* This would be the place for an allusion to the pollen also, were it not that this product of vegetable nature requires a separate consideration.

not of microscopic minuteness, usually reached only piecemeal, only in morsels, only by the unfolding of small disks (leaves) supported on radii (axes, branches, petioles), to which the peltate leaf or system of leaves terminating the branchlet or petiole is normal, as the spherical surface always is to its radii. Many, indeed, are the obstructions to the development of a spherical contour, many the impediments in the way: as, for instance, the structure of the embryo, and the specific development proper to it; the supply of food, not equally all around but in certain directions, and sometimes in one only; the embarrassment of the individual plant-form in its relations with other plants, with the ground in which it grows, the weather, &c. Still, with all these limitations, it is remarkable to what an extent the spherical is actually attained in the contour of fully developed outstanding plants and trees, as also the hemispherical in those which grow in tufts or clumps. The primary axis which carries up the first foliage into the air, does indeed often keep the lead which it takes at first, thus giving as the geometrical form which circumscribes the tree, not the exact sphere, but a spheroid (the form which is nearest to the sphere), the longer axis perpendicular to the horizon. Let but the eye, when wandering freely over Nature where her forms have not been modified by the artistic but mutilating hand of man, only mark the general contour of plant and tree, and construct in imagination the geometrical form by which the plant-form in the eye will be best circumscribed, you will wonder how often the circle in profile, the sphere in full form, is called for; and if not just these forms exactly, then those which constitute the least departures from them,—the ellipse, the spheroid or ovoid, the semi-ellipse or flattened tuft or clump or cone.

This, the first law of vegetable morphology, or rather of morphology in general, as illustrated by the vegetable kingdom, enables us also to explain in a satisfactory manner a phenomenon observed in simple plants or plants with a single axis, which in itself has been considered as strange, and seeming even to interfere with specific identity of form. Thus it is generally to be remarked of simple plants, and the fact is always introduced into drawings of ideal types of plants, such as those which are figured in the popular works of Schleiden and Unger, that their lower and upper leaves, whether viewed in reference to their disks or their petioles, are very imperfectly developed compared with those about the middle axis. The upper and lowest, in fact, are often quite simple, and want petioles altogether, though those in the middle between them be finely divided and fully petiolated. Now, what is this production of leaf-stalk and foliage about the middle of the stem but a normal development of radial and peripheral matter, bent on reaching and covering as far as possible the equatorial region of the plant-sphere periphery, a region which, being at once the largest and farthest from the axis, is most difficult to fill up and to reach? The phenomenon is usually explained by a reference to the condition of the vital action of the plant at different seasons,—its feebleness towards the beginning and the end of life, when the first and the last leaves are protruded. And no doubt the life of the plant is always coordinated with the work which it has to do. But why is life feeble at first, or why are the lower leaves developed when life is feeble, and why the same with regard to the last leaves, when the plant is touching on its full development? Why but because that life, that energy, has a certain design, a certain law to fulfil; whereof the hollow sphere is the most general and the most perfect expression among all possible forms. The very same thing is in fact observed among forest trees and perennial plants, to which this doctrine of feebleness at first and exhaustion at last does not apply.

But in what has preceded, I have taken for granted the existence of radii as well as a spherical superficies, of an axis as well as the foliage appended to it, of stem, branches, and petioles as well as leaves—of a scaffolding, in short, for supporting foliage widely extended in space, though belonging to a single individual, and though aiming at the formation of a single spherical shell of verdure. Now these radii, stems, branches, petioles, the law of sphericity can scarcely be held competent to supply. Were there no other law but that of the sphere which was determinative of the forms of vegetable nature, plants would be all parenchymatous and laminar, all leaf, frond, or thallus; the plant-form either successful in attaining the spherical form (as plant matter may, when individuality contents itself with minuteness), as cell or vesicle (*Sphæria, Sphærococcus, Hydrogastrum*, &c.), or unsuccessful, as is always the case where the plant is large, the *nisus* merely being indicated by the turning up or down of the edge of the frond, or the formation of a disk-like thallus, which is the first form of so many species,—now becoming a cylinder or tubular body (that is, a hollow sphere whose axis is indefinite), now a lamina turning round upwards and cup-like (*Cenomyce, Nidulariaceæ*), or pitted with lacunæ (*Sticta*), or turning downwards, or waved, or crisped at the edge, or over all the frond, as in many Algæ, Fungi, and Lichens. Now all this argues the influence of the sphere, and its power of direct self-construction without the aid of radii. And indeed to a much greater extent than in reference to the entire plant, the doctrine of the sphere accounts for the forms of the most fully developed and perfected parts of the thallophytes generally—those parts, namely, in which individuality has established itself most fully, and in which, consequently, the reproductive spherules or spores are produced. There is scarcely any of these tribes of plants whose forms do not culminate in spherical, hemispherical, or circular balls, shields, disks, or sporocarps of some such form, displaying lineaments of the sphere or its elements.

But it is equally certain that, from the simplest species up to the most perfect, the plant-form shows a disposition to ramify and to distribute itself as far and wide as possible in the medium in which it grows. In the very simplest organisms (*Confervaceæ, Hyphomyces*), ramification, radiation, is already carried very far. And although there has been a reluctance on the part of systematic botanists to recognise any analogy between this filamentation of these simple plant-forms and the branching of more perfect plants, yet, morphologically viewed, they are obviously and certainly analogous. Nay, among these simple plants, too, not only have we ramifications, but the rami or filaments even generally succeed in expanding at their tips either into laminæ exhibiting the forms of leaves (*Delesseria*) or into float-vesicles, which are hollow spheres or spheroids (*Sargassum*), or into multiple branchlets (*Polysi-*

phonia), or into spore-producing cells, as is general. On comparing the branching of a forest-tree between the eye and the horizon in a winter day, when the foliage does not intercept the sight, with that of a finely branched confervoid in water, in a glass vessel held up to the light, nothing can be more analogous than the two. They must be due to the same morphological law. Nay more, shocking as the assertion may at first sight appear, there is nothing for us but to affirm that the vital nodes in the stems of perfect plants, and the septa in the filaments of the simplest vegetations, are analogous, and do in point of fact owe their existence in both (as do also the analogous productions in veins, lymphatics, intestines, &c.) to the same morphological cause—and that the doctrine of the sphere, the tendency of every axis to become at once hollow and finite, so as to approximate the hollow sphere as nearly in form as it may, thus giving ends to itself and closing up in the line of the axis step by step as it lengthens, while as yet its length has exceeded as little as possible that of its diameter. But these things by the way at present. It is the very existence of an axis and branches, often long, tortuous, climbing, that we have now to explain; for this, which is nevertheless the characteristic feature of the vegetable kingdom, the law of sphericity does not explain. We might indeed affirm cogently in general, that the sphere gives its own radii, and therefore that the law which gives the foliage gives also the axis. But in actual nature the axis takes such a lead, ascends, spreads, creeps, at such a rate, that it is manifestly the illustration of some other law. Far from aiming at a minimum of space for the plant to grow in, the stem and branches seem to delight in extending and even often straggling farther and farther.

What, then, is the morphological law which gives axis and branches, diffusion and size to the plant, and which in fact modifies to such an extent the law of sphericity that, except in internal structure and microscopic species, it is realised only piecemeal, the foliage constituting a sort of dermo-skeleton or system of scales indefinite in number? This inquiry let us now proceed to answer. But here I would first remark, that this additional law, though it give the characteristics of the plant form, yet is not a law of vegetable morphology merely. It is like that which we have discussed—a cosmical law. But what is it? It has received many names, according to the point of view in which it has been regarded. Thus it has been designated now the law of continuity, now the law of diffusion, now of osmose, now of solution, now of crystallisation, now of chemical union, &c. I have elsewhere shown* that into them all the idea of assimilation enters, and that to include them all, and express the law in its most general and comprehensive terms, it must be called *the law of assimilation*. But as indicating a more purely mathematical conception of it, and therefore as more kindred with our former law, the law of the sphere, we may retain for it here the name of *the law of continuity*,—a name, moreover, which is consecrated by the invocation of the greatest philosophers of modern times, and especially Leibnitz. It is to the effect, that all abrupt and discontinuous movements and changes in nature shall be forbidden, and that dissimilars, on their mutual confines at least, shall be assimilated to each other more or less. It has been curiously verified in the laboratory in the phenomena of gaseous diffusion, liquid osmose, capillary action, &c. Nor has its operation been remarked on the small scale only. The relations of adjacent strata on the earth's crust supply many beautiful illustrations of it. But what we have here specially to remark is, that it takes place between the two great media that clothe our planet,—between the air and the earth, the incumbent atmosphere above and the soil in contact beneath. In virtue of this great law, the air on the confines of the earth tends to penetrate the earth, and to be assimilated to it by becoming concrete; while the earth, in its turn, on the confines of the air tends to penetrate—to ascend into the air, and to become aërial. Those earth-particles which are capable of the aëriform state tend to rise into the air as gas, vapour, odour; and those which are not volatile, yet separable from each other, tend to separate from each other, and to effloresce into the atmosphere, and to constitute, on the confines of the air,

* See Proceed. Roy. Soc. Edin., Sess. 1858–9, p. 146. Proceed. Phil. Soc. Glas. 1859, p. 52. Report Brit. Assoc. at Aberdeen, 1859; and *First Lines of Science Simplified*, &c., by the Author (Sutherland and Knox, Edin. 1860).

earth-tissues as highly diffused and lace-like, as spreading and elastic, mobile and coloured—in a word, as aërial and bright as possible. I say bright as well as aërial, because the atmosphere is the realm of light and colours as well as of air.

Such, under the law of continuity, the law of mutual assimilation, must be the tendency between themselves of these influential neighbours the air and the earth. The air-particles must seek downwards, and tend to become concrete like the soil; the earth-particles must seek upwards, and tend to become insulated as individuals like the air-particles, and to spread abroad in the air. Now, to what extent do we find this tendency actually realised in nature? To this it will be immediately answered, that the soil actually does absorb and retain in it a goodly quantity of air. The earth, also, it will be admitted, the longer it is exposed to the air, becomes more and more pulverulent; nay, actually rises in clouds of dust. Certain earth-particles also, of peculiar tectonic powers (potass, lime, &c.), in secret places, where all is still, are known to effloresce beautifully into the atmosphere, suggesting as it were, and anticipating, the vegetable kingdom. Nay, what does not vaporise or effloresce invisibly, more or less? The atmosphere over damp clay has a clay odour, and an iron smell is affirmed to be perceptible over damp iron. It seems as if there were a tenuous invisible efflorescence around the most fixed bodies, not sensibly diminishing their weight however long investing them, which a continued evaporation could not fail to do, but merging, fusing, rooting them in the ambient air, and fulfilling as far as possible the law of continuity between them and the air. Moreover, the moisture of the terraqueous globe, under the same law, is ever rising into the air as vapour, and thus forms the world of clouds, so varied, so beautiful, so grand, and no less beneficent than beautiful. For having ascended into the air and gained the aëriform state, the vapour is now called upon by the earth beneath, and that under the same law of assimilation, to be assimilated to the earth beneath—that is, to become concrete, and to come down again. And, accordingly, down it comes, in rain, hail, snow, causing what to blind sensibility seems no better than a war of the elements, but to intelligence a harmony and a mutual embracing.

But this is not all. By the miracle of the creation of the vegetable kingdom at first, and by sowing the surface of the earth thereafter with the seeds of plants, the Creator has provided for the fulfilment of the law of continuity between the earth and the air to a wonderful extent. In fact, the vegetable kingdom as a whole, what is it, when viewed in reference to the atmosphere, but air become concrete as vegetable tissue, piercing down into the earth, and rooting itself in it? And what is it, when viewed in reference to the earth, but a system of earth-particles—aqueous, gemmeous, earthy, or alkaline—poised in the air, which, in so far as they are incapable themselves of the aëriform state, are suspended in and diffused through the air to the utmost by the foresaid scaffolding of concrete air-elements and vapours, and exhale into it in forms more truly aëriform than those in which they enter the plant: fixed air exhaling as vital air, leaving its carbon behind; water becoming vapour; the vapour also resolving itself into oxygen and hydrogen, both of them more truly aëriform than the vapour itself; hydrogen, indeed, the most exquisite of all aëriforms, which, if it do not exhale from the plant into the atmosphere as pure hydrogen, it is only because it is obliged to take up carbon (one of the most fixed of all the elements) along with it, thus to render the vegetable kingdom fragrant, and to fill its cells with essences and oils, balsams and medicines manifold.

And thus we see that a plant must be animated by both an ascending and a descending system of parts and modes of action, of which the characteristics are, that the ascending system must be an analytic or separative, the descending a synthetic or combining agency. And thus we are fully able to understand how a living plant may accomplish such acts both of decomposition and of combination as cannot be at all imitated in the bottles of the laboratory.

But I confine myself here to remarking that, by this theory, by this additional law applied to vegetable nature, we obtain a full explanation of those features in the forms and structure of plants which the first law, the law of sphericity, fails to supply. That theory explains only the laminar, the parenchymatous, and the cellular. It does not explain the fibrous and vascular, or the existence of stem, branch, or root. But all these are fully accounted for by the law of continuity, the law of assimilation, if that law be allowed to take effect between the earth and the air. In a word, if a system of air-particles is to be made concrete in the earth and diffused there, and a system of earth-particles to be rendered as aërial as possible, and distributed through the air, what do we require as an instrument and a realization, but a radiating or branching root under ground, and a radiating or branching plant above ground, meeting in a stem which is common to both? While the Law of Sphericity gives the foliage and the general contour of the plant, the Law of Continuity or Assimilation (between the earth and the air) gives the stem, branches, and petioles, the root and rootlets.

To this theory there also attaches a standard, by which the place of a botanical species in the scale of vegetable forms may be determined. Thus, the more successfully a plant maintains a spherical contour, and at the same time ramifies, and subdivides, and multiplies its parts and organs, the more successfully it distributes its foliage and suspends earth-particles in the air, just so much more perfect is the plant as such, considered as an individual. And the same of the root, with regard to concrete air-particles.

Our theory also accounts for the substances of which plants consist, and the food which they require in order to growth, and therefore involves a theory of cultivation. All these points are at once indicated in our conception of a plant; namely, that it is an assimilative-diffusive apparatus placed on the confines of the air and the earth, and appointed to diffuse each in the other, and assimilate both. It is an apparatus (1.) for subliming earth-particles, for analysing and insulating them, for rendering them mobile like air-particles, and for carrying them up into the air; and (2.) for concreting air-particles, fixing them at the surface of the earth, and carrying them down into the earth as concrete matter. Hence we are able to understand why such large quantities of earths and alkalies should be found so constantly in plants, and are led along with the school of Liebig to affirm the necessity, in order to the successful cultivation of plants, of attending to the ashes of plants. But we are also prepared to find that, with the exception of the ashes, all the plant besides shall consist of concrete air-particles, or matter which the air can supply, and which can be best provided in the soil; for it is not to be forgotten that, with the single exception of atmospherical nitrogen, all the air-elements are earth-elements also, and belong to the earth as well as come into it by descent from the atmosphere. They are also the elements of which organic remains mainly consist. Our theory suggests, therefore, as the grand desideratum in agriculture, along with perfect tillage, not certain conditions as to the mineral constituents of soil merely, nor abundance of manure (considered as a combination of carbon, hydrogen, and oxygen, with nitrogen more or less) merely, but an adequate variety and abundance in the soil of *lakes*—that is, of air-elements in union with earth-elements—for the roots of plants to act upon, analyse, and absorb. And along with still improving methods of tillage, the construction of such lakes or dry manures with the greatest economy, and in variety answerable to the different crops which are grown, presents itself now as the great aim of agricultural science, nature having shown the example in giving guano.

But it is not the external forms and the chemical composition of the vegetable kingdom only which our theory explains. It throws great light upon the internal structure of plants. Thus it not only leads us to infer that all the first and simplest plants, and all the first elements in every plant, shall be little hollow spheres—that is, cells, vesicles, or utricles; but it leads us also to expect that, as soon as this cellular mass can claim individuality, and constitutes a plant at once aërial and terrene, with both a descending and an ascending system and therefore a combining or concreting, and an analysing or rarefying mode of action accompanying, the cellular matter, under the influence of the descending mode of action, commencing in the foliage, must, as it proceeds downwards, tend to concrete and combine into forms more and more continuous and dense, as, for instance, into vessels, fibres, and encrusting matter, still increasing in quantity as we approach the terrene part or root. Under the influence of the ascending, the separating, and rarefying system, on the other hand, the mass of cellular matter must continually tend to separate and expand into laminæ, or leaves and cells with their walls, still more and more bright and aërial (as in blossoms in particular, and parenchyma and the epidermis generally).

Under the same state of things, it follows that the distribution of woody (or concrete air) matter and of ashes (diffuse earth-elements) in plants and trees shall be the converse of each other. The woody matter, as the product of the foliage, and of the descending concreting system, will be found in greatest strength in the interior of the stem and root; the ashy matter or earth-particles, the product of the ascending system, in the periphery of the stem and of the entire plant or tree.

That all these deductions from our theory are verified by observation, is too well known to require to be stated; and here let us conclude with a remark suggested by the last inference, which throws light upon a great question in high philosophy.

It is well known, in accordance with what has just been shown, that plants and trees are aërial and light above, massy and strong beneath. Now, this fact in creation has usually, in common with others of the same order, been held to be fully explained by a reference to its expediency. It has been said that plants have been wisely made light and aërial above, solid and tough beneath, to the end that they may be able to support themselves and brave the storm. Now this is undoubtedly a good explanation so far as it goes; but from what has preceded, we find that it does not go to the root of the matter. From what has preceded, we find that the lightness of trees above and their solidity beneath is not a particular expedient adopted in their interest alone, for securing a special end in their behalf alone. We find that it is secured in the fulfilment of a grand principle—that it is provided for in an all-embracing law, in the framing of which this particular end and innumerable other beneficent ends were provided for. These ends may indeed be advantageously contemplated by us in detail as such. But if we are to look for such ends in every individual object in nature and in every organ, we are only preparing ourselves for frequent disappointment; for utility is not the point of view which ought *to rule* in our regards. In the natural as in the moral world, there is a higher principle than particular expediency or individual interest. There is a call all through nature, which is ever for order, universal order, the wellbeing of the whole. And accordingly there is in natural science a doctrine of *general homology* as well as of *special utility*. And truly wonderful it is to observe to what an extent, in the natural as in the moral world, multitudes of special uses and individual advantages in detail are secured as often as supreme law is obeyed. Hence the grand aim at once of science and philosophy ought to be, the discovery of supreme laws; and to this theme the preceding pages have been devoted in the delightful field of the vegetable kingdom.

II. *Observations on some Bisexual Cones occurring in the Spruce Fir*, (Abies excelsa). By ALEXANDER DICKSON, M.D., Edin.

When in Peeblesshire, in the beginning of last month, I met with an interesting, although apparently not a very uncommon abnormality in the shape of what may be termed bisexual cones, occurring in some young spruce firs. The abnormality consisted in the lower portion of the cone being covered with stamens, while the upper or terminal portion produced bracts and scales like an ordinary female cone.

The staminiferous portion varied in extent from about ½ to ¾, or even more, of the whole cone, and differed in no respect from the normal male cone, except perhaps that it was rather thicker, in consequence of the axis being a little stouter than usual.

The remaining upper part of the cone, on the other hand, bore small, narrow, more or less acute, bracts, with large pinkish or rose-coloured scales in their axils, and in fact resembled the normal female cone.

On closer examination, I found the stamens at the upper limits of the male portion of the cone somewhat altered in shape. The indurated scale-like crest of the anther became more elongated, whilst the anther cells at its base were diminished in size. The stamen now closely resembled one of the bracts of the female cone; indeed, some of these taper-crested stamens contained the lowermost scales of the female portion in their axils.

In these specimens, therefore, *the stamens in the lower part of the cone are serially continuous with the bracts of the terminal portion.*

Schleiden mentions, that "in *Abies alba* it not unfrequently happens that a portion of the lower leaves of the female inflorescence becomes converted directly into stamens; but then no axillary buds [scales] are developed." * The abnormality to which Schleiden refers must have been precisely similar to that which I have exhibited; and I cannot but think, that if he had looked at them closely enough, he would have found some of the lowermost scales in the axils of stamens as I have done.

Richard, in his *Mémoires sur les Conifères*, &c., plate xiv., has given a somewhat indifferent representation of an "*amentum androgynum*" in *Abies*, of which the lower portion is staminiferous; but without any commentary, beyond the mere indication of stamens in one portion and scales in another.

Dr Lindley, in his "Vegetable Kingdom," thus refers to the morphological constitution of the male cone. "It is obvious, that in the larch, the cedar of Lebanon, the spruce, and the like, each anther is formed of a partially converted scale, analogous to the indurated carpellary scale of the females; and therefore each amentum consists of a number of monandrous naked male flowers, collected about a common axis" (p. 227).

That the above is an erroneous view of the homologies of the male and female flowers in the coniferæ, I am fully persuaded, and I am the more impressed with the necessity of attempting its refutation, when I reflect on the consideration which is justly accorded to Dr Lindley's opinions.

1. There is no reason why the stamens in a male cone should not be regarded as foliar structures belonging to one

* Schleiden's Principles of Botany (Lankester's translation), Note to p. 299.

and the same axis, viz., that of the cone, since they are not placed in leaf axils, nor do they, so far as I know, present any articulation, or any other evidence of their being possibly other than what they seem,—viz., simple stamens arranged spirally upon one common axis, thus constituting a single male flower.

That such a view of the male cone is well founded, appears from the abnormality under consideration, which proves the stamens of the male cone to correspond to the "bracts" of the female. That the bracts of a female cone are the leaves proper to its main axis, is at once proved by examination of the larch cone, where there is a gradual and beautiful transition from the "bracts" to the ordinary green leaves surrounding the base of the cone, with which leaves the bracts are serially continuous. From these considerations it follows that the stamens in a male cone represent the leaves proper to its main axis, that, in fact, they collectively constitute a single male flower as I before mentioned.

2. In these bisexual cones, the "bracts" at the upper part are serially continuous with the stamens below. From this it is evident that the stamens in a male cone must be represented, morphologically at least, by the bracts in a female, and not by the scales, as Dr Lindley believes.

The question, however, remains—What is the nature of these scales?

As the bracts of the female cone are the leaves of its main axis, it is manifest that the scales which originate in their axils must belong to secondary or lateral axes, whether they are viewed as foliar or as axial structures.

The opinion generally entertained by botanists, that the scale is a foliar structure, analogous to a carpellary leaf, has been ably combated by Schleiden, who asserts that "throughout the whole vegetable kingdom, *no* simple leaf is *ever* formed in the axil of another leaf."* From this, among other reasons, he draws the conclusion that the scale cannot be considered as a leaf, but must be regarded as an axial organ.

Dr Lindley has attempted to negative the objection by asking "what the fruit of *Salix* is but *folium in axillâ folii?*"

* Schleiden's Principles of Botany (Lankester's translation), p. 385.

This question, however, regarding the fruit of *Salix*, seems irrelevant, since there is not merely a simple leaf contained in the axil of each bract in the amentum of *Salix*, but a floral axis with receptacular scales, carpels (probably two), and a placenta with ovules.

At the same time, Dr Lindley does not seem to consider the content of the bract in the cone as consisting *absolutely* of a simple leaf, since he says that the scales "occupy the same position with respect to the bracts as the leaves [I presume of *Pinus*] do to their membranous sheaths." The fascicled leaves, however, which occur in the axils of the membranous leaves in *Pinus* are, as he himself holds, the product of secondary or lateral axes; and the occurrence, indeed, of these short and more or less abortive shoots in the axils of membranous or bract-like leaves in *Pinus* affords a good argument in favour of Schleiden's determination of the scales of the cone as shoots, abortive so far as longitudinal extension is concerned, and comparable to the flattened leaf-like shoots of *Ruscus* and *Phyllanthus*, or to the curiously expanded shoots in *Phyllocladus*,* which, as being a gymnosperm, possesses a peculiar interest in this respect.

On the whole, as there is no evidence that the bract in the cone contains other than a simple structure—viz. the scale—and as we cannot consider this latter as a *simple leaf* ("*folium in axillâ folii*" being, strictly speaking, without a parallel), we are obliged for the present to accept, as more probable, the other alternative, and view the scale as a *simple flattened shoot.*†

* With these last must not be confounded the somewhat similar expansions in *Salisburia*, which, however, are true leaves, producing shoots in their axils.

† I must not omit to mention, that Dr Lindley (Vegetable Kingdom, p. 227) refers to a figure in plate xii. of Richard's *Mémoires sur les Conifères, &c.*, where he says that there is represented a monstrous cone of *Abies*, in which the scales have assumed the common appearance of leaves. I am rather at a loss to account for Dr Lindley's reference, because the abnormality figured in plate xii. is not a cone, but what Richard terms "*monstruosité strobiliforme*," and consists in a hypertrophy at the bases of the leaves, resulting from irritation or morbid stimulus induced by the attacks of an insect.

In plate xiii. of Richard's work, there is a figure of a larch-cone, to which, more probably, Dr Lindley may have intended to refer; but in this, as in all

I do not intend at present to enter at length upon the homological relations of the female flowers in gymnosperms to those in the other Phanerogamia. The remarkable similarity which various observers have shown to exist between the *corpuscula* in the coniferous "ovule," and the *archegonia* upon the *prothallus* in the large spore of Lycopods and Rhizocarps, would seem to indicate analogies very different from those which have been sought for in the Phanerogamic sub-kingdom, and would even lead us to doubt if the so-called "ovule" in Gymnosperms be really equivalent to the ovule in the other Phanerogamia. In reference to this point, it would be of great importance to determine whether the ovular envelopes of Gymnosperms (in those cases where there is more than one coat) follow the same order of development as those in the other Phanerogamia. The discovery by Griffith, that the third and most internal envelope of the "ovule" in *Gnetum* is developed *after* the appearance of the two outer coats, seems to point towards an important distinction between these and the ordinary Phanerogamic ovules, where, as is well known, the coats are developed in order from within outwards.

There remains much to be done in elucidation of the morphology of the bractless, or, more probably, *scaleless* cones of the *Cupressineæ.* It is very difficult, indeed, to see how they are to be compared with the cones of our ordinary conifers.

In conclusion, I would state, that although as a general rule it is improper to insist strongly upon any monstrosity as proving a general morphological principle, yet, in the present instance, the abnormality only confirms what may be deduced

ordinary instances where a portion of the axis of a cone becomes leafy, the leaves continue the series of the bracts, whilst the scales are suppressed at that part; and, in reference to this case, Richard makes the following observations (p. 68 of *Mémoires*) :—

"1. Coni axis interdum summitate abit in ramulum foliosum; foliis solitariis distantibus.

2. Squamularum posticarum plurimæ in folii principium desinunt; supremæ etiam nonnullæ in verum folium conversæ. Ergo, non squamæ fructiferæ, sed posticæ tantum in folia mutantur."

This is quite conclusive—"Therefore, *not* the scales (*squamæ fructiferæ*), but only the bracts (*squamæ posticæ*), are converted into leaves."

from a comparison of the normal male and female blossoms in the coniferæ to which I have alluded above.*

III. *On the Movements in the Cells of Anacharis and Vallisneria.* By S. J. Meintjes, Jun., Esq.

The author stated that the cells of this plant are brick-shaped, and formed of a single wall. The marginal cells contain less granular matter than those nearer the midrib. These granules, when in motion, line the circumference of the cell, never actually touching the wall. When in a favourable state the granules move regularly round the cells—some in one direction, others in an opposite one. The movement is a slow, rolling motion along the sides of the cell; when the angles of the cells are acute the granules are jerked across, and on regaining the opposite side resume their steady progressive movement. Sometimes a granule is sent out with a jerk from the true course, but it immediately returns, and continues its course. All these phenomena are seen under a power of about 300. When a higher power (650) is used, a thin wave-like line is seen lining the whole of the cell, and in actual contact with the granules when present. This at first seemed an optical delusion, but repeated examinations plainly showed this line to be the free margin of a row of cilia. F. Branson, in a paper published in one of the numbers of the *Microscopical Journal*, pointed out this some time ago, and without being at the time aware of Mr Branson's paper, Mr M. verified all his statements. The conclusion he arrived at is, that the motion of the granules is due to the presence of cilia. The way in which these cilia act is peculiar. Being set at an angle to the cell wall, their action takes place in the direction of their angle; when set in motion they create a strong eddy in the cell. This eddy, by its centrifugal force, drives the granules to the side of the cell, and, coming under the influence of the cilia, they are carried along the side. Owing to the shape of some of the cells, a secondary current is produced in the acute angles, and, when the granules come under the influence of the two currents, they are thus rapidly conveyed across the angle—hence the observed jerk. Another effect of the irregularity of the shape in the cells is, that the eddy can never be perfectly circular, and, this being the case, its force cannot be equally distributed. This inequality causes the outer edge of the eddy to act with greater force on some parts of the cell than on others, and the lighter granules, being sent with a greater force against those parts, rebound. The elasticity of the cilia increases the repulsive power, and also the force of the rebound caused by the action of the eddy.

* Since reading this paper, I have (in July) again visited the locality where I obtained the abnormal cones, and found several similar ones, some of which had withered, while on others the scales had become enlarged, and were approaching maturity. On one cone I found that not only the lowermost scales, but five or six a little higher up, were in the axils of well-developed stamens. Another cone which I examined had a few scales at its base; above this was a staminiferous portion; while further up, and terminating the cone, there were scales again—the whole reminding one somewhat of the inflorescence in *Arum maculatum*.

In another cone (from *Abies nigra*) which I obtained in Perthshire while these pages were in the press, the greater number of the scales upon the lower two-thirds of the cone had their bracts replaced by stamens. The axis of the cone at that part was somewhat elongated, the scales being laxly arranged and not very well developed.

IV.—*Account of Professor Balfour's Botanical Trip, with Pupils, to Moncreiffe and Kinnoull Hills in Perthshire.* By Mr John Sadler.

About 160 botanical students left Edinburgh on the morning of 16th June last for the Bridge of Earn; whence, after breakfasting, they walked by Moncreiffe, Kinfauns, and Kinnoull to Perth.

The principal plants observed by the party were—*Nymphæa alba, Montia fontana, Villarsia nymphæoides, Lemna trisulca, Alisma Plantago*, at Moncreiffe Loch; *Epipactis latifolia, Hesperis matronalis, Scrophularia vernalis, Symphytum tuberosum, Erodium cicutarium, Geranium columbinum, Geranium sanguineum, Peucedanum Ostruthium, Mimulus luteus*, and *Mentha sylvestris* var. *velutina*, in the woods and on the Hill of Moncreiffe; *Lactuca virosa, Dipsacus sylvestris, Hesperis matronalis, Cheiranthus Cheiri, Sedum Telephium, Fumaria micrantha, Malva moschata, M. rotundifolia, Geranium pyrenaicum, Myrrhis odorata, Trifolium arvense, T. striatum, Potentilla argentea, Valerianella Olitoria, Poterium Sanguisorba, Rosa systyla, R. villosa, Cynoglossum sylvaticum, Lamium maculatum, Inula Helenium*, &c., at Kinnoull, and near Bridge End.

V. *On the Structure and Development of* Botrydium granulatum. (Plate XII.) By George Lawson, Ph.D., Professor of Chemistry and Natural History in the University of Queen's College, Kingston, Canada.

In prosecuting an examination of the freshwater Algæ of Lake Ontario, I have had a good deal of trouble in arriving at satisfactory results regarding a little plant growing on the lake shore, which I now believe to be identical with the "Bladder-headed Laver" found by Dillenius between "Newington et Hackney, prope Londinum." I presume, also, that it is identical with *Botrydium* (*Hydrogastrum*) *granulatum* of more modern botanists, although the conflicting descriptions and figures contained in works presently within my reach are by no means so satisfactory as the account given by the old cryptogamist of the last century. This, indeed, is the reason why I seek to place on record what I conceive to be a true explanation, so far as it goes, of the structure, mode of vegetation, and reproduction of this little plant, which seems to be as interesting to the botanist as *Amœba* is to the zoologist, a striking example of the manifold physiological phenomena that may be enacted by the very simplest apparatus of life.*

* Lindley observes—"One of the most remarkable plants of the order *Fucaceæ* is *Hydrogastrum*, which Endlicher describes as a perfect plant, with root, stem,

To the westward of Kingston, near Mr Morton's distillery, there is a flat piece of land jutting out into the lake, but protected from the action of the water by a barrier of shingle that has been thrown up by the waves. When an elevation of the water of the lake takes place (and this usually occurs, temporarily, several times a-year),* this bit of flat land is inundated or temporarily covered with water, like other low-lying portions of land along the lake shore. Its vegetation consists chiefly of a singular form of *Ranunculus sceleratus*, not more than three inches high, intermixed with *Veronica peregrina*, &c., and the pools and moist spots are covered with a profusion of Algæ, such as *Nostochineæ*, *Oscillatoriæ*, *Vaucheriæ*, *Desmideæ*, and *Diatomaceæ*. In clayey spots the surface is covered with patches or clusters of green glossy spheres, not much larger than pin-heads. This is the *Botrydium granulatum*, which is represented in fig. 1 in its natural site, the surface of a crust of mud. Fig. 2 shows the appearance of the plants as little *stalked* spheres, when seen in profile; and fig. 3 shows one taken apart, and the earth washed away from its minute radical fibres. The plants are rooted very firmly in the soil.

When viewed under a low power (as with a one-inch objective), the little plant is found to consist of an upper globular part, or head, with a more or less elongated neck or stalk, and a widely ramifying root, consisting of very delicate branched filaments, all as shown in fig. 4. Although these parts are distinctly enough defined, and have the semblance of separate organs, yet the whole plant consists of only one cell—there is but one internal cavity ramifying throughout the whole. This is filled throughout with a colourless, transparent fluid, slightly granular, as usual in cell contents. The head portion alone contains granular endochrome of a bright green colour, which, however, seems to be disposed as a lining on

bud, and fruit, in imitation of the most highly developed races, but all produced by the branching of one single cell!" If we except the reference to a bud, the idea here expressed is not carried further than the real structure warrants.

* During the last year or two, a slight permanent rise in the level of the lake in this neighbourhood seems to have been going on, previous to which there was a subsidence.

the inner surface of the cell wall, rather than to be mixed indiscriminately throughout the cell contents, the bulk of which in the head (as elsewhere) consists of watery fluid. That the internal cavity of the plant is continuous, that there is no membrane or other obstacle separating the mass of green endochrome, may be readily seen by gently pressing the glass cover, whereupon the endochrome, previously confined to the globose part of the head, readily passes down the neck-tube, and finds its way into every ramification of the root, if the pressure be continued with sufficient force.

While the plant is immature, the endochrome does not present granules of any great size—the appearance, even under a one-eighth-inch objective of Grunow, being that shown in fig. 5. But as it gradually matures, it is found to contain spherical granules of larger size, which are filled up with green endochrome, often itself in the form of distinct chorophyll granules. It is these spherical granules, or gonidia, as they have been termed, that are concerned in the reproduction of the plant. They are represented in fig. 6. As the term *gonidium* involves theoretical considerations as to the genetic value of a body, I shall merely call them spherules.

From the above description, it will be seen that the mature *Botrydium* consists of a transparent sac, branched in the lower part, filled with fluid, and containing in the upper part or head endochrome, in which are numerous spherules. This sac, which is very tough and elastic, is distended with the fluid contents, and consequently presents a turgid appearance. Thus, if pricked with a sharp point, the sac bursts, and the watery contents are squirted out with force, scattering the spherules. This may probably take place spontaneously. When exposed to drought, the sac collapses, and allows exit to the spores by its gradual dissolution. But one of the most curious facts that I have to mention is one that probably explains the adaptation of the plant for its peculiar habitat. If a patch of *Botrydium in situ* is covered with water for a few hours, and then examined, it will be found that the sacs have burst spontaneously and scattered their contents, even although they did not appear to be quite mature. This result seems to depend upon a process of endosmosis. Moisture is absorbed through the whole surface of the plant, and to such an extent as to burst the already turgid sac, and thus the spherules are set free, and floated away from the parent, to form new colonies. While the collapsing of the plant by drought, and its gradual dissolution on the subsequent application of moisture, is one means of permitting the freedom and development of the spherules, the inundation of the plant's habitat by the water of the lake is a more speedy, and probably a more certain mode of determining the rupture, and transporting the spherules to suitable localities for germination.

These spherules, when carefully watched after their exit, are found to assume a new aspect. They gradually lose their spherical form, becoming more or less elliptical or elongated, and then passing through successive stages, indicated in figs. 7–14, until they have acquired the globose head, and neck, and root of the parent. The whole process of transition is so simple, that I need not do more than refer to the figures. If a process of impregnation takes place, I think it must be looked for *after* the spherules have quitted the parent sac. I have certainly seen phytozoid-like bodies *apparently* produced from the granular endochrome; but as to the contact of these with the spherules, and the effect thereof, this is precisely the point at which all such investigations become misty.

Several points remain still to be noticed.

Most algæ absorb nourishment through their tissues from the surrounding medium. This is not the case with *Botrydium*. It is furnished with an extensively ramifying root, the object of which is, not to spread over the surface, and give off buds for new individuals, as has been stated by some writers, but to enter the soil and absorb nourishment. Several authors have admitted this to a certain extent. Berkeley suggested the probability that "the rooting threads of *Botrydium*, *Caulerpa*, &c., do absorb nutriment from the soil, and perhaps for the reason that they are frequently exposed to the dry air, and would therefore wither without such a provision," &c. Not only is it capable of so absorbing nourishment; it is truly a terrestrial plant, furnished with a widely ramifying absorbing root, whose fibres do not contain endochrome; and it is incapable of being developed under water, for submersion has the effect of bursting its cell-wall.

Most authors regard *Botrydium* as unicellular, and truly so. Hassall, while merely quoting in the text brief characters from Greville and Harvey, gives a drawing (Plate 77, fig. 5) which by no means represents an unicellular plant, and I do not understand it.

While correctly describing this plant as developed from a "spore" or "gonidium," we find many authors also describing an additional mode of increase. This is best shown in Endlicher's figure (Lindl. Veg. K. fig. 9). In the words of Griffith and Henfrey, it is described as follows :—"The figure represents a specimen with a second budding from it by vegetative increase, and in this way the plants come to form tufts or groups like little bunches of grapes; hence the name" (Microgr. Dict. p. 103). In reference to this statement, I would mention that I have not been able to find a single instance of a bud arising or being given off in this way from a filament to form a new plant. It may, however, occur. But it must be observed, that the appearance of the plants in clusters does not depend upon such a mode of growth. If it did, we should have each cluster consisting of differently sized globules, according to their respective ages; whereas there is usually a general uniformity in size, showing that all the plants of each cluster are about the same age, and have probably arisen contemporaneously from one batch of spores.

I shall, in conclusion, offer a few observations on the nomenclature of the plant, which must be prefaced by a list of synonymes :—

Lichenoides fungiforme, capitulis vel vesiculis sphæricis aqueo humore repletis.—"Ray, Syn. iii. p. 70." (Dill.)

Tremella palustris, vesiculis sphæricis fungiformibus. The Bladder-headed Laver.—Dillenius, Historia Muscorum, p. 55, t. x. fig. 17.

Ulva sphærica aggregata.—"Linn. Fl. Suec." (Linn. Sp. Pl.)

Ulva granulata.—Linn. Sp. Plant. ed. 3, t. ii. p. 1633. Syst. Veg. Lichfield ed. vol. ii. p. 831. Œder, Enumer. Pl. Fl. Danicæ, p. 14. Lightf. Fl. Scot. 2 ed. vol. ii. p. 976.

Tremella granulata.—Linn. Syst. Nat. ed. Gmelin. Reg.

Veg. tom. ii. p. 1446. Hudson, Fl. Anglica, p. 566. Wither. Arr. Br. Pl. 3 ed. vol. iv. p. 80. Roth, Sims' Ann. Bot. vol. i. p. 279 (description very good).

Ulva radicata.—" Retz. in Act. Holm. p. 251" (Agardh).

Vaucheria radicata.—Agardh, " Disp. p. 22." Species Algarum, vol. i. p. 465.

Vaucheria granulata.—" Lyngbye, Hydroph. p. 78" (Agardh).

Linkia granulata.—" Wiggers, Prim. Fl. Holsaticæ, p. 94," according to Agardh, but not of Micheli, nor Roth. Consult Sims' Bot. An. vol. i. p. 269, &c.

Botrydium argillaceum.—"Wallr. Ann. Bot. p. 153" (Agardh).

Hydrogastrum granulatum.—" Desv." " Endl." Lindl. Veg. K. 3 ed. p. 21, fig. 9.

Botrydium granulatum.—" Grev. Alg. Brit. p. 196, t. 19." " Hook. Br. Fl. p. 321." (Hass.) Hassall, Brit. F. W. Algæ, p. 305 (pl. lxxvii. fig. 5, is unlike the Canadian plant). Mohl, Veg. Cell. p. 3, fig. 1. Berkeley, Int. Crypt. Bot. p. 83, fig. 24. Griffith and Henfrey, Micrographic Dict. p. 103, fig. 75.

" *Gongoseira clavata*, Kutz.?" (Hass.)

Although some modern works on Algæ do not contain any but recent references, it will be seen from the above list that this plant was familiar to our early English botanists, and it was correctly understood by them so far as their means of observation permitted. They seem also to have vied with each other in giving it new names, most of which have proved unfortunate. The old descriptive names of Ray and Dillenius are good. Linnæus first termed the plant *Ulva granulata* (1764), and subsequently in Gmelin's edition of the " Systema Naturæ," we find it removed to the genus *Tremella*, the specific name *granulata* being still retained. These two names were followed by many authors, both in continental Europe and in England; but Retzius had at an early period (1769) described it under the name of *Ulva radicata*, and this, as a *specific* name, was subsequently taken up by Agardh in preference to the prior one of Linnæus. Another specific name (*Botrydium argillaceum*, Wallr.) originated about 1815. From this statement it will appear that whatever generic appellation is chosen, the proper specific name is the Linnean one (*U.*) *granulata*.

In regard to the generic name there is more difficulty. Our modern ideas of classification require that the plant should not remain either in *Ulva* or *Tremella*, and there seems also to be good reason for separating it from *Vaucheria*. It must, in fact, form a genus by itself. Of the special generic names that have been proposed for it, that which has priority is undoubtedly *Linkia* or *Linckia*; but that genus of Algæ, orginally proposed by Micheli, does not seem to have been intended by him to include this plant, much less to be restricted to it. On the contrary, Roth describes four species of *Linckia;* one of which he *compares* to *Tremella granulata*, L., in regard to *form* and *size*, expressly stating that it is distinguished from that plant by important characters which are detailed. Moreover, we find (Lindl. Veg. K.), not only *Linkia*, Micheli, among the *Nostochineæ*, but *Lynckia*, Lyngb., among the *Oscillatoriæ*, besides a "*Rivularia Linckia*, Roth;" *Linkia*, Persoon, in *Gentianaceæ;* and *Linkia*, Cavanilles, in *Proteaceæ*. Herr Link might well exclaim, "Save me from my friends !" The result seems to be that all these generic names are practically sunk into synonymes. Whatever group may be chosen by botanists to commemorate Link, it is evident that it cannot be the bladder-headed laver of Dillenius. The next generic name that appears is *Botrydium*, Wallr., which is expressive enough, and has been adopted by most English writers; but it was originally associated by its author with the unnecessary specific name *argillaceum*. Greville retained the generic term, and restored the Linnean specific name, and I hope in future the example will be followed. *Hydrogastrum* is more recent, and should be dropped; so also of *Gongoseira*, Kutz., if it refers to our plant, which seems doubtful.

I ought to mention that I have not had an opportunity of referring to the works in which correct descriptions of *Botrydium* are most likely to be found, viz. those of Dr Greville and Kützing.

The conclusions that seem warranted by the above observations are these :—

1. *Botrydium granulatum* is an unicellular plant.

2. It is strictly terrestrial, and is incapable of being developed under water, like most algæ.

3. It is furnished with finely branched root fibres, which en-

able it to absorb nourishment from the soil, like other land plants.

4. Reproduction is effected by means of young spherical cells, formed in the endochrome in the interior of the parent one, which are set free at maturity, by the bursting of the cell membrane of the parent.

5. Even where the plant is not mature an inundation of the habitat by water bursts the membrane, and thus effects the liberation of the spores.

6. If a process of impregnation occurs, it probably takes place after the spherules and endochrome have been ejected.

7. The plant does not increase by buds given off from the radical filaments (as stated by several writers), so far as the author has observed.

Explanation of Plate XII.

1. Crust of mud, with numerous specimens of *Botrydium granulatum* on its surface. Natural size.
2. The same seen in profile *in situ*. Natural size.
3. A single plant detached from the soil. Natural size.
4. The same as seen under a low power (one inch objective).
5. Endochrome from the globose head of the immature plant, as seen under an eighth-inch objective with low eyepiece.
6. Spherical cellules, ("gonidia," "resting spores"), from endochrome of mature plant. ($\frac{1}{8}$th inch.)

7–14. Spores or spherules in successive stages of development, showing the principal steps of transition into a plant ($\frac{1}{8}$th inch.)

VI.—*On the Effects of Lightning on an Ash-Tree.* By Dr John Alexander Smith.

Mr Smith remarked—" I send a splinter and piece of bark of an ash-tree, which may perhaps be considered worthy of a place in the Botanical Museum. The tree was demolished by lightning on Saturday the 16th June. I examined the tree and found it had been about two feet in diameter at the base, and formed one of a long row of old trees of a similar kind (none of which were injured except itself) on the farm of Hollydean, in the parish of Bowden, Roxburghshire. It had been struck apparently at the upper part of the trunk (the branches not being stripped of their bark), and the tree was cloven in two to the very root, two stumps only remaining in the ground, and these were shattered again in a lateral direction, as if the bolt had exploded in the tree, and blown the trunk into numerous fragments, some of the pieces being picked up at the distance of fifty yards or more. The wood of the tree seemed quite sound, and the fragments, when examined, were apparently perfectly dry and sapless. Could the sap of the tree (for it was just coming into full leaf, and therefore full of sap), by its rapid conversion into vapour by the electric fluid, have any share in splitting the tree so effectually into fragments? The tree was cloven to the ground, one-half of the root itself being raised out of the earth, and the ground was ploughed up in a straight line for ten paces to the north, and the same distance to the south of the riven stump of the tree. This adds another instance to the list of ash-trees struck by lightning. No doubt the ash is a common hedgerow tree; still it seems to have rather a dangerous attraction for the electric fluid."

VII.—*Notice of some Plants, specially Orchids, found in Kent by* G. Chichester Oxenden, Esq.

Mr Oxenden says:—"I have seen some very fine sights this May and June—namely, vast tracts of steep picturesque grass hills extending for some miles, and throughout their whole length decked and garnished with one or other of the following plants:—*Ophrys aranifera* and *muscifera*, *Orchis ustulata*, a lovely orchid, and *Habenaria bifolia*—all this vast range of hill slopes to the south and south-west. The east side of the same range is all forest ground, and it affords in abundance every variety of *Orchis fusca*, from a dull white to a very deep mulberry colour, and in size over twenty inches. These same woody banks yield a few specimens of the strange *Lathræa squamaria*, and more to the eastward I find the truly curious *Monotropa Hypopitys*. Near the place from which I write (Broome Park, near Canterbury), grows the monarch of orchids, *Orchis hircina*, the lizard orchid; and within fifty yards of my house I have one growing which at this moment (25th June 1860) is 29½ inches high, and with nearly 50 "lizards" upon it. Next month (July) will afford me very fine specimens of *Ophrys arachnites*; and if you have never seen the wonderful varieties of this orchid, they will astonish you. Some of the varieties of the Bee Orchis are also exceedingly curious. In August we get *Herminium Monorchis* in abundance, very minute, very fragrant, and under the microscope the most beautiful object imaginable. In July and August we have *Epipactis latifolia*, and *E. purpurata* in tolerable abundance."

VIII.—*On the Stem or Axis as the Fundamental Organ in the Vegetable Structure.* By Christopher Dresser, Ph.D., Lecturer on Botany, London.

The doctrine of Goethe relative to the nature of the floral parts, introduced into science by Jussieu and De Candolle, has, by its maturation under the most favourable circumstances, resulted in the conclusion, that only two fundamental organs exist in plants—the axis and the leaf. This conclusion has been very happy for botany; for upon the reduction of a science towards simplicity, we generally have a corresponding extension of its higher and more general principles. But when we carefully view the position of our science in relation to innumerable incidents which are continually occurring, it behoves us to inquire seriously as to whether we have yet fully solved the question relative to the fundamental organs of plants, and whether we are right in referring certain organs of plants to these types, at least in the manner that we do. To this subject I have already called the attention of the Society, in a paper which I presented in November last, wherein I expressed certain opinions relative to the morphology of the flower, which to my mind have a most intimate association with our knowledge of the ovule, and of embryogeny. Having thus expressed an opinion as to one cause of our not having a more definite knowledge of the facts connected with the fertilisation of the ovule, I proceed to a second point, which also stands in close relation to these facts.

I have stated that all vegetable organs are referrible to two types, the foliaceous and the axial; and now I have to offer my firm conviction that there is but one fundamental organ in the vegetable structure, viz. the stem or axis. In order to understand the nature of the case now presented, it is necessary that we should mark the distinctive characters of the stem and leaf:—

1st, The axis is the pre-existing organ by which the leaf is given off.

2d, The leaf can only be formed by an axis; hence it always proceeds from such, and is younger than the axis by which it is developed.

3d, The stem grows primarily by the formation of cells at its summit.

4th, The leaf grows by the formation of cells at its base.

5th, It follows as a corollary, that the oldest portion of a stem is its base, and of a leaf its apex.

To my mind, the leaf is simply a branch with a retrograde development, which position I will endeavour to establish in few words; but in doing this I shall continually have to refer to the stoppage of growth in certain directions, as occurs in the definite axis, which stoppage I shall, for the sake of convenience, attribute to a quasi-paralysis of the growing-point, as I am totally unacquainted with its real cause.

In order to establish my position, it is necessary that we inquire into the result of the quasi-paralysis of the summit of an axial organ, and here we notice that new cells cease, at this point, to be formed; but mark, the stem does not at once cease to elongate, at least necessarily, for new cells are still formed in the internodes, by which it becomes extended, and thus the quasi-paralysed apex of the stem is raised, for the stem is not solely elongated by the formation of cells at its apex, but also, by the development of utricles, for a given time, throughout its entire length.

A similar thing occurs in the case of the leaf, where the latter is a branch which is quasi-paralysed, for which reason it is a body which does not grow at its apex. And mark the manner in which the paralysis proceeds. It first takes place at the apex of the leaf, and then passes gradually downwards in the manner that the sensation passes down the leaf of the *Mimosa pudica*, when the terminal leaflets are cut; thus the cell formation is first arrested at the summit of this organ, and then consecutively lower. This explanation will fully account for the reverse mode of growth of the leaf. The active cell-formative power of the plant resides near the periphery of the axis, and this would also account for the growth of the leaf taking place at its base when its summit is quasi-paralysed; and light would seem to be thrown upon this by the fact that the apex of the leaf, when removed from the stem, ceases to grow, a circumstance which was long since pointed out.

The leaf appears to be a stem, the growth of which is limited or definite, and which is formed (speaking according to appearances) in a retrograde or backward manner. That the leaf is a stem appears to be proved by its being possessed of nodes, as seen in *Bryophyllum calycinum;* and that the crenatures of the margin of the leaf of the *Bryophyllum* are nodes is proved by these points giving off regular buds. Also, adventitious buds are alike given off by stems and by leaves (that the leaves of *Begonias* and *Crassulas* have this power to a remarkable extent has lately been proved). And we have intermediate forms between the axis and the leaf, as are presented by the phyllous branches of *Xylophylla* and *Ruscus*. But the point which will most fully establish my position, if it can be completely worked out (and my firm conviction is that it will, as soon as we have made more observations on the subject), is, that a second layer of wood is deposited in the perennial leaves of Pinus, Abies, &c., which Schleiden is fully persuaded he has already traced.

While I regard the stem and leaf as modifications of one organ, yet I of course admit that there are both leaf and stem, which are each characterised by particular habits, in the same manner that common and allatropic phosphorus are conditions of the same element, yet I consider that, between the leaf and the stem we have a great number of transitionary bodies, which establish the relation between them which I have endeavoured to express.

Mr Scot Skirving sent a specimen of grass which had been observed by Dr Scott of Her Majesty's 79th Regiment, when in the Crimea, to withstand the utmost rigour of the severe winter there. He states that cattle ate it, and fattened on it. The seeds had been sown in East Lothian, and had produced an abundant crop. The plant was *Bromus maximus*.

Dr Rorie, of the Dundee Asylum, sent specimen of cabbage leaves exhibiting peculiar hollow pitcher-like appendages at their extremities.

Mr Guthrie, of the "North British Agriculturist," sent a specimen of a plant from St George's Sound, Australia, which was said to be highly poisonous to cattle and sheep, who partake of it readily. The plant seemed to be *Gastrolobium obtusum*.

Dr Balfour exhibited, from Dr Christopher Dresser, specimens of monstrosities in the flower of the *Passiflora cærulea*—the parts of the ovary being converted into stamens.

Dr Balfour also exhibited a specimen of *Rhodymenia cristata*, Grev., found by Mr Charles W. Peach in Wick Bay, June 1854, the same locality in which the plant was obtained by Borrer and Hooker many years ago.

Mr R. M. Stark exhibited several varieties of British ferns, including *Athyrium Filix-fœmina* var. *plumosum*.

Mr M'Nab placed on the table a complete series of species and varieties of British ferns.

Mr Archer exhibited a peculiar pipe from Zambesi, used for smoking, sent by Dr Kirk.

APPENDIX.

LIST OF MEMBERS,

Corrected to October 1860.

HONORARY MEMBERS.

BRITISH.

His Royal Highness The PRINCE CONSORT, K.G.

FOREIGN.

Antonio Bertoloni, M.D., Professor of Botany, Bologna
Karl Ludovic Blume, M.D., Member of the Royal Acad. of Sciences of Amsterdam, Leyden
Alexander Braun, Member of the Royal Academy of Sciences, Berlin; Professor of Botany and Director of the Royal Botanic Garden, Berlin
Adolphe Theodore Brongniart, M.D., Professor of Botany at the Garden of Plants, Paris
Alphonse de Candolle, Emeritus Professor of Botany, Geneva
Joseph Decaisne, Member of the Institute, Professor of Agriculture, Paris
Elias Fries, M.D., Professor of Political Economy, Upsal
Le Chevalier Giovanni Gussone, Director of the Royal Botanic Garden, Naples
William Hofmeister, Leipzig
Janus Wilken Hornemann, Professor of Botany, Copenhagen
Charles Frederick Ledebour, Ph.D., Professor of Botany, and Director of the Botanic Garden, Dorpat
Charles Frederick Philip von Martius, M.D., Director of the Royal Botanic Garden, Munich
Hugo von Mohl, M.D., Corresponding Member of the Institute of Paris, Professor of Botany, Tubingen
John Francis Camille Montagne, Member of the Institute, Paris
M. J. Schleiden, Professor of Botany, Jena
John Torrey, M.D., Professor of Botany and Chemistry, New York
Ludovic Christian Treviranus, M.D., Professor of Botany, Bonn
Ludovic R. Tulasne, Member of the Institute, and Botanical Assistant in the Museum of Natural History, Paris
Gustave Thuret, Member of the Institute, Paris
Francis Unger, M.D., Member of the Imperial Academy of Sciences, Vienna; Professor of Botany, Vienna

ORDINARY MEMBERS.

(Those marked with an asterisk were Members of the Wernerian Society, and incorporated with the Botanical Society on 9th December 1858.)

(R) indicates Resident Fellows and those who, though Non-Resident, continue to pay as Resident Fellows.

Alexander, Richard Chandler, M.D., London
Allan, Dr James, 52 Hanover Street, Sheffield
Allman, G. A., M.D., Prof. of Natural History (R)
Allshorn, G. E., 63 George Street (R)
Anderson, Findlay, 32 Moray Place (R)
Anderson, John, 41 St Andrew Square (R)
Anderson, Robert, 41 St Andrew Square (R)
*Anderson, Rev. John, D.D., Newburgh
Armitage, S. H., Bradford, Yorkshire
10 Ashley, William Henry, M.D., Brighton
Baber, Rev. Harry, M.A.
Babington, Charles Cardale, M.A., F.R.S., Cambridge
Babington, Rev. Churchill, B.D., Cambridge
Baikie, William Balfour, M.D., African Expedition
*Bald, Robert, Mining Engineer, Alloa
Balfour, Andrew Howden, Portobello
Balfour, James B., M.D., Lasswade
Balfour, John Hutton, M.D., Prof. Bot. (R)
Ballantyne, John, jun., Dalkeith (R)
20 Barclay, Thomas, Sheriff-Clerk of Fife (R)
Bayldon, John, Lecturer Bot. (R)
Bayley, George, 13 Regent Terrace (R)
Bell, J. M., 11 Royal Circus (R)
Bell, Rev. Thos. Blizard, Leswalt, Stranraer
Benson, Edward W., Birmingham
*Bentham, George, F.L.S., London
*Berry, George, Rosefield, Portobello
Beveridge, James S., Surgeon, London
Bidwell, Henry, M.D., Albrighton
30 Blackie, George, M.D., Professor of Botany, Nashville, Tennessee
Blackie, J. S., Professor of Greek (R)
Bligh, Richard, M.D., Southampton
Blyth, John B., M.D., Cork
Bodenham, Thomas, Shrewsbury
Booth, J. G. jun., 2 Rochester Place, Glasgow (R)
Borrer, William, F.R.S., Sussex
Bowerbank, J. S., LL.D., F.R.S., London
Brand, William, W.S. (R)
Branfoot, J. H., M.D., West Indies
40 Broome, C. E., M.A., Bath-Easton, Somerset
Brown, Isaac, Ackworth, near Wakefield
Brown, Rev. Thomas, Comely Bank (R)
Brown, William, R.N., 24 Blacket Place (R)
Bryson, Alexander, 66 Princes Street (R)
Buckley, Nathaniel, M.D., Lancashire
*Buist, George, LL.D., Bombay
Bull, Henry G., M.D., Northampton
Burnett, Charles John, 21 Ainslie Place (R)
Burslem, W. Marshall, M.D., Upper Grosvenor Street, Grosvenor Square, London
50 Call, Thomas J., Surgeon, Addingham (R)
Camara, Luiz A. da
Campbell, William H., LL.D., Demerara
Carnegie, W. F. Lindsay, Kinblethmont
Carr, Andrew Morton, London
Carpenter, Wm. B., M.D., London University
Carruthers, Wm., British Museum, London (R)
Carter, James, Cambridge
Charlton, Edward, M.D., Newcastle
Christison, David, M.D., 40 Moray Place (R)
60 Christison, Robert, M.D., Prof. Mat. Med. (R)
Clark, Benjamin, London
Cleghorn, Hugh F. C., M.D., Madras
Cleland, Dr John, 5 Pitt Street (R)
*Coldstream, John, M.D., 51 York Place
Coleman, Rev. W. H., M.A., Ashby-de-la-Zouch
Condamine, John de la, 28 Broughton Pl. (R)
Cowan, Alexander, jun., M.D., East Indies
Craig, Sir William Gibson, Bart. (R)
Cullen, W. H., M.D.
70 Cunynghame, R. J. B., 25 Pilrig Street (R)
Dalzell, Nicol Alexander, M.A., Bombay
Daw, Robert, late H.M. Customs, Plymouth
Dempster, Alexander, Aberdeen
Dennes, George Edgar, F.L.S., London
Dennistoun, John, Greenock
*Deuchar, John, Morningside House
Dickie, George, M.D., Professor of Botany, Aberdeen
Dickinson, Joseph, M.D., F.R.S., Liverpool
Dickson, Alex., M.D., 18 Dean Terrace (R)
80 Dickson, Joseph, M.D., Jersey
Douglas, Archibald, M.D., London
Dresser, Christopher, Ph.D., St Peter's, Hammersmith (R)
*Drummond, Captain Henry, H.E.I.C.S.
Dubuc, Dr, 121 George Street (R)
Duckworth, Dyce, 31 Stafford Street (R)
Duncan, James, M.D., F.R.S.E., 12 Heriot Row (R)
*Duncan, Rev. James, Denholm
Duncanson, John, M.D., Forth Bank, Alloa
*Edmonston, Laurence, Surgeon, Shetland
90 Elliott, Robert, Wolflee, Hawick
*Ellis, Adam Gib, W.S., 4 Royal Terrace
Errington, John Edward, Greenock
Etherington, George Francis, M.D.
Evans, W. W., Tynefield, Dunbar
Falconer, Randal W., M.D., Bath
Falconer, Hugh, M.D., London
Farre, Frederick John, M.D., London

Fawssett, Frederick, Oxcombe House, near Horncastle (*R*)
Fayrer, Joseph, M.D., Prof. of Surgery, Madras
100 Fernandez, Braz, Bombay
Fernando, C. A., 39 Albany Street (*R*)
Fitzgerald, Augustin, H.E.I.C.S. (*R*)
Fleming, Alexander B., M.D., Birmingham
Fleming, Andrew, M.D., Seafield, Leith
Flower, Thomas Bruges, F.L.S., Bath
Foot, Simon, M.R.I.A., Dublin
Forbes, Arthur, of Culloden, Inverness
Forbes, John, M.D., Culloden
Fox, Charles H., 6 Albany Street (*R*)
110 Fraser, P. Neill, Canonmills Lodge (*R*)
Fraser, James A., M.D., Cape Town
French, J. B., Australia
Garnons, Rev. W. Lewis Pugh, B.D., Utting, Colchester
*Geddes, John, Mining Engineer
Gerard, Adam, London
Gibson, G. S., Saffron Walden, Essex
Gilchrist, Dr James, Crichton Institution, Dumfries
Giraud, Herbert J., M.D., Bombay
Goldie, Alexander, 21 Queen Street (*R*)
120 Goodsir, John, Professor of Anatomy (*R*)
Gordon, Rev. George, Birnie, Elgin
Gorrie, William, Bangholm (*R*)
Gough, George S., M.R.I.A., Dublin
Graham, Alex., of Kirkhill, Stirlingshire
Grant, James Simpson, M.D., London
*Grant, Robert Edmond, M.D., Professor of Comparative Anatomy, University College, London
Gray, John, Greenock
Gray, John Edward, F.R.S., London
Greenwood, Alfred, Chelmsford, Essex
130 Greville, Robert Kaye, LL.D. (*R*)
Grigor, Alexander, Otago
Gutch, John W. G., Swansea
Hambrough, Albert J., Isle of Wight
Hamilton, Rev. James, D.D., London
*Hamilton, Robert, M.D., Sciennes House
Harvey, Joshua R., M.D., Cork
Harvey, William Henry, M.D., Prof. Bot., Dublin
Harris, Henry Barham Mitchell, M.D., Exeter
Hay, Samuel, Trinity Cottage (*R*)
140 Henslow, Rev. John S., Prof. Bot. Cambridge
Heslop, Ralph C., Lancashire
Hewetson, Henry, Newland House, Hull
Hill, James H. G., 15 Moray Place (*R*)
Hincks, Rev. Thomas D., LL.D.
Hincks, Rev. William, F.L.S., Prof. of Nat. Hist., Toronto
Holmes, Rev. E. Adolphus, M.A., Harleston, Norfolk
*Home, David Milne, of Milnegraden, 10 York Place
Homfray, Rev. Kenyon, Usk, Monmouth
*Hooker, Sir William Jackson, K.H., Director of the Royal Gardens, Kew
150 Hope, Charles W., Allahabad
Hopper, Ralph S., M.D., Leeds
Hore, Rev. William S., Stoke, Devonport
Hort, Fenton J. A., B.A., Hitchin
Howitt, Godfrey, M.D., Nottingham
Hunter, Alexander, M.D., Madras
Hunter, Rev. Robert, late of Nagpore, 38 Cumberland Street
Hunter, John M., 25 Albany Street (*R*)
Inglis, Andrew, M.D., 33 Albany Street (*R*)
Inglis, Archibald, M.D., 33 Albany Street (*R*)
160 Inman, Thomas, M.D., Liverpool
Innes, John George, Forres
Ivory, Thomas, 9 Ainslie Place (*R*)
Ivory, William, W.S., 22 Duke Street (*R*)
Jacob, Philip W., Rochester
Jardine, Sir William, Bart., F.R.S.E.
Jenner, Charles, Princes Street (*R*)
Jepson, Octavius, Gainsborough, Lincolnshire
Johnston, William, M.D., Royal Navy
Johnston, William G., 13 Harley Street, Battersea
170 Johnston, James, Willow Park, Greenock
Johnston, John W. (*R*)
Jones, David Fielding, Manillah, Belturbet
Keddie, William, 15 North St Mungo Street, Glasgow
*Keir, Patrick Small, of Kindrogan
Kerr, C. Webster, Ferry Road, Dundee (*R*)
Kerr, Robert, Greenock
Kirk, Dr John, Livingstone's African Expedition
*Knox, Robert, M.D., London
Lacon, Graham, M.D., Bengal Establishment
180 Lane, Edward, M.D.
Lawson, Charles, jun., 34 George Square (*R*)
Lawson, Dr George, Prof. Nat. Hist. and Chemistry, Kingston, Canada
Lawson, G. S., 1 George IV. Bridge (*R*)
Leefe, Rev. J. E., M.A., Sunderland
Lees, Edwin, F.L.S., Worcester
*Lees, George, LL.D.
Leighton, Rev. William A., Shrewsbury
Lingwood, R. M., M.A., Lyston, Herefordshire
Logan, F. Lockwood, M.D., 14 Saxe Coburg Place (*R*)
190 Lowe, John, M.D., King's Lynn
Lowe, William Henry, M.D., Balgreen (*R*)
Lyon, George Jasper, Glasgow
Macadam, Dr Stevenson, F.R.S.E. (*R*)
Macaulay, James, M.D., London
MacDonald, William, M.D., Professor of Civil and Natural History, St Andrews
Macfarlan, A. J., Park Place (*R*)
Mack, Anthony, Ardrossan
Mackay, James Townsend, LL.D., M.R.I.A., Dublin
Mackenzie, Nicolson C. (*R*)
200 Maclagan, Andrew Douglas, M.D. (*R*)
Maclagan, Philip W., M.D., Berwick
Maclagan, R., M.D., 28 Heriot Row (*R*)
M'Laren, John, jun., advocate, 12 Dublin Street (*R*)
MacLelland, John, M.D., Calcutta
Macreight, Daniel C., M.D., F.L.S.
M'Bain, James, M.D., R.N., Trinity Cres. (*R*

M'Nab, James, Botanic Garden (*R*)
*Macvicar, Rev. John Gibson, Moffat
Maingay, A. C., M.D., East Indies
210 *Maingy, Alexander Robert, Mining Engineer
Mann, Thomas White, F.L.S., London
Marshall, George Hunter, 3 Heriot Row (*R*)
Marshall, John, jun., 11 Wemyss Place (*R*)
Marshall, Thomas, Castle Terrace (*R*)
Marshall, William, Lord Mayor's Walk, York
Martin, George Anne, M.D., Isle of Wight
Maynard, Alleyne, Cincinnati
Meintjes, Stephen James, 30 Northumberland Street (*R*)
Melville, A. G., Professor of Natural History, Galway
220 Melville, Henry Read, M.D., St Vincent
*Mitchell, Joseph, Superintendent of Parliamentary Roads
Moore, David, A.L.S., Dublin
Moore, Thomas, F.L.S., Curator, Botanic Garden, Chelsea
More, A. G., Bembridge, Isle of Wight
Morrison, James Stuart, East Indies
Mudge, John William, M.D., Madras
Munro, William, Lieut.-Col. H.M. 39th Foot
Murchison, Charles, M.D., London
Murray, A., of Conland, W.S., 1 Scotland Street (*R*)
230 *Mushet, David, Mining Engineer, Gloucestershire
Newbould, Rev. W. W., M.A., Comberton, Cambridge
Newman, Edward, F.L.S., London
*Nicolson, Sir Arthur, Bart.
Niven, Ninian, Dublin
Ogilvie, George, M.D., Prof. of Physiology, Aberdeen
Ogilvie, John Forbes, M.D., Aberdeen
Oliver, Daniel, Kew
Oliver, John Robert
Osborne, Jonathan, M.D., Dublin
240 *Paterson, Robert, M.D., 32 Charlotte Street, Leith
Parker, Charles Eyre, Welsh Pool, Montgomeryshire
Parnell, Richard, M.D., 7 James Place, Leith Links (*R*)
Paul, James, M.D., Jamaica
Percy, John, M.D., Jermyn Street Museum, London
Perry, William Groves, Warwick
Pires D'Albuquerque, Le Chevalier, Brazil
Pollexfen, Rev. John Hutton, Colchester
Polwhele, T. Roxburgh,
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Scott, John, Greenock
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John Thompson, Newcastle, Northumberland

Members are requested to notify to the Assistant-Secretary any change in their Address.

The Botanical Society of Edinburgh was instituted on the 17th March 1836, its object being the advancement of Botanical Science, by means of periodical meetings, correspondence, and the mutual interchange of specimens amongst its members. The Society meets on the second Thursday of every month from November to July inclusive. The Herbarium of the Society was incorporated with that of the University by a special agreement with the Patrons, dated 8th January 1839, and the Professor of Botany was appointed Honorary Curator *ex officio*, with the full use of the collection for the instruction of his Class. The British portion of the Herbarium is kept in the Botanical Rooms at the College, and may be consulted by Fellows of the Society every Monday from 12 to 2 under the direction of the Assistant-Curator. The Society's Library is also accommodated in the Rooms at the College.

The Queen is Patron of the Society. The Office-bearers consist of a President, four Vice-Presidents, ten Councillors, a General Secretary, Foreign Secretary, Treasurer, Auditor, Artist, Curator, and an Assistant-Secretary and Curator; all of whom are elected annually at the December meeting.

Extracts from the Laws relative to the Admission of Members, &c.

RESIDENT FELLOWS.

A Candidate for admission into the Society as a Resident Fellow must present an application signed by at least two Resident Fellows. The application shall be read at the proper time during private business, and at the next Ordinary Meeting shall be determined by ballot.

Resident Fellows shall, on admission, sign the Laws, and pay the sum of 12s. 6d. to the funds of the Society; and shall contribute 12s. 6d. annually thereafter at the November meeting. Resident Fellows are entitled to receive the "Transactions" yearly, as published.

Resident Fellows may at any time compound for their annual contributions, by one payment of Five Pounds.

Resident Fellows leaving Edinburgh within six years from the date of their admission, may be enrolled as Non-Resident Fellows, if they have paid, besides their Entry-Money, six annual contributions; or, after that period, on payment of all arrears due at the time of their departure.

The Society shall from time to time adopt such measures regarding Members in arrear as may be deemed necessary.

NON-RESIDENT FELLOWS.

Any person not residing in Edinburgh may be elected a Non-Resident Fellow, on being recommended by two Members of a Scientific or Literary

Society, and paying a contribution of Three Guineas. From such no annual payment is required.

Non-Resident Fellows wishing to become Resident, must be balloted for, but shall be exempt from payment of Entry-Money. In the event of any such Candidate being blackballed, his name shall be struck out of the List of Members.

Non-Resident Fellows coming to Edinburgh shall, for a period of two months, be entitled to attend the Meetings of the Society, and participate in the other privileges of Resident Fellows; after which, should they remain longer, they must become Candidates for admission, and, if elected, pay the same annual contribution as Resident Fellows.

The Rules also empower the Society to elect a limited number of *Honorary* and *Foreign Members;* also as *Associates* persons who have acquired a claim on the Society by sending communications or by contributing to the Herbarium.

Any Lady, whether Resident or Non-Resident, may become a Member for life on payment of a single contribution of Two Guineas.

Diplomas may be procured from the Assistant-Secretary, the sum payable being 7s. 6d.; but no Fellow shall be entitled to receive a Diploma until his Contributions shall amount to Three Guineas.

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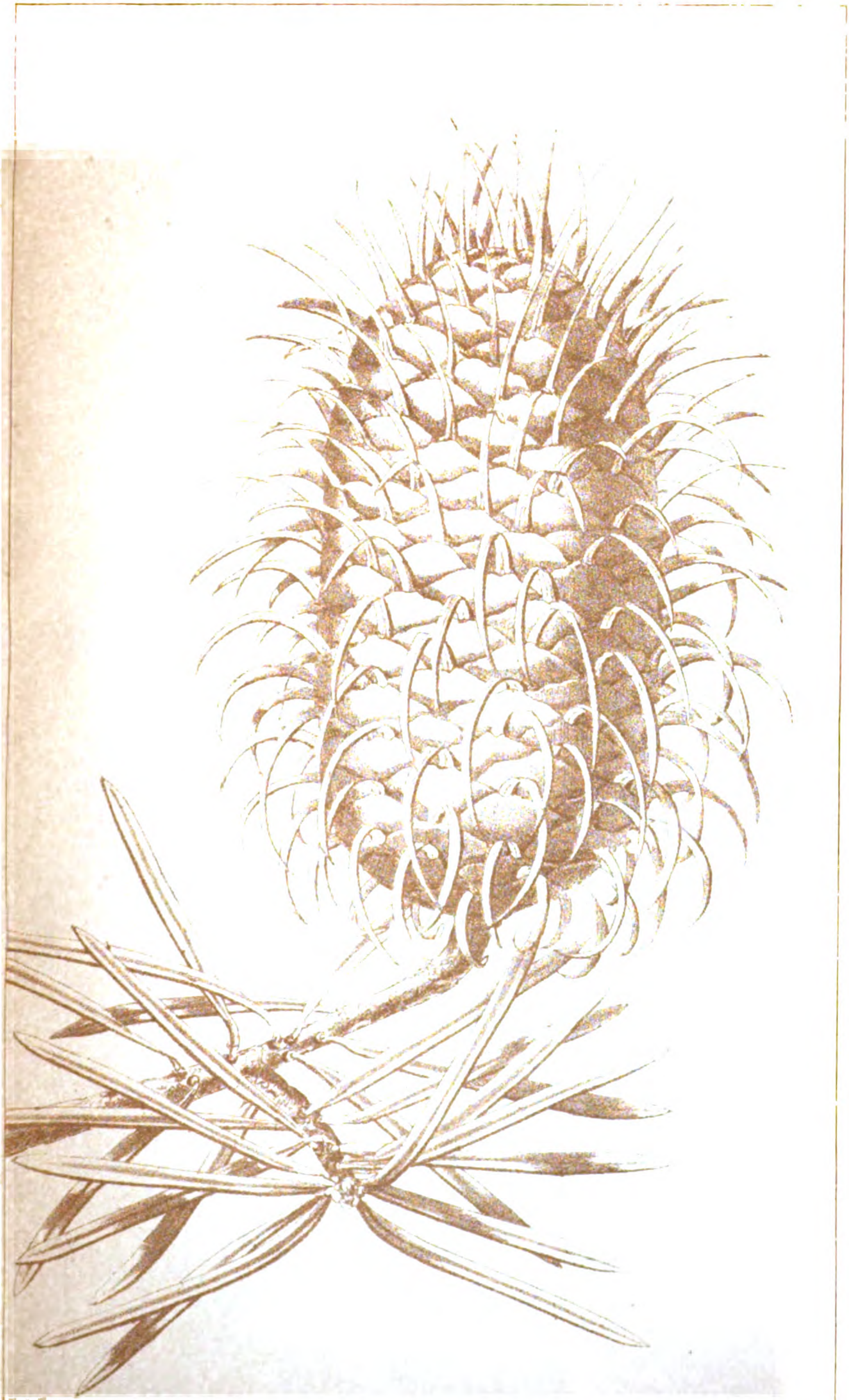
END OF VOLUME VI.

W. Peebles, delᵗ W. & A. K. Johnston, Edinʳ

Abies bracteata Don.



R. K. Greville del.

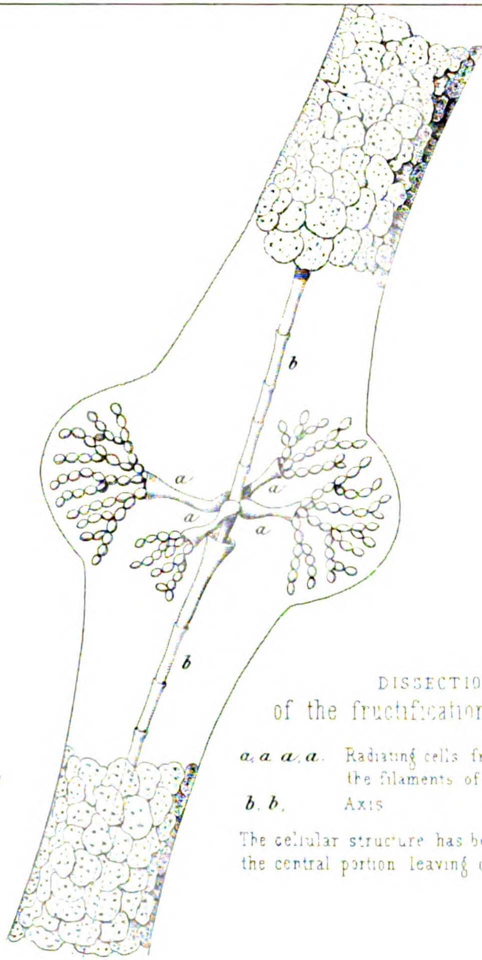
Cone of Abies bracteata Don

W. Peebles delt W. & A. K. Johnston Edin.

Torreya Myristica. Hooker

Trans Bot Soc Vol 6.

A.



400 Dia:

DISSECTION
of the fructification of "Lemania".

a, a, a, a. Radiating cells from the axis bearing the filaments of spores

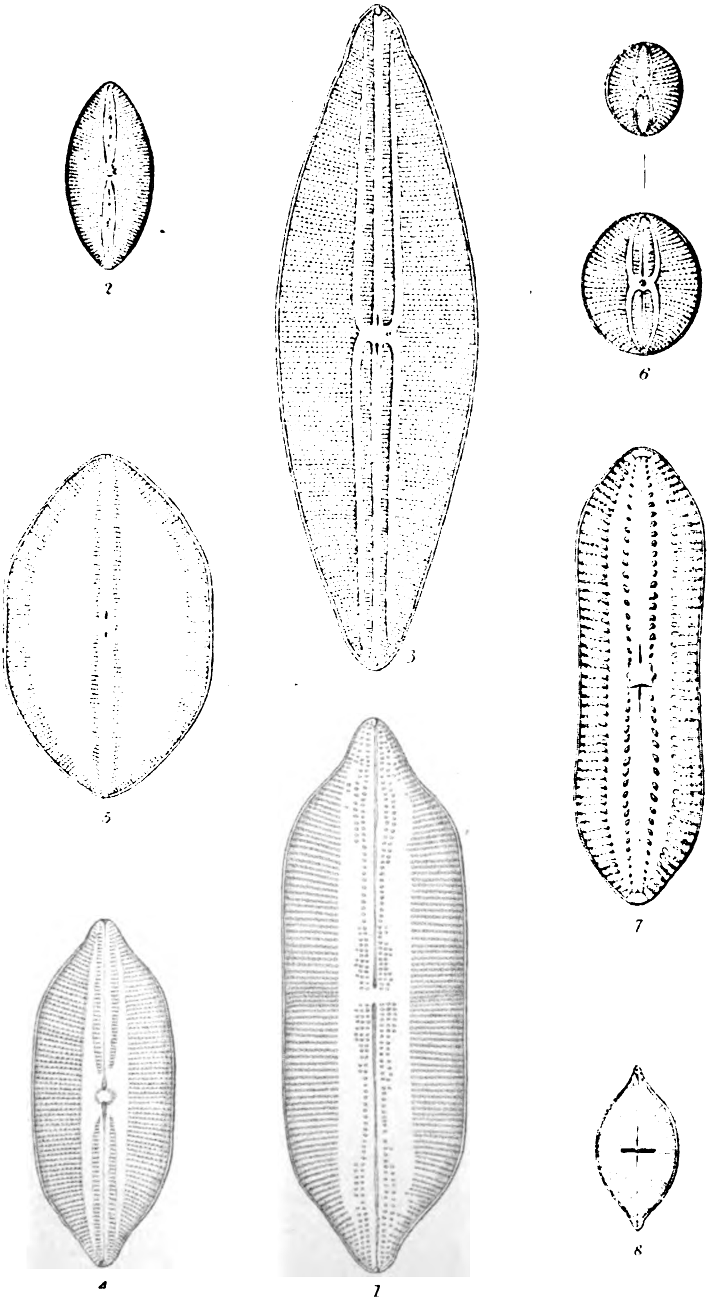
b, b, Axis

The cellular structure has been removed from the central portion leaving only the outline

B.

Fig 1.

Fig. 2.

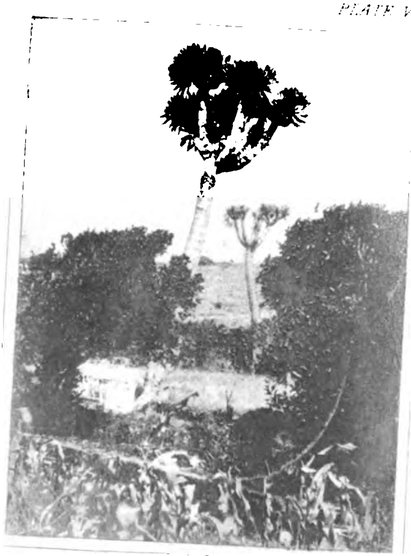


R. K. G. del^t

W. & A. K. Johnston

DIATOMACEÆ

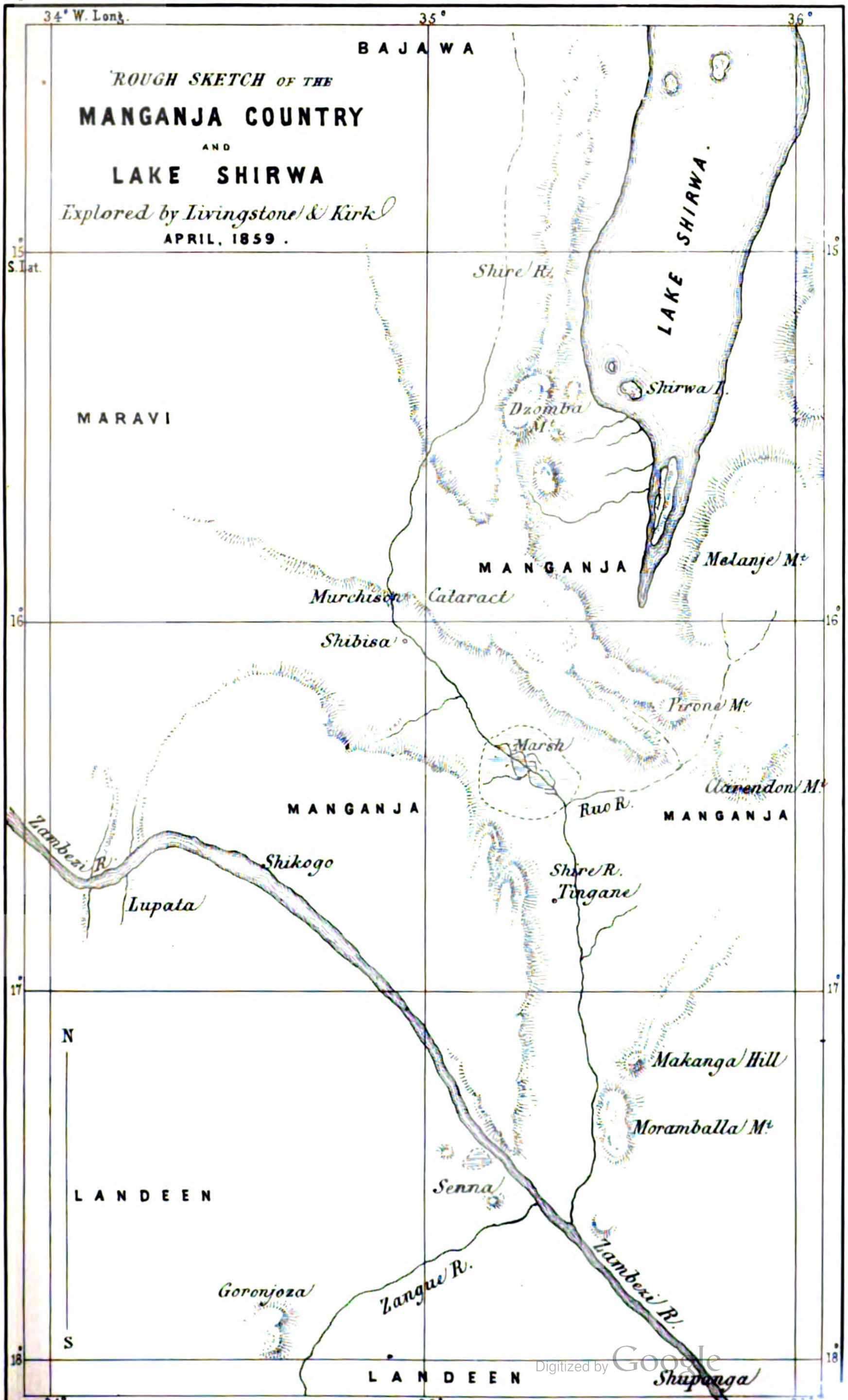
PLATE VI



Young Dragon trees near Orotava, Teneriffe.

[illegible]

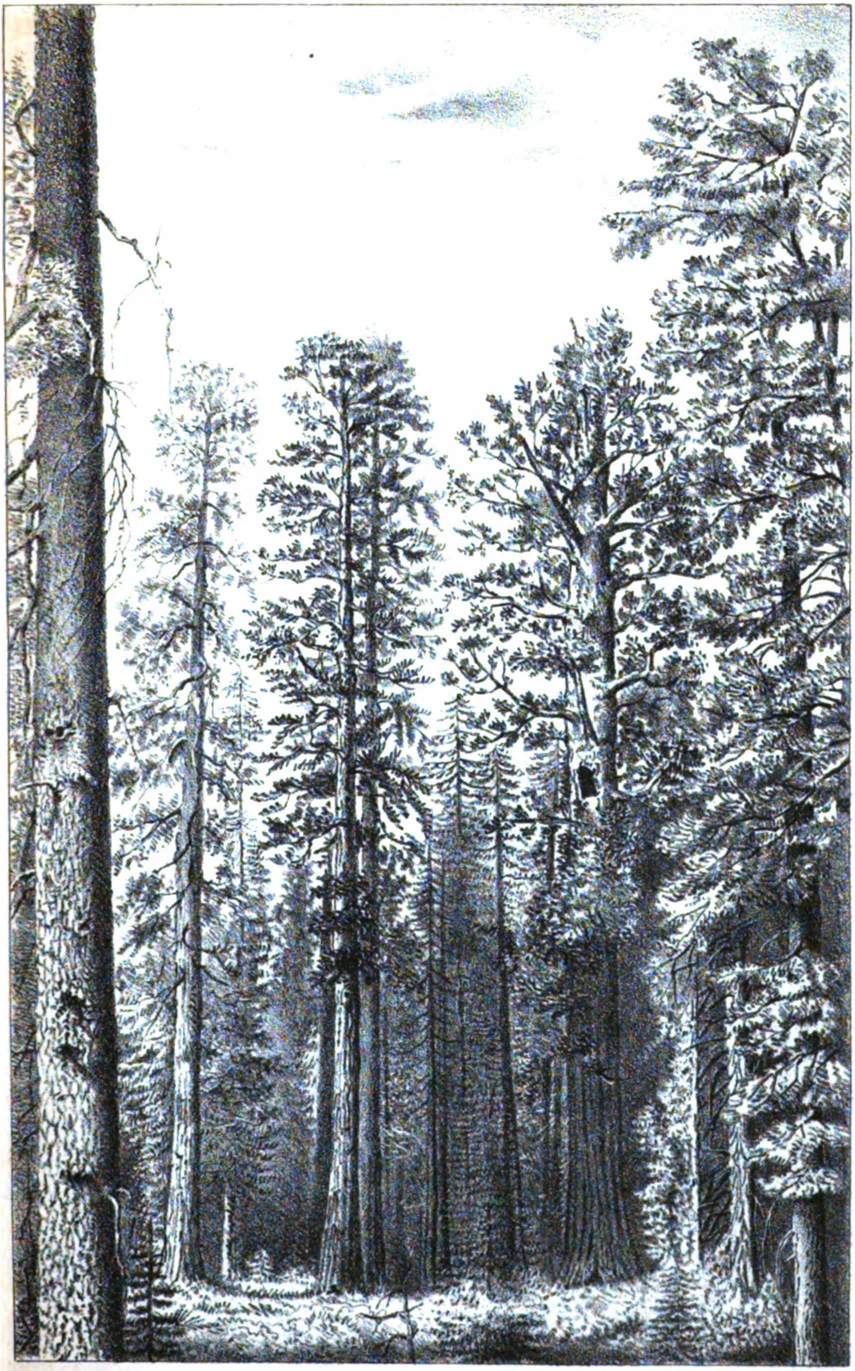
PLATE VII.


ROUGH SKETCH OF THE
MANGANJA COUNTRY
AND
LAKE SHIRWA
Explored by Livingstone & Kirk
APRIL, 1859.
34° W. Long.
35°
36°
15°
S. Lat.
16°
17°
18°
BAJAWA
LAKE SHIRWA.
Shire R.
Shirwa I.
Dzomba Mt.
MARAVI
MANGANJA
Melanje Mt.
Murchison Cataract
Shibisa
Pirone Mt.
Marsh
Clarendon Mt.
Ruo R.
MANGANJA
MANGANJA
Zambezi R.
Shikogo
Lupata
Shire R.
Tingane
Makanga Hill
Moramballa Mt.
N
S
LANDEEN
Senna
Zangue R.
Zambezi R.
Goronjoza
LANDEEN
Shupanga

W & A K Johnston, Edinburgh

WELLINGTONIA GIGANTEA Lindl. - 94 feet in circ.

from a Photograph. Mariposa grove.



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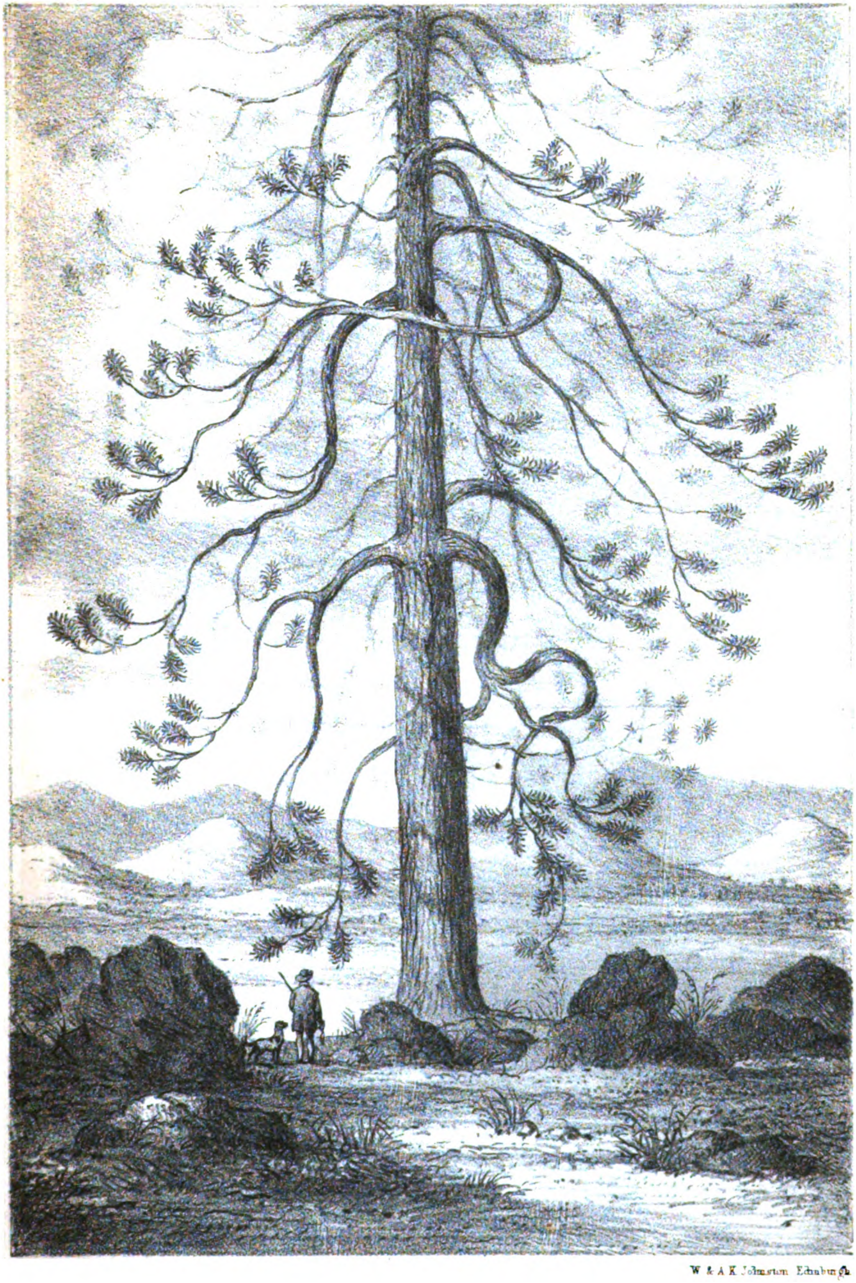
GROUP OF WELLINGTONIA GIGANTEA

from a Photograph taken in the Mariposa



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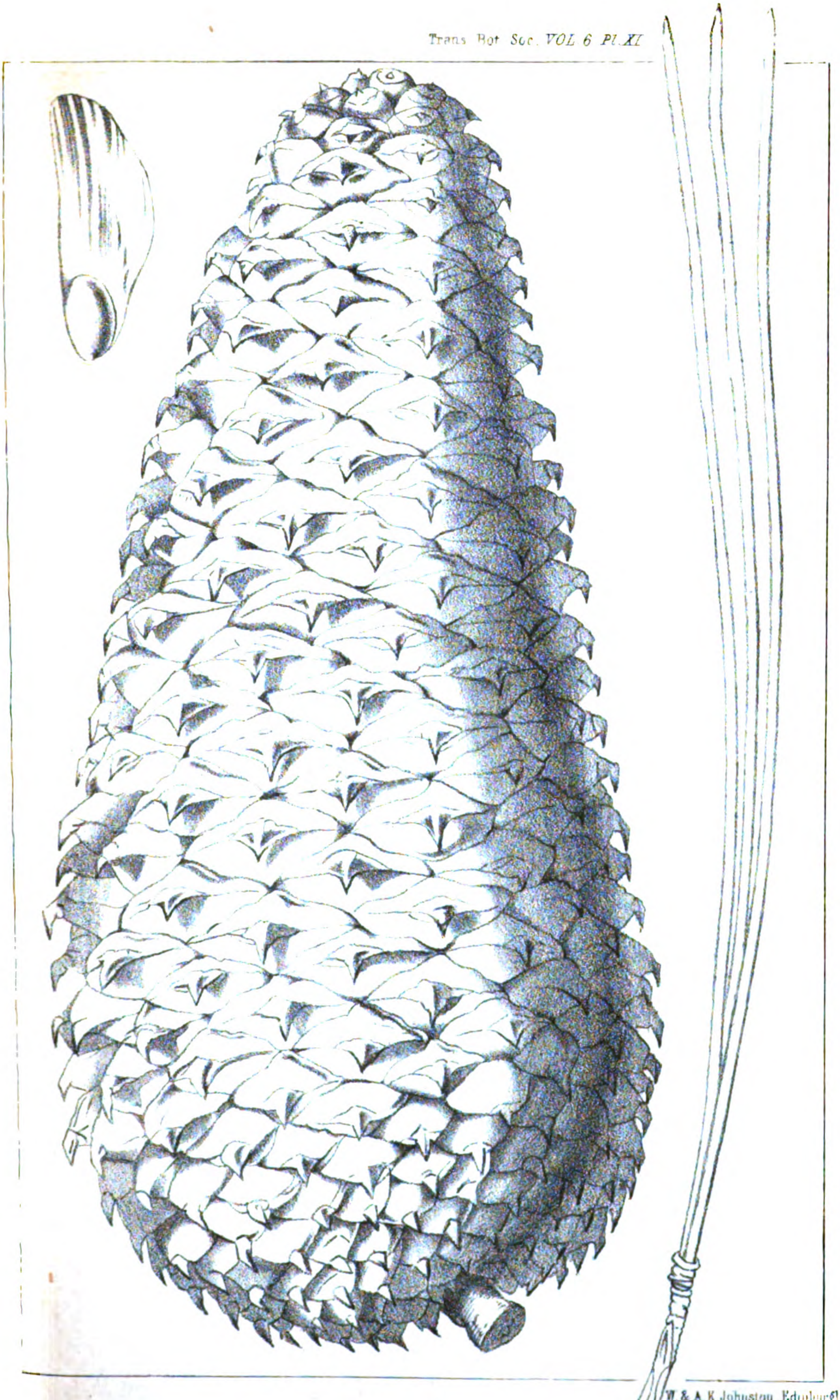
PINUS JEFFREYI, Oreg Com



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PINUS JEFFREYI. Oreg Com.

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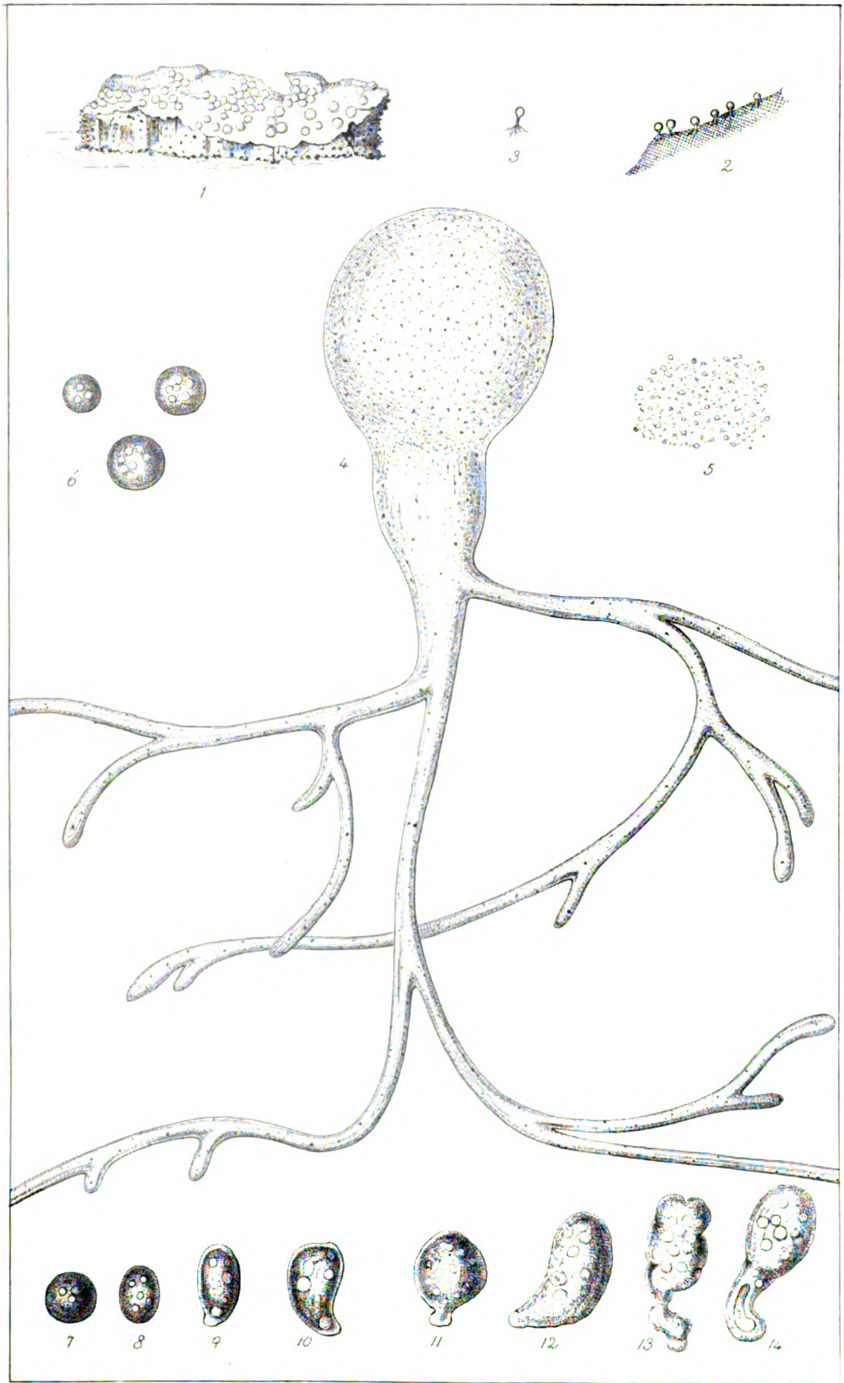

G. Lawson del.

W. H. M'Farlane Lith.

Botrydium granulatum

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The Society as a body is not to be considered responsible for any facts or opinions advanced in the several papers, which must rest entirely on the credit of their respective authors.

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A few complete sets of the Transactions, to the end of Vol. V., still remain, and may be had by Members at the reduced price of 25s. for the whole.

The third edition of the Botanical Society's Catalogue of British Plants, including the Flowering Plants, Ferns, and Characeæ, may be had from the Publishers, Messrs A. & C. BLACK, price 6d.

ERRATUM IN PART I.

Page 79, line 5—*For* "On this subject," *read* "On the subject of Diatomaceæ."

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