

educational information in common, the French and English journals are quite distinct, though each characterized by the same commendable effort to adapt it to the special tastes and sympathies of its readers. Indeed a local interest and a Canadian feeling of a healthful kind pervade both Journals. Bishop Laval, the Hon. James McGill, Generals Brock, Wolfe, and Montcalm; Jacques Cartier, Champlain, and other notable names interestingly associated with the early history of the province, are introduced to the reader in connexion with historical narratives of discoveries made, Colleges founded, or victories won on Canadian soil. The illustrative wood-cuts are also appropriate, and well executed; including views of the most important public buildings of Lower Canada, of its monuments, and some of its most striking city scenes. The Editors also merit the high commendation of aiming at the very difficult achievement of dealing in an impartial and unsectarian spirit with the questions of education, which in the Lower Province are affected by elements of language, race, and creed, very partially felt in Upper Canada.

Feeling as we do, how greatly some means is required for getting hold of the whole population of Lower Canada, and developing among the people feelings of a common sympathy and interest in the spirit of intelligent progress which is at work in the great centres of our public provincial life, we cordially wish success to both Educational Journals, and shall welcome new evidences of improvement, such as we have good reason for anticipating, with each succeeding volume.

D. W.

On the Origin of Species by means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life. By Charles Darwin, M.A., &c. London, John Murray, 1860.

The idea of a *species* as conceived by most minds, is that of a distinct and independent creation, capable of continuing itself unchanged in all its fundamental characters, although subject to partial modification by the influence of external agencies. It is believed, moreover, by those who hold this view, that all our living species having been thus separately created from the beginning of the existing geological age or present condition of things, no real species (*id est*, a type-form capable of continuing itself) has originated, or is capable of being originated, by the intermixture of two distinct

types. Such is the general, but not the universal, belief. An opposite view, dating probably from a very distant period, has been brought forward and maintained, from time to time, by many philosophic minds. This view is to the effect that what we call *species*, are no independent-creations—at least for the greater part—but are simply *varieties*, arising from the modification of a few original types, or, if pushed to its extreme length, of a single originally-existing organism. The object of Mr. Darwin's book is to impart an increased vitality and support to this view, by arguments based on a large series of facts, the accumulation of many years of research on his own part and on that of other naturalists. The present work purports to be merely a general synopsis of the materials thus gathered together, and of the results to which their consideration tends; but it is on a sufficiently extended plan to enable us to test, fairly, the relative solidity of the structure which its facts and arguments support.

Although an hypothesis of this kind must naturally seem to those who consider the question seriously for the first time, as one wholly indefensible and preposterous; it is nevertheless probable, that, few persons have ever made the close contemplation of Nature their study for any time, without having experienced, at one period or another, the visitation of sundry hauntings of a similar character. When we see, for example, certain forms, at first remarkably distinct, become more and more closely connected by after-discoveries, until the one appears to merge into the other, and our once clear definitions become no longer tenable; when we see in many species the extraordinary varieties sometimes produced by the crossing and intercrossing of other varieties; when we consider the transition stages of foetal development, the homologies of organic structure, the presence of rudimentary organs in many forms, the marked relations which obtain more or less between all living and extinct types of the same series, with other facts of an allied kind—the question becomes forced upon us: why is this? Why these relations, these homologies, these transition-phases of embryonic development, these rudimentary organs, these closely-connected forms, if all species were separate and distinct creations? Why, in other words, this recognised unity of plan, amidst this variety of structure, unless by the long-continued modification of an original unit-organism? Here, however, we merely express our inability to fathom the design of the CREATOR

in these varied repetitions, so to say, of the CREATIVE THOUGHT; and the transmutation theory, with all Mr. Darwin's ingenious and eloquent reasonings, offers to us no real help in our difficulty. We yield willing homage to the unquestionable ability which his book displays in so many of its details; we go with him most willingly to a certain point, but there our steps are arrested by obstacles that we are altogether unable to surmount. In his introductory observations, for example, we find the following statements :

"Although much remains obscure, and will long remain obscure, I can entertain no doubt, after the most deliberate study and dispassionate judgment of which I am capable, that the view which most naturalists entertain, and which I formerly entertained—namely, that each species has been independently created—is erroneous. I am fully convinced that species are not immutable; but that those belonging to what are called the same genera are lineal descendants of some other and generally extinct species, in the same manner as the acknowledged varieties of any one species are the descendants of that species."

Now, if the author had confined himself to these limits; if he had sought, by his laborious collection of facts and his skilful deductions, to prove the truth of his opinion as here expressed—using the term *species*, not in its absolute or normal sense, but as limited by our present knowledge—many, we think, who cannot honestly follow him farther, would have become his willing disciples. That various so-called genera have merely the right to rank as species, we firmly believe, and confidently look forward to such researches as those in which Mr. Darwin is engaged, to afford direct proofs of this conclusion.* Thus far then we are prepared to listen trustfully to Mr. Darwin's teachings, but when he seeks to carry his applications beyond this, we lose our convictions; certain broad and apparently insurmountable barriers stand up before us; and we find ourselves unable to believe, for example, in the probability of a true transition-link between the carnivorous, retractile-clawed Felidæ, and the four-stomached, hoofed, and herbivorous sheep: and yet this is nothing to what the theory advocated in Mr. Darwin's book would impose upon us.

* It is somewhat remarkable, that, with regard to genera and species, the Inorganic subdivision of Natural History should differ so completely from the Organic branches of that study. That which to the majority of Mineralogists is simply a species, to the Botanist and Zoologist would rank as a genus, and be subdivided into species and varieties. Mineralogy was at one time, in this respect it is true, in unison with these other departments; but notwithstanding various attempts from time to time, to raise its varieties into species, and to bestow upon these latter, "Natural History" names, the broader and more philosophic view has long prevailed.

"It may be asked how far I extend the doctrine of the modification of species. The question is difficult to answer, because the more distinct the forms are which we may consider, by so much the arguments fall away in force. But some arguments of the greatest weight extend very far. All the members of whole classes can be connected together by chains of affinities, and all can be classified on the same principle, in groups subordinate to groups. Fossil remains sometimes tend to fill up very wide intervals between existing orders. Organs in a rudimentary condition plainly show that an early progenitor had the organ in a fully developed state; and this in some instances necessarily implies an enormous amount of modification in the descendants. Throughout whole classes various structures are formed on the same pattern, and at an embryonic age the species closely resemble each other. Therefore I cannot doubt that the theory of descent with modification embraces all the members of the same class. I believe that animals have descended from at most only four or five progenitors, and plants from an equal or lesser number.

Analogy would lead me one step further, namely, to the belief that all animals and plants have descended from some one prototype. But analogy may be a deceitful guide. Nevertheless all living things have much in common, in their chemical composition, their germinal vesicles, their cellular structure, and their laws of growth and reproduction. We see this even in so trifling a circumstance as that the same poison often similarly affects plants and animals; or that the poison secreted by the gall-fly produces monstrous growths on the wild rose or oak tree. Therefore I should infer from analogy that probably all the organic beings which have ever lived on this earth have descended from some one primordial form, into which life was first breathed."

It is very clear, as already stated, that many of the so-called species of naturalists, are not true species, but simply varieties; and hence, arguments founded merely on closely related forms, are of comparatively little weight as regards the main question here at issue. For the proper acceptance of the theory, it will be necessary to show the passage of one truly distinct type into another, or of these into some common parent-type, so as to render an explanation of the structural homologies and other relations existing between them. If this cannot be effected by reference to existing Nature, let us look back into the rock-preserved annals of the Past, and see if these will lend us any aid. Mr. Darwin is forced to acknowledge that Geology fails, in this respect, to furnish any direct support to his hypothesis. But then, he argues, the geological record is incomplete. In place of a full and connected history, it offers to us only a few isolated leaves of the great book of the Past. Granting this, it must nevertheless be considered highly adverse to his view—as he himself, indeed, has candidly stated—that in these stony annals we find everywhere the same unity

of plan with the same distinctness of type as in existing Nature; and that in no part of the world can we glean from them any examples even approaching to a transitional series of forms, in the sense demanded by the theory. But leaving this subject for awhile, let us examine the theory itself, as modified and set forth in Mr. Darwin's Essay, a little more in detail. We will take in succession the more prominent chapters of the book, and attempt respectively, a brief analysis of their contents.

In his first chapter, the author discusses the variations to which species give rise under domestication. He considers more especially and in great detail, the various breeds of the domestic pigeon. He shews, and every one must be familiar with this fact, the extraordinary differences in external aspect, mode of flight, etc., exhibited by many of these. So great is this diversity of character, that Mr. Darwin thinks an Ornithologist would not hesitate to class most of these breeds as distinct species, if he met with them for the first time, and were led to suppose them wild birds; nay, that he would even feel warranted in placing them under several genera. And yet, Mr. Darwin regards all our known breeds as undoubted descendants of the rock pigeon, the *Columba livia*. The strongest fact, perhaps, in favour of this view, is the production from time to time in various breeds, of the normal colours of the supposed parent-type. The question however, is by no means proved. If these pigeons have all sprung from *Columba livia*, should there not be occasionally a more striking reversion to the characters of the original type? Are we moreover authorised to conclude from any *direct evidence*, that a pair of rock pigeons could ever produce the numerous varieties that we now possess? Mr. Darwin shews us that a certain amount of variation does constantly occur amongst pigeons generally, and hence he assumes *by inference* that in course of time, the variation being accumulative, so to say, we *might* obtain the breeds we now possess. It seems, however, as legitimate an inference, notwithstanding Mr. Darwin's able advocacy of the contrary view, that various sub-species or varieties of the pigeon were originally created; just as we believe the leading varieties of the dog and horse have sprung from originally-created varieties. We have certainly no authority to assume that the greyhound and the mastiff were not originally created as such, although capable of breeding together, and producing fertile offspring. We can produce varieties now, because we have varieties from which to produce them; but if we had to breed

from a single variety, it seems evident that, in spite of the most judiciously-exercised selection in continuing the breed so as to produce the greatest possible variation, no great success could in this respect be arrived at; and a return to the characters of the original type would be constantly occurring. In the case of the dog, this is apparently allowed by Mr. Darwin, for, whilst expressing his conviction that all our domestic pigeon-breeds have descended from the rock pigeon, he does not regard our various dogs as the descendants of a single wild species. But granting that, in the case of the pigeon, and even in that of the dog, horse, &c., all known varieties have sprung from one existing or extinct type-pair—granting this—what does the admission amount to? Simply to the fact, that certain species are capable of great variation; but, after all, of a variation amounting to no real specific, much less generic, difference. Stay! cry the upholders of this theory: a certain amount of time is required for the production, in this manner, of changes to that extent. We point to the monumental records of Egypt—but these, we are told, are but the works of yesterday. We exhume the dead forms of the geologic Past—and the assumed imperfection of our record is brought against us. On this latter point however, we shall have more to say in the sequel.

In his succeeding chapter, the author discusses some important points connected with "variation under Nature;" but much of his argument is here based rather on the deficiency of our present knowledge, than on absolutely-proved facts. He points out for instance, how greatly certain naturalists differ as to what should be considered species and what varieties, in particular genera, more especially amongst plants and insects; but, rightly considered, although this may go far to prove the unnatural sub-divisions of the systematists, it cannot be looked upon as helping in any material way to explain the origin of true species: *id est*, of God's actual creations as distinguished from the necessarily imperfect conceptions of man. The grand argument of the chapter is founded on the (to a great extent, perhaps, undoubted) fact, that, in large genera, the amount of difference between the included species is often exceedingly small; and that such species present also, as a general rule, more varieties than belong to the species of smaller genera.

"From looking at species as only strongly-marked and well-defined varieties, I was led to anticipate that the species of the larger genera in each country would oftener present varieties than the species of the smaller genera; for wherever

many closely related species (*i. e.* species of the same genus) have been formed, many varieties or incipient species ought, as a general rule, to be now forming. Where many large trees grow, we expect to find saplings. Where many species of a genus have been formed through variation, circumstances have been favourable for variation; and hence we might expect that the circumstances would generally be still favourable to variation. On the other hand, if we look at each species as a special act of creation, there is no apparent reason why more varieties should occur in a group having many species, than in one having few.

To test the truth of this anticipation I have arranged the plants of twelve countries, and the coleopterous insects of two districts, into two nearly equal masses, the species of the larger genera on one side, and those of the smaller genera on the other side, and it has invariably proved to be the case that a larger proportion of the species on one side of the larger genera present varieties, than on the side of the smaller genera. Moreover, the species of the large genera which present any varieties, invariably present a larger average number of varieties than do the species of the small genera. Both these results follow when another division is made, and when all the smaller genera, with from only one to four species, are absolutely excluded from the tables. These facts are of plain signification on the view that species are only strongly marked and permanent varieties; for wherever many species of the same genus have been formed, or where, if we may use the expression, the manufactory of species has been active, we ought generally to find the manufactory still in action, more especially as we have every reason to believe the process of manufacturing new species to be a slow one. And this certainly is the case, if varieties be looked at as incipient species; for my tables clearly show as a general rule that, wherever many species of a genus have been formed, the species of that genus present a number of varieties, that is, of incipient species, beyond the average. It is not that all large genera are now varying much, and are thus increasing in the number of their species, or that no small genera are now varying and increasing; for if this had been so, it would have been fatal to my theory; inasmuch as geology plainly tells us that small genera have in the lapse of time often greatly increased in size; and that large genera have often come to their maxima, declined and disappeared. All that we want to show is, that where many species of a genus have been formed, on an average many are still forming; and this holds good.

With regard to the deductions contained in this quotation, as bearing on the origin of actual species, two things have to be observed; first, that many of the so-called species of these large genera may not be, and in many cases decidedly are not, true species; and secondly, as already observed in the case of the dog, &c., many leading varieties in these genera, may be varieties of original creation, or sub-species if we choose to call them so; and thus, a larger amount of material for variation being provided in the one case than in the other, a more extended variation in the former will follow as a natural consequence.

It is just as rational to assume for example, that several pairs of a type or species *A*, differing slightly from one another but capable of fertile intermixture, were created with a single pair, or a smaller number of pairs, of another species *B*—as to suppose that these types with their varieties, and in addition, other types *C*, *D*, *E*, *F*, etc., all sprang from an unknown type-pair, *X*, endowed with an innate plasticity of nature sufficiently accommodating to produce such changes in its descendants, as, gradually branching off in different directions, led eventually to the generation of a whale, a cat, and a sheep—not to mention other and more widely separated forms. This may be a rude, and in the eyes of those who favor Mr. Darwin's view, a coarse and very unphilosophic method of putting the argument; but it is a perfectly legitimate one. Granted, we say, that our system-species, which in many instances are not species at all, are susceptible of a certain amount of variation: there your argument stops. You can go no farther except by the help of blind and gratuitous surmises; of surmises clothed certainly in attractive colours, and in some cases possessing probably the germs of an unseizable truth—but gratuitous, all the same, in the present condition of our knowledge.

Passing over a chapter headed "the Struggle for Existence," in which in brief but graphic terms, the mutual antagonism, and the no less mutual dependency of living forms, throughout the wide range of nature, is forcibly depicted, we arrive at one of the principal topics discussed in Mr. Darwin's volume. This is entitled "Natural Selection," a term employed to express the assumed tendency of Nature to avail itself of any slight change advantageous to a species, in the gradual production of varieties, and through these, of new types. The author appears to claim this principle of natural selection as a doctrine peculiar to the present work; but, in truth—as shown by his own illustration of how a fleet brood of wolves might be produced, in this manner, by the destruction of all but swift-footed prey in their locality—it is essentially identical with the views of the author of the *Vestiges of Creation*. The latter, indeed, goes farther, in recognising also the full claims of climatic and other external causes towards the production of these changes, whilst to such influences, Mr. Darwin is inclined to concede no more than a very secondary importance. Logically considered, however, the first step in this principle of "natural selection," must be more or less dependent, at least in most instances, on the agency of physical

conditions. The first slight change, in an accumulative series of changes produced in a plant or animal, can scarcely be effected otherwise than through the direct or indirect influence of external causes. In his introduction, Mr. Darwin alludes to the "Vestiges of Creation," but seeks apparently to mask the mutual affinities of the two works, by assuming, for the earlier one, a theory which certainly does not in any way fairly represent its views. He states, for example:—

"It is preposterous to attribute to mere external conditions, the structure, for instance, of the woodpecker, with its feet, tail, beak, and tongue, so admirably adapted to catch insects under the bark of trees. In the case of the mistletoe, which draws its nourishment from certain trees, which has seeds that must be transported by certain birds, and which has flowers with separate sexes absolutely requiring the agency of certain insects to bring pollen from one flower to the other; it is equally preposterous to account for the structure of this parasite, with its relations to several distinct organic beings, by the effects of external conditions, or of habit, or of the volition of the plant itself.

The author of the 'Vestiges of Creation' would, I presume, say that, after a certain number of generations, some bird had given birth to a woodpecker, and some plant to the mistletoe, and that these had been produced perfect as we now see them."

Now the "Vestiges" theory, really supposes nothing of the kind; but, and in so far at least in accordance with Mr. Darwin's view, that one form is capable of originating another, by a slow and accumulative process of development. The author of "the Vestiges" does not assume, for example, that a bird of an absolutely different kind ever gave birth to a woodpecker "perfect as we now see it;" but that this latter type originated from an older one, by slight, gradual, and long-continued modifications of beak, claws, &c.,—the process giving rise to a complete series of intermediate forms. The two theories are thus essentially alike; although the works themselves stand widely apart. Whilst the one contents itself with broad assumptions, the other seeks to afford proofs of its statements, and honestly brings forward and discusses points apparently hostile to its views. All the proofs it is able to collect, however, are, as we have already attempted to shew, totally inadequate to affect the main question. But—explains Mr. Darwin—although the changes recorded are confessedly slight, they are sufficient to show what would be accomplished, if greater time were called into play; and, in illustration of this, he refers to the agency of present causes in

producing, contrary to an earlier belief, geological changes of the greatest magnitude. But the two cases have no true parallelism. One who had never seen the sea, or had never studied its effects, might naturally be inclined to look with incredulity on statements of its wasting powers, and of the results asserted to arise from these. But if he were to reside for a certain time on a sea-coast, where this wasting action were going on, and thus witnessed how, bit by bit, the destruction of the coast took place, he could not shut his eyes to the fact, that, however slight the annual waste, this must amount in a given number of years, to such or such a quantity. In like manner, one residing near an estuary in which rock-sediments were constantly under process of deposition, would be forced to acknowledge by what he saw daily or annually going on, that in course of time (other conditions not interfering) a delta of greater or less extent must necessarily arise. But to make the two cases parallel, we should have to assume that these natural processes would produce, not their obvious and natural results, but some altogether unexpected issue. Natural selection as maintained by Mr. Darwin, is undoubtedly a modifying power or principle of recognised action; and no one can read the section of his book which refers to that subject, without deriving profit and instruction from the perusal. But when the author attempts to establish the sufficiency of this power to effect generic changes, stronger arguments are certainly required, than any he has yet been able to bring forward.

After some additional remarks of an interesting and original character, on the laws influencing variation, but which our comparatively limited space compels us to pass over, we arrive at a distinct portion of the work, in which the author, having stated his views in detail, and advanced facts in support of the theory which these embody, takes up the so-called difficulties of this theory, or the questions which oppose themselves to its reception. Some of these have been already touched upon, and others must have suggested themselves to the reader, but we have forborne to consider them collectively until reaching the present part of the work, in which they are boldly brought forward and combated by the author himself. Mr. Darwin enunciates them as follows :

“ Long before having arrived at this part of my work, a crowd of difficulties will have occurred to the reader. Some of them are so grave that to this day I can never reflect on them without being staggered; but, to the best of my judg-

ment, the greater number are only apparent, and those that are real are not, I think, fatal to my theory.

These difficulties and objections may be classed under the following heads:—
 Firstly, why, if species have descended from other species by insensibly fine gradations, do we not everywhere see innumerable transitional forms? Why is not all nature in confusion instead of the species being, as we see them, well defined?

Secondly, is it possible that an animal having, for instance, the structure and habits of a bat, could have been formed by the modification of some animal with wholly different habits? Can we believe that natural selection could produce, on the one hand, organs of trifling importance, such as the tail of a giraffe, which serves as a fly-flapper, and, on the other hand, organs of such wonderful structure, as the eye, of which we hardly as yet fully understand the inimitable perfection?

Thirdly, can instincts be acquired and modified through natural selection? What shall we say to so marvellous an instinct as that which leads the bee to make cells, which have practically anticipated the discoveries of profound mathematicians?

Fourthly, how can we account for species, when crossed, being sterile and producing sterile offspring, whereas, when varieties are crossed, their fertility is unimpaired?

The first objection is met on Mr. Darwin's part by several pleas, of which we give the author's own summary below, merely stating our personal inability to see clearly the force of his replies. We should remember, in this connection, that our present knowledge is not confined to a few limited areas, but extends over almost the whole surface of the globe; and imperfect as the geological record may be, it is at least exceedingly surprising that neither dead nor existing nature in any part of the world should be capable of affording direct support, however slight, to the author's views. We cannot but think, consequently, that he asks us here to accord him too much. The following are the arguments—as given in a condensed form by the author himself—by which the first of the above most serious objections is attempted to be overcome:—

“To sum up, I believe that species come to be tolerably well-defined objects, and do not at any one period present an inextricable chaos of varying and intermediate links: firstly, because new varieties are very slowly formed, for variation is a very slow process, and natural selection can do nothing until favourable variations chance to occur, and until a place in the natural polity of the country can be better filled by some modification of some one or more of its inhabitants. And such new places will depend on slow change of climate, or on the occasional immigration of new inhabitants, and probably, in a still more important degree, on some of the old inhabitants becoming slowly modified, with the new forms thus

produced and the old ones acting and reacting on each other. So that in any one region and at any one time, we ought only to see a few species presenting slight modifications of structure in some degree permanent; and this assuredly we see.

Secondly, areas now continuous must often have existed within the recent period in isolated portions, in which many forms, more especially amongst the classes which unite for each birth and wander much, may have separately been rendered sufficiently distinct to rank as representative species. In this case, intermediate varieties between the several representative species and their common parent, must formerly have existed in each broken portion of the land, but these links will have been supplanted and exterminated during the process of natural selection, so that they will no longer exist in a living state.

Thirdly, when two or more varieties which have been formed in different portions of a strictly continuous area, intermediate varieties will, it is probable, at first have been formed in the intermediate zones, but they will generally have had a short duration. For these intermediate varieties will, from reasons already assigned (namely, from what we know of the actual distribution of closely allied or representative species, and likewise of acknowledged varieties), exist in the intermediate zones in lesser numbers than the varieties which they tend to connect. From this cause alone the intermediate varieties will be liable to accidental extermination; and during the process of further modification through natural selection, they will almost certainly be beaten and supplanted by the forms which they connect; for these, from existing in greater numbers will, in the aggregate, present more variation, and thus be further improved through natural selection and gain further advantages.

Lastly, looking not to any one time but to all time, if my theory be true, numberless intermediate varieties, linking most closely all the species of the same group together, must assuredly have existed; but the very process of natural selection constantly tends, as has been so often remarked, to exterminate the parent-forms and the intermediate links. Consequently evidence of their former existence could be found only amongst fossil remains, which are preserved, as we shall in a future chapter attempt to show, in an extremely imperfect and intermittent record."

With regard to the objections placed under the second head, objections of perhaps a still more grave character, the replies, as might be expected, are even still less satisfactory. We have here, indeed, two principal difficulties which it is impossible to set aside except by the aid of entirely gratuitous suppositions. In one of these difficulties, the mode of transition of one generic form into another—of (and Mr. Darwin might have chosen a more startling example) an insectivorous quadruped into a bat, for instance—the author confesses that he can give us no rational explanation. At the same time, *he thinks such difficulties have very little weight.* The arguments here, we trust we do not speak offensively, for nothing

is farther from our intention—the arguments here, become painfully akin to those of the “Vestiges.” Take the following for example :

“Seeing that a few members of such water-breathing classes as the Crustacea and Mollusca are adapted to live on the land, and seeing that we have flying birds and mammals, flying insects of the most diversified types, and formerly had flying reptiles, it is conceivable that flying fish, which now glide far through the air, slightly rising and turning by the aid of their fluttering fins, might have been modified into perfectly winged animals. If this had been effected, who would have ever imagined that in an early transitional state they had been inhabitants of the open ocean, and had used their incipient organs of flight exclusively, as far as we know, to escape being devoured by other fish !”

If the author had attempted to show that an imperfectly-flying fish might become gradually modified into a fish possessing more perfect powers of flight, the principle might perhaps be admitted, at least for the sake of discussion: but when “perfectly winged animals” are spoken of, especially in connexion with the context, the argument, if it mean anything, implies the possible transformation of a flying fish into a pterodactyle or some kind of flying reptile; and through this, or without its intervention, into a bird or a bat—a transformation involving most assuredly, greater difficulties, than any examples of petty, subordinate modifications, such as the author’s tabular lists may exhibit, will help us to consider one of little weight. Turning now to the second of the grave difficulties referred to above, the formation of a complex organ, like the eye of a vertebrated animal, by the gradual modification of an inferior organ in a lower type, we may again let the author speak for himself: only warning the reader unfamiliar with geological discussions, that where Mr. Darwin speaks of our having to descend far beneath the lowest known fossiliferous stratum to discover the earliest stages by which the eye in the vertebrated class has been perfected, he assumes data altogether denied by the greater number of our most eminent geologists. The lowest sedimentary rocks (containing it should be remarked many beds which retain all their sedimentary characters, and thus agree with higher and fossiliferous strata) are *generally* looked upon as truly azoic formations: as deposits accumulated before the dawn of life upon the globe. The first fish-remains, moreover, the earliest recognised examples of Vertebrata, do not occur at or near the actual base of the fossiliferous strata, but only at the extreme upper limit of the Silurian formation; and in all our earliest fishes the eye exhibits

apparently the normal structure. Fishes and other organisms, may, it is true, have lived at earlier periods than Geology indicates; but that view, whether true or false, is purely hypothetical, is opposed to the results of actual observation, and cannot therefore be legitimately introduced into an argument of this kind. But we proceed to our quotation, the last that our decreasing space will allow us to give.

“To suppose that the eye, with all its inimitable contrivances for adjusting the focus to different distances, for admitting different amounts of light, and for the correction of spherical and chromatic aberration could have been formed by natural selection, seems, I freely confess, absurd in the highest possible degree. Yet reason tells me, that if numerous gradations from a perfect and complex eye to one very imperfect and simple, each grade being useful to its possessor, can be shown to exist; if, further, the eye does vary ever so slightly, and the variations be inherited, which is certainly the case; and if any variation or modification in the organ be ever useful to an animal under changing conditions of life, then the difficulty of believing that a perfect and complex eye could be formed by natural selection, though insuperable by our imagination, can hardly be considered real. How a nerve comes to be sensitive to light, hardly concerns us more than how life itself first originated; but I remark that several facts make me suspect that any sensitive nerve may be rendered sensitive to light, and likewise to those coarser vibrations of the air which produce sound.

In looking for the gradations by which an organ in any species has been perfected, we ought to look exclusively to its lineal ancestors; but this is scarcely ever possible, and we are forced in each case to look to species of the same group, that is to the collateral descendants from the same original parent-form, in order to see what gradations are possible, and for the chance of some gradations having been transmitted from the earlier stages of descent, in an unaltered or little altered condition. Amongst existing Vertebrata, we find but a small amount of gradation in the structure of the eye, and from fossil species we can learn nothing on this head. In this great class we should probably have to descend far beneath the lowest known fossiliferous stratum to discover the earlier stages, by which the eye has been perfected.

In the Articulata we can commence a series with an optic nerve merely coated with pigment, and without any other mechanism; and from this low stage numerous gradations of structure, branching off in two fundamentally different lines, can be shown to exist, until we reach a moderately high stage of perfection. In certain crustaceans, for instance, there is a double cornea, the inner ones divided into facets, within reach of which there is a lens shaped swelling. In other crustaceans the transparent cones which are coated by pigment, and which properly act only by excluding lateral pencils of light, are convex at their upper ends and must act by convergence; and at their lower ends there seems to be an imperfect vitreous substance. With these facts, here far too briefly and imperfectly given, which show that there is much graduated diversity in the eyes of living crustaceans, and bearing in mind how small the number of living animals is in

proportion to those which have become extinct, I can see no very great difficulty (not more than in the case of many other structures) in believing that natural selection has converted the simple apparatus of an optic nerve merely coated with pigment and invested by transparent membrane, into an optical instrument as perfect as is possessed by any member of the great Articular class.

He who will go thus far, if he finds on finishing this treatise that large bodies of facts, otherwise inexplicable, can be explained by the theory of descent, ought not to hesitate to go further, and to admit that a structure even as perfect as the eye of an eagle might be formed by natural selection, although in this case he does not know any of the transitional grades. His reason ought to conquer his imagination, though I have felt the difficulty far too keenly to be surprised at any degree of hesitation in extending the principle of natural selection to such startling lengths."

An entire chapter, and a most instructive one, in Mr. Darwin's book, is devoted to the subject of *Instinct*, another serious obstacle as all will readily understand, to the reception of the transmutation theory. Mr. Darwin seeks to overcome this obstacle, by establishing two points: first, that a certain amount of judgment or reason enters into the composition of instinct; and secondly, and chiefly, that, instinct can be shewn, in certain remarkable cases, to be a quality of gradation, so to say. In the cell-building instinct of the bees for example, he traces out, as he imagines, a specific connexion between the humble bees and the hive bee—the Mexican *Melipoma domestica* affording a transition-link. But here, we should consider, that, the principle of instinct is perhaps in no case a *simple specific principle*, nor even a generic one; but a principle pervading entire families or groups, and, as such, one that we might naturally infer to offer inherent degrees of variation. To establish the point aimed at by Mr. Darwin, we ought to be able to shew, that the humble-bee could be made to acquire the higher artistic-instinct of the hive-bee. We may be told that this might probably be effected under favourable circumstances, and with sufficient lapse of time; but as this assumption is altogether without proof, we have an equal right to infer that these separate amounts, or rather *kinds* of instinct, were originally bestowed on these different bees at their special creation. The followers of Mr. Darwin's theory, would, of course, ridicule the idea of a separate creation on the part of insects so nearly allied; but as they can offer us nothing to the contrary but inferences and surmises, every one is at liberty, on this point, to entertain his own opinion. Instinct may be legitimately regarded as entirely depend-

ent upon the inherent character of the brain or its representatives, much as the mode and power of flight in birds and other winged animals, depends essentially upon the conformation of the wing. Hence the possession of peculiar instincts in the case of neuter insects incapable of continuing their race (as the neuter bees, neuter ants, &c.,) alluded to by Mr. Darwin as of difficult explanation, becomes, on the older theory, easily explained. Instinct forms, so to say, a portion of the organization of the animal: and thus, if a neuter insect were so organized as to become a fertile one, its instincts would necessarily become modified with the other parts of the organization. If instinct be really capable of improvement or modification, as the transmutation theory is forced to assert, but of which not the slightest proof is afforded, instinct and reason must in a manner be one. But all known facts are opposed to this, although the two principles are sometimes confounded by the unreflective, or by those who are disinclined to allow a certain share of reason to the lower animals. Rightly considered, these principles are not only distinct, but are actually antagonistic elements. The higher the reasoning powers, the feebler or less developed become the manifestations of the instinct principle.

We now come to the fourth great obstacle to the reception of Mr. Darwin's views—the fertility of varieties when crossed, and the sterility of the offspring of separate species in the few cases in which these latter can be made to unite. This subject is discussed by the author at some length, although necessarily under a very limited aspect. His data are chiefly, indeed almost entirely, derived from the Vegetable Kingdom, and hence, are scarcely available as fair test-elements for the proper elucidation of the question. The broad, opposing facts presented by animal hybridism are left, and unavoidably, almost untouched; or are masked under other more or less distinct inquiries: as where the author says—“Laying aside the question of fertility and sterility, in all other respects there seems to be a general and close similarity in the offspring of crossed species and of crossed varieties.” Briefly, on this subject, we require to know why separate species (which under Mr. Darwin's view are nothing more than varieties) cannot be made to breed together, or do not breed together in the wild state—or why, in the few instances in which this is effected between closely allied forms, the offspring are sterile—whilst on the other hand, our known varieties

breed freely, and produce fertile offspring? This is the real question at issue; and, up to the present time, it has received no definite answer, except on the assumption that true species are separate and distinct creations, and are intended by the CREATOR to remain distinct.

Some of the most striking arguments in opposition to the transmutation theory, are based on geological revelations. These have been already referred to in a previous page, but as Mr. Darwin has devoted a separate chapter to their consideration at the portion of the work to which we have now arrived, we will briefly re-discuss them before closing our review. These geological arguments are two-fold: First, the non-occurrence of intermediate or transitionary forms in rock-strata; and, secondly, the simultaneous occurrence, again and again, at various geological horizons, of entire groups of allied forms, distinct entirely (or for the greater part) from the organisms of lower and consequently earlier formed deposits. To make these points clear to our non-geological readers, we may observe, that, on each side of the Atlantic, we find certain beds entirely destitute of organic remains, underlying other beds in which these remains occur in great numbers. In some places it is difficult to draw an exact line of demarcation between the two, but that in no way affects our argument. At a certain depth all fossils cease. Now, some observers, Mr. Darwin amongst others, believe that organic forms really existed during, and perhaps before, the deposition of these fossil-free strata. Many of these strata, it should be observed, are evidently much altered, by various chemical, igneous, or other agencies, from their original sedimentary condition; and hence, fossils, if ever enclosed in them, may have become obliterated. Other strata of this fossil-free series, however, in various parts of the world, clearly retain their original characters, and do not differ, except in the absence of fossils, from many fossiliferous strata above them. From this fact, combined with the great thickness and extent of the rocks in question, most geologists consider these to be truly *azoic* rocks, formed out of sediments deposited before the actual creation of living things. If this could be absolutely proved, the transmutation theory would receive its death-blow: because in the strata which succeed or lie above these, and which constitute, be it remembered, the first or earliest fossiliferous strata really known, we find various types appearing simultaneously; and amongst these types we meet with various

allied forms without any intermediate or truly transitional links between them. If we cannot absolutely assert, however, that these Silurian forms (using the term Silurian in its extended sense) were the first created forms upon our earth, the weight of evidence is in favour, and strongly in favour, of that view. Hence, in common justice, the contrary hypothesis, resting as it does on purely negative evidence, ought not to be admitted into the discussion. But if we exclude it, what becomes of Mr. Darwin's theory? "If my theory be true," writes Mr. Darwin—"it is indisputable that before the lowest Silurian stratum was deposited, long periods elapsed, as long as, or probably far longer, than the whole interval from the Silurian age to the present day: and that during these vast yet quite unknown periods of time, the world swarmed with living creatures." But if so, where are the remains of these? Vast thicknesses of rocky strata, formed during some at least of these periods, occur in various parts of the world, but as yet no fossils have been obtained from them; whilst the remains of forms which flourished afterwards, are entombed in thousands in the overlying rocks. It is not sufficient to urge, in refutation, that the lower limit of the fossil-bearing strata has been pushed lower and lower by the discovery of an obscure graptolite here, and the fragment of a trilobite, there. To substantiate Mr. Darwin's theory, something more than this is clearly required.

But passing over this weighty obstacle, we find in these geological revelations, others not less weighty. Above the Silurian formations, for example, we find another set of strata, to which, collectively, the term Devonian has been applied, and in which the fossils (with very few exceptions) are entirely different. Above the Devonian beds again, we come upon the Carboniferous with another distinct series of organic remains; and so on successively, through various other groups of strata, each representing a certain period of time during which it was under process of deposition in the form of muddy, sandy, or calcareous sediments. In these sediments, moreover, a portion of the flora and fauna of the period (*id est*: of the plants and animals then living) was entombed, and so preserved to us: just as we see, at the present day, the leaves, shells, bones, &c., of existing organisms, enclosed in sediments under process of deposition in seas, lakes, and estuaries. Now, on the hypothesis of distinct acts of creation, there is nothing unaccountable in the sudden appearance, successively, of these distinct sets

of forms, and in the want of transitional forms amongst them ; but the abrupt appearance in this manner, of numerous, varied, and distinct types ; and especially, the abrupt appearance of distinct sets of these, again and again, in geological history, if not absolutely fatal, is, at least, highly adverse to the Lamarckian or transmutation view. The only possible way indeed, in this case, to reconcile fact with theory, is to maintain, with Mr. Darwin, the imperfection of the geological record. But admitting freely the imperfect state of this record, we may legitimately inquire if the imperfection be really sufficient to invalidate the force of our argument. In each of these groups of rocks, we have evidence, according to Mr. Darwin's own shewing, of the lapse of an immense interval of time—and yet, transition-forms are absent. And, again, is it not most remarkable that the annals of this imperfect record, belonging to different and distant ages, and collected from such widely distant localities, should all tell the same tale, should all point to one and the same conclusion, and that an adverse one to Mr. Darwin's view. Assuredly, this cannot be the mere effect of chance. If so, it is as remarkable as would be the case of a hundred coins, thrown at random into the air, all falling with the same face uppermost. It seems impossible therefore, to avoid the conclusion, that, although—by the advancement of organic forms generally, from lower to higher types, which it reveals ; by the extinction of entire races, which it plainly announces ; by the vast periods of time, which the just explanation of its facts demands—Geology might seem at first thought to favor the transmutation hypothesis : its records, when rightly and fairly read, will be found altogether opposed to that illusive view.

We have not yet reached the end of Mr. Darwin's book : several chapters still remain undiscussed, but the grand argument virtually closes here. The remaining portions of the work are occupied chiefly by additional illustrations, and by a general recapitulatory statement of the subjects brought under review in the earlier chapters of the volume. These illustrations bear principally on the difficulties attached to the commonly received belief, the special-creation theory as this has been termed ; and seek to uphold the development view, not by shewing the real strength of this, but by exposing the assumed weakness of the opposing system—in its impossibility, for example, to explain the cause of various striking phenomena connected with the geographical

distribution of plants and animals, the embryological development of these, and so forth.

But this is scarcely a logical, certainly not a just method, of meeting the question. The case stands thus. Certain facts are given: certain remarkable phenomena are witnessed everywhere around us. We are asked to explain them. We are forced to confess they transcend our explanation. We are asked how the world comes to be peopled by so very many different plants and animals. We reply, by the act of the CREATOR: these plants and animals being the essentially-unchanged descendants of species separately created at the commencement of the existing state of things. But, say our questioners, if this be the case, if these type-forms were all separately created, is it not most strange that certain points of resemblance should pervade the whole? Even proud Man in his physical organization is but the end-link of the series, differing only in special points of structure from the beast that perisheth. Is it not most remarkable that many forms should have been created with rudimentary organs (as the mammae of male mammals, the soldered and abortive wings of certain insects, &c.) useless, normally, to themselves, though useful, under an enlarged development, to other forms? Is it not most startling that the foetal forms of various animals should pass through certain stages of development, representing in part the organization of other types? Are not these and other facts that might be adduced, really without obvious explanation on the view that each species has been separately created, and kept distinct?

To these questionings, we have, of course, but one reply: These strange phenomena, we make answer, are regarded by us, as parts of a great plan, conceived and carried out by the ALMIGHTY in his wisdom, for some purpose unfathomable to us at present, and perhaps ever to remain unfathomed by our restricted powers of inquiry. Beyond this, they are as inexplicable to us, as the object of our presence here is inexplicable. They belong to those mysteries of GOD which are kept "on the outside of man's dream." Many have attempted their interpretation, but all, as yet, have failed. Not so, say the supporters of the transmutation theory—these difficulties are met and answered by the principle of "descent with modification" of species from one another. Let us do this theory no injustice. It certainly does afford a rational explanation of the remark-

able facts detailed above; but when tested by other facts, it fails entirely. It is comparatively easy to invent a theory in explanation of a particular series of phenomena, provided we be allowed to exclude all collateral facts from consideration. If we look back into the history of any science, how many futile, though at one time universally-accepted theories of this kind, do we not encounter. Many of these, however, though eventually discarded, have helped by their elaboration, to enrich our knowledge; and the wide discussion to which the present work has led, will undoubtedly yield the same good fruits.

In concluding our confessedly-imperfect analysis of this noted Essay, we may perhaps be allowed to state, apologetically, that having been disappointed of a review on the subject, by another pen, we have been forced, at the eleventh hour, to throw thus hastily into form, the thoughts suggested to us by an impartial study of the work when first obtained. If we have been compelled to record our protest against the reception of what we believe to be an unfounded theory; no one, we may safely affirm on the other hand, can lay down Mr. Darwin's book, so remarkable in many points of view, without feeling that a large accession of new thought has been added by it to our common store.

E. J. C.

SCIENTIFIC AND LITERARY NOTES

LIST OF BIRDS OBSERVED IN THE VICINITY OF HAMILTON, C. W. ARRANGED AFTER THE SYSTEM OF AUDUBON.

BY THOMAS M^oILWRAITH, ESQ.

The object of the writer in preparing the following list, has been to afford such information as may be of use, should inquiry at any future period be made regarding the birds frequenting this part of the country. In its present state, the list has been drawn up from observations made during occasional excursions within a period of four years. Those who are acquainted with the subject will see that it is necessarily incomplete; but it will be easy to add the names of such species as may yet be found. In order that the list may be strictly local, no species has been mentioned which has not been found within six miles of the city limits.

Genus *Buteo*.—BUZZARD.

1. *B. borealis*—*Red-tailed Hawk*. Seen in spring and fall. Not very common.
2. *B. lineatus*—*Red-shouldered Hawk*. More plentiful than the preceding, which it resembles in appearance and habits.