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ARTICLE VIII. *Observations on the Natural History of the Valley of the River Rouge, and the surrounding Townships in the Counties of Argenteuil and Ottawa.* By W. S. M. D'URBAN.

(*Continued from page* 276, *Vol. IV*)

INVERTEBRATA.

INSECTA.

COLEOPTERA.

Nearly all of the 114 species in the following Catalogue were obligingly determined for me by Dr. J. L. Leconte of Philadelphia. Besides those enumerated, many others were collected, but were unfortunately lost by the accidental fracture of the bottle which contained them.

I have added a list of 34 species, not observed in this district by myself, but brought by Mr. Robert Bell from the Augmentation of Grenville, and the neighbourhood of L'Orignal, on the south bank of the Ottawa.

Cicindela longilabris, Say.—Hamilton's Farm on the River Rouge, 2nd September.

" *vulgaris*, Say.—Very abundant on sand-banks, River Rouge, August.

* " *Baltimorensis*, Herbst. (*repanda*, Say.)—Common on sand-banks, River Rouge, July and August.

* The larvæ of this species were numerous in their burrows in the sand, by the side of the Rouge, five miles below Hamilton's Farm, 13th August.

ARTICLE IX.—*Review of "Darwin on the Origin of Species by means of Natural Selection."**

Nothing is more humbling to the scientific enquirer than to find that he has arrived in the progress of his investigations at a point beyond which inductive science fails to carry him. The physicist finds himself in this position when required to explain the nature of matter, or the cause of gravitation or cohesion, or the essence of the mysterious influences of light, heat, and electricity. The chemist is equally baffled in the presence of those mysterious atoms which are in all his processes, yet are not perceptible to his senses The physiologist stands awe-stricken in the presence of a microscopic cell whose structure he knows, but whose origin and wonderful vital endowments he fails to comprehend. The geologist and the systematic zoologist are haunted in their dreams by those multifarious species that appear and disappear, like phantoms on the stage of geological time, yet seem so fixed and unchangeable in existing nature. True science is always humble, for it knows itself to be surrounded by mysteries—mysteries which only widen as the sphere of its knowledge extends. Yet it is the ambition of science to solve mysteries, to add one domain after another to its conquests, though certain to find new and greater difficulties beyond. Hence we find every difficult problem assailed by a constant succession of adventurers, some of them content cautiously to explore the ground and prudently to retreat where to advance is no longer safe; others gathering all their strength for a rush and a leap into an unknown and fathomless abyss. Both classes do good to science. The first show us the real nature of the difficulties to be overcome or to be abandoned as hopeless. The second we follow to the last crumbling margin of sound fact and deduction on which their feet have rested before their final plunge, and thus gain an experience that otherwise we should not have had the courage to seek.

The question of the origin of species yields in difficulty to none of the problems to which we have referred above, and Mr. Darwin's book is a noted instance of the second of the methods of

* *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. 1 vol. post 8vo. pp. 502. London: John Murray. New York: Appletons. Montreal: Dawson. 1860.

treatment which we have indicated. We do not however value him the less on account of his boldness and rash self-sacrifice in the cause of science. We follow him with pleasure over many agreeable and instructive paths not previously explored, and we shrink back only when he leads us to the brink of a precipice, and we fail to perceive the good land which he says lies beyond, or to place confidence in the bridge, thinner than gossamer, which he has woven to bear our feet over the gulf that separates the proved ground of specific variability from the mystery of specific difference. We regard this as the most accurate and concise statement that can be made respecting the character of this book. It elaborately investigates the question of variation of species, and illustrates its laws in a very full and satisfactory manner, though giving to some of these laws an undue prominence as compared with others. It then attempts to apply the laws of variation to an entirely different series of phenomena, those of specific diversity, and finding some analogies between the characters that distinguish species and varieties, seeks on this ground to break down all specific distinction in respect to origin, and to reduce all species to mere varieties of ancient and perhaps perished prototypes.

The work thus divides itself naturally into two distinct and quite dissimilar portions: 1st. The careful induction of facts bearing on the nature and laws of variation, in which the author appears in all his strength as a patient and reliable zoologist; and, 2nd. The wild and fanciful application of the results thus attained to another class of phenomena with which they have no connection except that of mere analogy. We shall endeavor to distinguish these two portions of the work, but cannot avoid treating of them together.

Variation occurs under two very different conditions. It takes place in domesticated animals and plants, and in animals and plants in a wild state. Very properly our author first examines its conditions under domestication, in which state variation is much more extensive and also more easily observed. The great variations that occur in a state of domestication are no doubt due to changed and unnatural conditions of life; but farther than this we know nothing of their precise causes. On this subject our author indulges in some preliminary speculations, and tries to rid the subject of what he terms misconceptions, some of which are, however, only facts too stubborn to be bent to his theory. For example, in speaking of the prevalent idea, that domesticated

animals have been chosen by man on account, among other things, of their capacity for variation, he says:—"I do not dispute that these capacities have added largely to the value of some of our domesticated productions; but how could a savage possibly know when he first tamed an animal whether it would vary in succeeding generations, and whether it would endure other climates? Has the little variability of the ass or the guinea-fowl, or the small power of endurance of warmth of the reindeer or of cold by the common camel, prevented their domestication? I cannot doubt that if other animals and plants equal in number to our domesticated productions, and belonging to equally diverse classes and countries, were taken from a state of nature, and could be made to breed for an equal number of generations under domestication, they would vary on the average as largely as the parent species of our existing domesticated productions have varied." On reading these sentences it must occur to any reflective reader, 1st. That savages very rarely tame animals. 2d. That if savages or others attempted to tame animals indiscriminately, they would fail in many cases, and these in the very cases in which species could endure little change. 3d. Animals little variable, like the reindeer and the camel, have little geographical range, and this just because of the fixity or tenderness of their constitution. 4th. Even the capacity of breeding at all under the changed conditions of domestication, is wanting in some species. In short, there is no reason whatever to believe that species are equally variable; but, on the contrary, that they differ very much in this respect,—as naturalists have always maintained. In the same loose way he treats the doctrine of the tendency of varieties to revert to the original types of the species. This, our author admits, if established, would overthrow his whole hypothesis, and he gets rid of it by denying the evidence of reversion afforded by so many of our domestic animals and cultivated plants, and by farther affirming that such reversion, if it does occur, amounts to nothing, because produced by external causes. Certain species, by the external causes applied in domestication, are caused to vary. These causes being removed, as every one knows, they gradually lose their acquired and unnatural characteristics; but, according to Mr. Darwin, this gives no evidence of an original type, but only of the operation of other causes of change, tending in some other direction. The argument would be good if we could have species destitute of all distinctive characters to begin with; in

other words, if we could create species. But as the case stands, it is a mere *petitio principii.*

In this way our author, in the opening paragraphs of his first chapter, quietly ignores a number of facts essential to the validity of the received views of species, and so leads the unwary reader to enter on the consideration of variation with an impression already formed that varieties and species are not distinguishable. We take the liberty of entering on the enquiry in another spirit, and of beginning with the fact that we have species which have remained distinct in the whole period of human experience, and also as far back in geological time as we can trace any of them. This being premised, we may enquire what variations man has been able to effect in those species which he has domesticated, and by what processes and under what laws these changes have occurred.

These changes have been very great. Mr. Darwin has studied the domestic pigeon as a convenient instance, and his investigations on this animal are worthy of all praise, and establish most clearly the great amount of variation of which some species are susceptible. We quote this in full, as the most valuable portion of the book:—

"Believing that it is always best to study some special group, I have, after deliberation, taken up domestic pigeons. I have kept every breed which I could purchase or obtain, and have been most kindly favoured with skins from several quarters of the world, more especially by the Hon. W. Elliot from India, and by the Hon. C. Murray from Persia. Many treatises in different languages have been published on pigeons, and some of them are very important, as being of considerable antiquity. I have associated with several eminent fanciers, and have been permitted to join two of the London Pigeon Clubs. The diversity of the breeds is something astonishing. Compare the English carrier and the short-faced tumbler, and see the wonderful difference in their beaks, entailing corresponding differences in their skulls. The carrier, more especially the male bird, is also remarkable from the wonderful development of the carunculated skin above the head, and this is accompanied by greatly elongated eyelids, very large external orifices to the nostrils, and a wide gape of mouth. The short-faced tumbler has a beak in outline almost like that of a finch; and the common tumbler has the singular and strictly inherited habit of flying at a great height in a compact flock, and

tumbling in the air head over heels. The runt is a bird of great size, with long massive beak, and large feet; some of the sub-breeds of runts have very long necks, others very long wings and tails, others singularly short tails. The barb is allied to the carrier, but, instead of a very long beak, has a very short and very broad one. The pouter has a much elongated body, wings, and legs; and its enormously developed crop, which it glories in inflating, may well excite astonishment and even laughter. The turbit has a very short and conical beak, with a line of reversed feather down the breast; and it has the habit of continually expanding slightly the upper part of the œsophagus. The Jacobin has the feathers so much reversed along the back of the neck that they form a hood, and it has, proportionally to its size, much elongated wing and tailfeathers. The trumpeter and laugher, as their names express, utter a very different coo from the other breeds. The fantail has thirty or even forty tailfeathers, instead of twelve or fourteen, the normal number in all members of the great pigeon family; and these feathers are kept expanded, and are carried so erect that in good birds the head and tail touch; the oil-gland is quite aborted. Several other less distinct breeds might have been specified."

"In the skeletons of the several breeds, the development of the bones of the face in length and breadth and curvature differs enormously. The shape, as well as the breadth and length of the ramus of the lower jaw, varies in a highly remarkable manner. The number of the caudal and sacral vertebræ vary; as does the number of the ribs, together with their relative breadth and the presence of processes. The size and shape of the apertures in the sternum are highly variable; so is the degree of divergence and relative size of the two arms of the furcula. The proportional width of the gape of mouth, the proportional length of the eyelids, of the orifice of the nostrils, of the tongue (not always in strict correlation with the length of beak), the size of the crop and of the upper part of the œsophagus: the development and abortion of the oil-gland; the number of the primary wing and caudal feathers; the relative length of wing and tail to each other and to the body; the relative length of leg and of the feet; the number of scutellæ on the toes, the development of skin between the toes, are all points of structure which are variable. The period at which the perfect plumage is acquired varies, as does the state of the down with which the nestling birds are

clothed when hatched. The shape and size of the eggs vary. The manner of flight differs remarkably; as does in some breeds the voice and disposition. Lastly, in certain breeds, the males and females have come to differ to a slight degree from each other."

"Altogether at least a score of pigeons might be chosen, which if shown to an ornithologist, and he were told that they were wild birds, would certainly, I think, be ranked by him as well-defined species. Moreover, I do not believe that any ornithologist would place the English carrier, the short-faced tumbler, the runt, the barb, pouter, and fantail in the same genus; more especially as in each of these breeds several truly-inherited sub-breeds, or species as he might have called them, could be shown him."

"Great as the differences are between the breeds of pigeons, I am fully convinced that the common opinion of naturalists is correct, namely, that all have descended from the rock-pigeon (*Columba livia*), including under this term several geographical races or sub-species, which differ from each other in the most trifling respects. As several of the reasons which have led me to this belief are in some degree applicable in other cases, I will here briefly give them. If the several breeds are not varieties, and have not proceeded from the rock-pigeon, they must have descended from at least seven or eight aboriginal stocks; for it is impossible to make the present domestic breeds by the crossing of any lesser number: how, for instance, could a pouter be produced by crossing two breeds unless one of the parent-stock possessed the characteristic enormous crop? The supposed aboriginal stocks must all have been rock-pigeons, that is, not breeding or willingly perching on trees. But besides *C. livia*, with its geographical sub-species, only two or three other species of rock-pigeons are known; and these have not any of the characters of the domestic breeds. Hence the supposed aboriginal stocks must either still exist in the countries where they were originally domesticated, and yet be unknown to ornithologists; and this, considering their size, habits, and remarkable characters, seems very improbable; or they must have become extinct in the wild state. But birds breeding on precipices, and good fliers, are unlikely to be exterminated; and the common rock-pigeon, which has the same habits with the domestic breeds, has not been exterminated even on several of the smaller British islets, or on the shores of the Mediterranean. Hence the supposed extermination of so many species having similar habits with the rock-pigeon seems to

me a very rash assumption. Moreover, the several above-named domesticated breeds have been transported to all parts of the world, and, therefore, some of them must have been carried back again into their native country; but not one has ever become wild or feral, though the dovecot-pigeon, which is the rock-pigeon in a very slightly altered state, has become feral in several places. Again, all recent experience shows that it is most difficult to get any wild animal to breed freely under domestication; yet on the hypothesis of the multiple origin of our pigeons, it must be assumed that at least seven or eight species were so thoroughly domesticated in ancient times by half-civilized man, as to be quite prolific under confinement."

"An argument, as it seems to me, of great weight, and applicable in several other cases, is, that the above-specified breeds, though agreeing generally in constitution, habits, voice, colouring, and in most parts of their structure, with the wild rock-pigeon, yet are certainly highly abnormal in other parts of their structure: we may look in vain throughout the whole great family of Columbidæ for a beak like that of the English carrier, or that of the short-faced tumbler, or barb; for reversed feathers like those of the jacobin; for a crop like that of the pouter; for tail-feathers like those of the fan-tail. Hence it must be assumed not only that half-civilized man succeeded in thoroughly domesticating several species, but that he intentionally or by chance picked out extraordinarily abnormal species; and further, that these very species have since all become extinct or unknown. So many strange contingencies seem to me improbable in the highest degree."

"Some facts in regard to the colouring of pigeons well deserve consideration. The rock-pigeon is of a slaty-blue, and has a white rump (the Indian sub-species, *C. intermedia* of Strickland, having it bluish); the tail has a terminal dark bar, with the bases of the outer feathers externally edged with white; the wings have two black bars; some semi-domestic breeds and some apparently truly wild breeds have, besides the two black bars, the wings chequered with black. These several marks do not occur together in any other species of the whole family."

"Now, in every one of the domestic breeds, taking thoroughly well-bred birds, all the above marks, even to the white edging of the outer tail-feathers, sometimes concur perfectly developed. Moreover, when two birds belonging to two distinct breeds are

crossed, neither of which is blue or has any of the above-specified marks, the mongrel offspring are very apt suddenly to acquire these characters; for instance, I crossed some uniformly white fantails with some uniformly black barbs, and they produced mottled brown and black birds; these I again crossed together, and one grandchild of the pure white fantail and pure black barb was of as beautiful a blue colour, with the white rump, double black wing-bar, and barred with white-edged tail-feathers, as any wild rock-pigeon. We can understand these facts, on the well-known principle of reversion to ancestral characters, if all the domestic breeds have descended from the rock-pigeon. But if we deny this, we must make one of the two following highly improbable suppositions. Either, firstly, that all the several imagined aboriginal stocks were coloured, and marked like the rock-pigeon, although no other existing species is thus coloured and marked, so that in each separate breed there might be a tendency to revert to the very same colours and markings. Or, secondly, that each breed, even the purest, has within a dozen or, at most, within a score of generations, been crossed by the rock pigeon: I say within a dozen or twenty generations, for we know of no fact countenancing the belief that the child ever reverts to some one ancestor, removed by a greater number of generations. In a breed which has been crossed only once with some distinct breed, the tendency to reversion to any character derived from such cross will naturally become less and less, as in each succeeding generation there will be less of the foreign blood; but when there has been no cross within a distinct breed, and there is a tendency in both parents to revert to a character, which has been lost during some former generation, this tendency, for all that we can see to the contrary, may be transmitted undiminished for an indefinite number of generations. These two distinct cases are often confounded in treatises on inheritance."

"Lastly, the hybrids or mongrels from between all the domestic breeds of pigeons are perfectly fertile. I can state this from my own observations, purposely made on the most distinct breeds. Now, it is difficult, perhaps impossible, to bring forward one case of the hybrid offspring of two animals *clearly distinct* being themselves perfectly fertile. Some authors believe that long-continued domestication eliminates this strong tendency to sterility: from the history of the dog I think there is some probability in this hypothesis if applied to species closely related together,

though it is unsupported by a single experiment. But to extend the hypothesis so far as to suppose that species, aboriginally as distinct as carriers, tumblers, pouters, and fantails now are, should yield offspring perfectly fertile, *inter se*, seems to me rash in the extreme."

"From these several reasons, namely, the improbability of man having formerly got seven or eight supposed species of pigeons to breed freely under domestication; these supposed species being quite unknown in a wild state, and their becoming nowhere feral; these species having very abnormal characters in certain respects as compared with all other Columbidæ, though so like in most other respects to the rock-pigeon; the blue colour and various marks occasionally appearing in all the breeds, both when kept pure and when crossed; the mongrel offspring being perfectly fertile;—from these several reasons, taken together, I can feel no doubt that all our domestic breeds have descended from the *Columba livia* with its geographical sub-species."

"In favour of this view, I may add, firstly, that *C. livia*, or the rock-pigeon, has been found capable of domestication in Europe and in India; and that it agrees in habits and in a great number of points of structure with all the domestic breeds. Secondly, although an English carrier or short-faced tumbler differs immensely in certain characters from the rock-pigeon, yet by comparing the several sub-breeds of these breeds, more especially those brought from distant countries, we can make an almost perfect series between the extremes of structure. Thirdly, those characters which are mainly distinctive of each breed, for instance the wattle and length of beak of the carrier, the shortness of that of the tumbler, and the number of tail-feathers in the fantail, are in each breed eminently variable; and the explanation of this fact will be obvious when we come to treat of selection. Fourthly, pigeons have been watched, and tended with the utmost care, and loved by many people. They have been domesticated for thousands of years in several quarters of the world; the earliest known record of pigeons is in the fifth Ægyptian dynasty about 3000 B. C., as was pointed out to me by Professor Lepsius; but Mr. Birch informs me that pigeons are given in a bill of fare in the previous dynasty. In the time of the Romans, as we hear from Pliny, immense prices were given for pigeons; "nay, they are come to this pass, that they can reckon up their pedigree and race." Pigeons were much valued by Akber Khan in India,

about the year 1600; never less than 20,000 pigeons were taken with the court. "The monarchs of Iran and Turan sent him some very rare birds;" and, continues the courtly historian, "His Majesty, by crossing the breeds, which method was never practised before, has improved them astonishingly." About this same period the Dutch were as eager about pigeons as were the old Romans. The paramount importance of these considerations in explaining the immense amount of variation which pigeons have undergone, will be obvious when we treat of Selection. We shall then, also, see how it is that the breeds so often have a somewhat monstrous character. It is also a most favourable circumstance for the production of distinct breeds, that male and female pigeons can be easily mated for life; and thus different breeds can be kept together in the same aviary."

The common rock-pigeon is thus proved to be highly variable in a state of domestication, so much so that naturalists not aware of all the facts, might well be excused for concluding, as some of them have done in the similar instances of the ox, the domestic fowl, and man himself, that the varieties represent several distinct species. To what then do these differences amount? (1) They are mainly in non-essential points, as colour, development of feather, etc., and they do not consequently interfere, to any important extent, with the food and habits of the animal; or if we were to represent the matter from the opposite point of view to that taken by Mr. Darwin, the constitution and instincts of the species being fixed by the law of its creation, it cannot vary beyond these. The author is clearly wrong in stating that any of them could amount to generic distinctions; that is, if genera are to be based on *structural* differences, for of these there is comparatively little, except in the one point of proportion of parts, difference in which is of specific value only, and often occurs in near varieties. (2) Many of the differences are abnormal; that is, they are of the character of monstrosities, and this separates them widely from true specific differences. (3) The varieties are perfectly fertile, which is not the case with hybrids between clearly distinct species. (4) The cross breeds revert to the characters of the rock-pigeon, showing that the specific type still remains uneradicated, or that each variety is, so to speak, a hemitropic form, which, when united with an opposite one, tends to reproduce the original form. It follows from these results, that, however

likely to be mistaken for species, the varieties of the pigeon are really something essentially different from true species, and the same conclusion would hold with any animal that could be selected.

We now come to the causes of variation in a state of domestication; and here, already, in the twenty-ninth page of his volume, we find our author leaving the basis of fact and losing himself in the mazes in which he henceforth continues to wander. He attributes the varieties of domestic animals to "Man's power of accumulative selection; nature gives successive variations; man adds them up in certain directions useful to him." We object to this, as altogether a partial and imperfect statement. It is not nature that gives the variations, but external circumstances; while nature only gives a certain capacity to vary, the extent of which is the point in question. Man places animals in abnormal conditions into which their instincts and natural powers would not permit them of themselves to enter. They vary in consequence of these, sometimes suddenly, sometimes gradually, sometimes from premeditated treatment, sometimes unaccountably, sometimes in directions useful to man, sometimes the reverse. Out of all the diversities thus produced, man no doubt selects what suits him, and keeps it, as far as he can, in the conditions favorable to its permanence and improvement; but such selection is a comparatively small part of the actual cause of the phenomena observed, which result really from unnatural conditions of life compelled by man. Who selected, for example, the niata cattle of South America, the hairless dogs of Chili, the tail-less cats of the Isle of Man, and many other forms?

Selection is no doubt an important cause of the continuation and improvement of varieties, and has also, as our author maintains, been practised from a very remote antiquity in the case of the more valuable domesticated animals. He might have referred to a more ancient case than any of those he has noticed. Laban selected all the speckled cattle from Jacob's flock, understanding very well the principle of selection; but Jacob was better informed than Laban or Mr. Darwin, and not trusting to selection, but knowing the effect of external influences and their special importance in the embryonic state, he set up peeled twigs before the pregnant cattle, and so acting on the embryo through the senses of the mother, produced the variety he desired. The undue prominence given to selection by our author is the main basis on which he subsequently proceeds.

His next step is to establish analogies between variation and specific difference, as observed in nature. Many species are doubtful; that is, naturalists are not quite decided that they may not be varieties. This is true; but such species are the exceptions, and the differences of view have arisen as much from defective observation or reasoning as from any real difficulty. Again, in large genera the species approach each other very nearly. This is inevitable from the nature of the case, and though it may cause difficulties in distinguishing them, it proves nothing as to their not being true species. Species which range widely also are prone to vary, and this also follows from the nature of the case, great range and much variability being really cause and effect, and reacting on each other. Farther, it is stated that species belonging to large genera are more prone to vary than species belonging to small genera. This has not been established as a general principle, nor, if it should be, would it necessarily bear the interpretation put upon it. To reach the facts we must be certain that we are comparing natural genera consisting of species having true affinities of structure, and that all our generic distinctions are based on the same grades of difference. Further, we must make separate lists of the genera small now but large if we take all geological time, as for instance the genus *Lingula*, of genera small in any particular country, but large if the whole world be taken; and lastly, of genera large in some particular region or country. This last is the only case which can fairly test Mr. Darwin's principle, and we must say that in our limited experience there appear to be quite as many exceptions as agreements with the rule. Take, for instance, the genera *Solidago* and *Aster* among American plants, which, though growing together in numerous species, are not remarkably variable. Further, when a generic type has proved suitable to occupy many places in a particular country, it may well be that many of its species will be capable of a wide range, and so variable. For such reasons we hold that the attempt made on the ground of analogies between the species and the variety to break down the distinction between them signally fails.

But if the reader is willing to take this for granted, Mr. Darwin will carry him a step further. He next proceeds to maintain that in nature there is a power of selection similar to that which the breeder exercises—a power of "Natural Selection" not heretofore recognised, and by virtue of which varieties are produced and developed

into species. There is here a huge hiatus in the reasoning of our author. We have already shown that an excessive importance is attributed to artificial or human selection; but with all the exaggeration of its powers, it has proved insufficient to change one species into another. The pigeon, with all its varieties, is still a pigeon, and, according to our author's own conclusive argumentation, a rock-pigeon. It is not a wood-pigeon, or turtle dove, still less a partridge or a rook. But now we are asked to believe that those same natural courses which break down all the breeder's elaborate distinctions so soon as his breeds are allowed to intermix and live in a natural way, are themselves able to take up the work and do still greater marvels in the way of selection. Such a doctrine is self-contradictory, and, we believe wholly incapable of proof; but let us see how this is attempted:

As might have been anticipated, natural selection being either creation or nothing, a new power is evoked as a *primum mobile*. This is the "struggle for existence," a fancied warfare in nature, in which the race is always to the swift and the battle to the strong, and in which the struggle makes the strong stronger. In a previous chapter we have been told very truly that the reason why the wealthy and skilful breeder succeeds in producing marked races is that his animals are cared for and pampered, while the savage and the poor man fail because their animals must struggle for subsistence. Nature it appears takes the opposite way, and improves her breeds by putting them through a course of toil and starvation, a struggle not for happiness or subsistence, but for bare existence. We can understand how this should deteriorate and degrade species, as we know it has done in every case of the kind that we have observed; but how it should elevate or improve is past comprehension. But does nature deserve to be charged with such niggardliness, and with so concealing it that all the world seems to be full of happiness and plenty, except where poor man toils on in his poverty? In looking for the proof of this strange doctrine, we find stated in support of it only a number of isolated and exceptional facts, many of them cases in which man interferes with the equilibrium of nature; and we have to fall back on the general statement that the struggle for existence inevitably follows from the high rate at which organic beings tend to increase but this Malthusian doctrine, though good for a single species viewed by itself, is false for the whole in the aggregate. Vegetable life and the lower forms of animal life support the higher,

and these supporting forms increase far more rapidly than those that subsist on them. So much so, that vast quantities of organic food go to waste, or would do so but for the hordes of scavengers of low organization that seem specially created to gather up the fragments of nature's bounteous feast. Plant life thrives on the exhaustless stores of inorganic food provided for it by the soil and the atmosphere. Plant life supports animal life; but who ever saw the floor of the ocean denuded of its algæ, or the landscape bared of its verdure by the struggle of feeders for existence, except in a rare and exceptional case, as in a flight of locusts? There is always enough and to spare. Again, do the insects fail or become scarce under the ceaseless attacks of the insectivorous birds? Do not *Clios* and *Salpas* and coral polyps abound almost as much as if not preyed on by countless fishes and other animals? The beautiful harmony of nature provides that the feeders shall multiply more slowly than the food, and that the food shall be kept under by the feeders. When any form does locally multiply too far, the checks appear, usually in the form of a diminished reproduction or in the more rapid removal of the infirm, the sickly and the aged. When through the slow operation of physical causes or the introduction of new species, certain forms of life can no longer find the means of subsistence, all the facts we know indicate their disappearance, not their change into new forms. Nay, species verging to extinction or struggling for existence, like the red deer of Scotland, degenerate rather than improve, and must necessarily do so, so long as the laws of organic being remain what they are. In short, the struggle for existence is a myth, and its employment as a means of improvement still more mythical.

Were we bound to argue for such a thesis as that proposed by Mr. Darwin, we should much rather take up our ground on the improvement of the physical conditions of the earth, and maintain that each species finding its means of subsistence and happiness constantly extending, exerted itself for their occupancy, and so developed new powers. This would have the advantage of giving a more agreeable view of nature, and of accounting for elevation; as if nature, like a skilful breeder, were giving constantly better food or pasture, instead of imitating the luckless experimenter who strove to reduce the daily food of the horse to a single straw.

The remarks that we have made on natural selection, and the struggle for existence, afford a key to the whole of Mr. Darwin's argument, which amounts to little else than a wholesale appropria

tion of all the effects of external conditions of existence to these supposed causes of change. We could fill pages with evidence of the entire confusion of ideas which pervades his mind on this point, but one extract must suffice, both as an indication of this confusion, and as a fair example of the argument:

"How much direct effect difference of climate, food, &c., produces on any being is extremely doubtful. My impression is that the effect is extremely small in the case of animals, but perhaps rather more in that of plants. We may, at least, safely conclude that such influences cannot have produced the many striking and complex co-adaptations of structure between one organic being and another, which we see everywhere throughout nature. Some little influence may be attributed to climate, food, &c.: thus, E. Forbes speaks confidently that shells at their southern limit, and when living in shallow water, are more brightly coloured than those of the same species further north or from greater depths. Gould believes that birds of the same species are more brightly coloured under a clear atmosphere, than when living on islands or near the coast. So with insects, Wollaston is convinced that residence near the sea affects their colours. Moquin-Tandon gives a list of plants which when growing near the sea-shore have their leaves in some degree fleshy, though not elsewhere fleshy. Several other such cases could be given."

"The fact of varieties of one species, when they range into the zone of habitation of other species, often acquiring in a very slight degree some of the characters of such species, accords with our view that species of all kinds are only well-marked and permanent varieties. Thus the species of shells which are confined to tropical and shallow seas are generally brighter coloured than those confined to cold and deeper seas. The birds which are confined to continents are according to Mr. Gould, brighter coloured than those of islands. The insect species confined to sea-coasts, as every collector knows, are often brassy or lurid. Plants which live exclusively on the sea-side are very apt to have fleshy leaves. He who believes in the creation of each species, will have to say that this shell, for instance, was created with bright colours for a warm sea; but that this other shell became bright coloured by variation when it ranged into warmer or shallower waters."

"When a variation is of the slightest use to a being, we cannot tell how much of it to attribute to the accumulative action of natural selection, and how much to the conditions of life. Thus,

it is well known to furriers that animals of the same species have thicker and better fur the more severe the climate is under which they have lived; but who can tell how much of this difference may be due to the warmest-clad individuals having been favoured and preserved during many generations, and how much to the direct action of the severe climate? for it would appear that climate has some direct action on the hair of our domestic quadrupeds."

"Instances could be given of the same variety being produced under conditions of life as different as can well be conceived; and, on the other hand, of different varieties being produced from the same species under the same conditions. Such facts show how indirectly the conditions of life must act. Again, innumerable instances are known to every naturalist of species keeping true, or not varying at all, although living under the most opposite climates. Such considerations as these incline me to lay very little weight on the direct action of the conditions of life. Indirectly, as already remarked, they seem to play an important part in affecting the reproductive system, and in thus inducing variability; and natural selection will then accumulate all profitable variations, however slight, until they become plainly developed and appreciable by us."

It would be possible to fill up the remainder of our space with the objections we have to the statements in these few paragraphs. The scepticism as to the effects of food, climate, &c., in producing variation, and the effects attributable to a supposed selecting power which can merely act on such changes when previously induced; the failure to perceive that the adaptation of certain species to certain conditions of life necessarily implies that if other species not so adapted migrate within the influence of the conditions, they must, so far as their natures permit, be influenced by them; that in short such variation vindicates the wisdom of the Creator while showing that the plasticity of species may simulate in a humble way specific distinctness; the feeble attempt to attribute the warm fur of northern varieties to selection, while manifestly unable to deny that climatic influence is the main cause; these are specimens of a style of thought which pervades the whole book, and which leaves the task of a reviewer hopeless, for it would require a book as large as the original to expose the fallacies which appear in every paragraph.

In one respect Mr. Darwin vindicates fully his well-earned

reputation as a scientific naturalist. He fairly and ably states the many objections to his view that must occur to the minds of zoologists, botanists and geologists, and manfully, though unsuccessfully, attempts to cope with them.

Such objections are, the geographical distribution of the creatures supposed in Mr. Darwin's view to be nearly related by descent, the want of the innumerable transitional forms that should exist, the difficulty of accounting for the peculiar instincts of many animals, the sterility of first crosses and hybrids compared with the fertility of crosses of varieties, the want of any trace of unlimited variation in the geological succession of animals.

We shall only refer to the last of these, the geological objection. Geology he admits shews no trace of the "finely graduated organic chain" which in his theory should connect man with the extinct kangaroo-rat-like marsupials of the oolite and trias, and all our existing animals and plants with the perished creatures supposed to be their progenitors. He has but one explanation of this, the "extreme imperfection of the geological records." To illustrate this imperfection, he refers to the immense lapse of time involved in the geological record, to the small number of species known compared with this great lapse of time, to the breaks caused by the absence of fossiliferous deposits at certain periods. All these are fair abatements from the completeness of the geological series, and many of the remarks made on them are very valuable; but they do not mitigate the condemnation of the selection theory pronounced by geology. Breaks in the geological record are usually only local, and if general, might indicate actual destruction and renewal of species. Though it is true that estuary and land deposits have in most cases been preserved only in times of subsidence; this is not true of marine deposits, some of the most perfect of which mark times of elevation. Moreover, in those parts of the geological scale which are the most perfect and unbroken, there is no graduated transition of forms. Take for instance the great Silurian limestones of America, or the plant-bearing beds of the coal formation. In both we find some species perseveringly unchanged through many great deposits, and others suddenly appearing and disappearing, and this in cases where the profusion of specimens and continuity of formations preclude any supposition of much imperfection in the evidence. Nothing is more conclusive on this subject than the last of the fossiliferous deposits, next to the modern period; as, for instance, the Post-Pliocene clays and

sands of Canada. These belong to a period of elevation proceeding gradually from the time of the boulder formation up to the modern era. In these deposits we have more than stxty species of invertebrate animals, all except one or two known to be now living in the Gulf of St. Lawrence. Yet in all this lapse of time not one of the species has, by natural selection or any other cause, varied more than its living relatives now do. Still further, one or two species, as the *Leda truncata* and *Trichotropis arctica*, now found only in the Arctic seas, are quite like their modern representatives in those distant waters. They had plenty of time to vary, in order to suit the new circumstances, but they could not. Further, at the same time when these shells lived in the plains of Canada, Arctic plants, conveyed probably by ice, became settled on the White Mountains, the descendants of which still remain isolated but unchanged. Such facts as these are conclusive, notwithstanding the imperfection of the geological record on other points.

In one point our author endeavors to find support to his views from geological evidence, in the resemblance of successive faunas of the same locality to each other. The extinct tertiary animals of South America, New Zealand and Australia, for example, are like in type to those now inhabiting the same regions. But then we have no connecting links, and hence it seems more probable that successive creations were conformed to the same generic types, because the physical conditions remained unchanged, than that the modern sloths, for example, are degenerate descendants of the *Megatheria*. Farther, it does not seem to have occurred to Mr. Darwin that these resemblances are confined to the southern hemisphere. They do not obtain at all in North America, in Northern Asia, in Europe. In these countries new types have replaced the old, and certain old species, like the musk ox, the megaceros, the beaver, the aurochs, have become locally or wholly extinct, instead of undergoing change. All this has happened no doubt because the modern conditions are too dissimilar from the ancient to permit the continuance of old forms under any variety of them, and thus new forms have been introduced.

In his closing chapters the author endeavours to shew that his theory accounts in a satisfactory manner for the typical likeness of species to each other, for the curious embryological relations of animals, and for the existence of rudimentary organs; but all these things are equally intelligible on the opposite view. If spe-

cies are parts of a plan devised by an intelligent Creator, that plan must appear in their structures. If the plan embraces more general and more specialised contrivances, the latter must, in their earlier stages of growth, simulate the former. All organs, if there is a plan at all, must appear in its different parts in different degrees of relative perfection and complexity, and what we call rudimentary organs are merely the lowest of these degrees; not useless, for in many cases we know their uses, but of less relative importance than in other cases.

We have in the foregoing remarks dwelt chiefly on the points in which we believe the author to be mistaken; but we do not wish to undervalue the work. In many respects it is eminently useful. It shews, in opposition to many views maintained with much vigour on this side of the Atlantic, the great variability of species. It imposes a salutary caution on those naturalists who too readily admit geographical distribution as an evidence of specific distinctness. It illustrates by a vast fund of curious fact the obscure laws of variation and hybridity. All these pearls are not the less valuable to the judicious reader, that the author has seen fit to string them upon a thread of loose and faulty argument, and to employ them to deck the faded form of the transmutation theory of Lamarck.

In conclusion, it is but fair to state in his own words the ultimate deductions of the author, and then the opposite view, as maintained by the greater number of naturalists:—

"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."

We may well ask what is gained by such a result, even if established. The origin of species, as we now have them, it is true is mysterious, but what is gained by reducing them all to one primitive form? That would be an equal mystery, more especially if it included within itself the germs of all the varied developments of animal and plant life. By such a doctrine also we involve ourselves in a host of geological and other difficulties, and so break down the distinction between species and varieties as to deprive our classifications of any real value. On the contrary, if we are content to take species as direct products of a creative power, without troubling ourselves with supposed secondary causes, we may examine, free of any trammelling hypothesis, the law of their succession in time, the guards placed upon their intermixture, the limits set to their variation in each case, the remarkable arrangements for diminishing variations by the natural crossing of varieties, the laws of geographical distribution from centres of origin, and the physical causes of variation, of degeneracy, of extinction.

All these are questions to be investigated apart from any hypothesis of the common origin of different species on the one hand, or of the diverse origin of individuals apparently identical on the other; and we cannot doubt that the results will approach to the following conclusions. (1) That the origin of specific distinctness lies beyond the domain of any natural law known to us. (2) That the variations of the species are the effects of the combined influences of its natural endowments and of external circumstances. (3) That

in nature specific force and causes of variation constitute antagonist powers, acting and reacting on each other, and thus producing an equilibrium which is disturbed only by the artificial contrivance of man. We are quite certain that the belief of naturalists in these great doctrines will eventually be confirmed by Mr. Darwin's book, and that his failure, with all the immense mass of facts at his disposal, to maintain the theory of transmutation, will give an eternal quietus to the Lamarckian hypothesis; though we shall be quite prepared to find that for a time it may gain a wide acceptance with young naturalists, and with those who are willing to adopt any amount of error rather than appear not to be on a level with the latest scientific novelties. For this signal service to science we sincerely thank him, though we are sorry that it has been rendered by a man whose sincerity and honesty of purpose all who know him respect and love, and to whom natural science is under so many eminent obligations.

Since writing the above, we have seen able reviews of Mr. Darwin's work by Prof. Gray and Prof. Huxley. Both naturalists dissent from his ultimate conclusions as not satisfactorily proved, though neither, in our view, insists sufficiently on the fundamental unsoundness of the argument.

J. W. D.

ARTICLE X.—*Abridged Sketch of the life of Mr. David Douglas, Botanist, with a few details of his travels and discoveries.*

The inducement for collecting the few scattered fragments that are to be found in the following pages, is the desire to prolong somewhat, the public remembrance of one who was warmly attached to Natural History, and who also in his own short day, largely contributed by his enterprise and unwearied spirit of research, to swell the list of novelties in some of its principal departments. Cut down in the prime of life, and in the midst of his usefulness, his memory is still fondly cherished by his friends, and his successful exertions in his sphere of labour have procured him among botanists, an undying fame. Had he lived, he would have attained to the highest celebrity as a traveller, for his diligence in investigating, and accuracy in observing, would have tended to elucidate much that is of great interest in the physical geography of the earth.

David Douglas, of humble but respectable parentage, was born at Scoone in Perthshire in the last year of the last century. He received his early education at the parish school of Kinnoul, in the neighbourhood. He was somewhat wayward, and therefore frequently the mark for the master's ire. Trout-fishing and bird-nesting held out temptations too strong for the lively boy, and such occupations often lengthened his road, if they did not entirely prevent his march to school. His love of nature soon displayed itself in the rearing of birds, collecting of plants, and other such amusements. Following up these early intuitions, employment was found for him, first in the nursery ground and then in the gardens of the Earl of Mansfield, at Stowe.

Here his zeal and industry were so conspicuous, that they gained him the esteem and affection of the superintendent. After a seven years apprenticeship in these gardens, where he acquired a thorough knowledge of the practical part of gardening, the friendship of the superintendent Mr. Beatty, procured him a situation under Mr. Alexander Stewart, who had charge of the gardens at Valleyfield, the seat of Sir Robert Preston near Culross. There being at this place a very choice collection of plants, the attractions of the kitchen-garden and of out-door work, soon lost their weight with young Douglas, who now began to study botany, and to attach himself to the care of the exotics, of which Valleyfield could boast a magnificent display. Being very careful of the plants committed to his care, Mr. Stewart showed him much kindness, and allowed him the privilege and advantage of Sir Robert's botanical library. Such an opportunity was not lost by the youthful naturalist. The second year he became foreman to Mr. Stewart, when upon application, he gained admission to the Botanical gardens at Glasgow. This nursery of botanists was still in its infancy, but advancing rapidly to high reputation under the knowledge, skill, and fostering influence of Professor Hooker, since whose time, a succession of able and indefatigable Botanists have well preserved its celebrity. The energetic working qualities of Douglas, and his vivacity of disposition, speedily procured him the esteem and regard of all connected with the gardens; and the valuable friendship of the professor, which he at this time acquired, may be looked upon as the reward of his sterling merits. For the Professor, now Sir W. Jackson Hooker, I have heard him express such sentiments as a son might hold for a revered and beloved parent. First a diligent attendant at the botanical lectures,