

LONDON, SATURDAY, DECEMBER 24, 1859.

REVIEWS.

*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., F.R.S., F.G.S., F.L.S., &c., Author of "Journal of Researches during H.M.S. *Beagle's* Voyage Round the World." (Murray.)

[FIRST NOTICE.]

In this work Mr. Darwin has unquestionably made one of the most important contributions to zoological theory which for a long time has been given to the world. We must go back to the publication of "The Vestiges of Creation," some years ago, in order to find anything approaching to a parallel to the sensation which it is sure to produce in the minds both of the general and of the scientific public. Not that, in making this remark, we mean in any way to imply that an actual comparison can fairly be instituted between "The Origin of Species" and "The Vestiges of Creation." The latter, the work of an anonymous author, was far more remarkable for the boldness of its speculations than for the extent or accuracy of the researches on which its theory was based; and, as a natural consequence, its success, at first brilliant and rapid enough to satisfy the most eager aspirant for literary fame, has ultimately proved to be but of ephemeral duration. The former, on the contrary, is the avowed work of one of the first naturalists of the day; and is distinguished not more for the striking originality of its views than for the evidence which it affords of patient and accurate observation of facts, and for the singular fairness and candour with which the most weighty objections to its theory are stated and examined. Mr. Darwin's book is, in fact, the first-fruits of the labour of more than twenty years. Ever since 1837, on the termination of the expedition round the world to which he was attached in the capacity of naturalist, he has been engaged in collecting and arranging materials for this work; and it was not until after five years of continued observation and experiment that he allowed himself to indulge in any speculations on the subject, or drew up even the briefest sketch of the conclusions towards which he found himself being gradually led. The views contained in a work which has been undertaken and carried out by so distinguished an investigator in so accurate and impartial a manner, are clearly entitled to be received with the greatest respect, and to be examined in the same spirit of fairness and candour by which, both in their formation and enunciation, their author has throughout been guided and controlled.

The different views which have hitherto been entertained as to the origin of species may, broadly, be reduced to two. According to one of them, which has as yet been adopted by an immense majority of naturalists, species are absolutely immutable, and depend for their existence on the possession of some distinct and permanent specific character, the precise nature of which has not, however, been satisfactorily ascertained. Being immutable, they clearly cannot have been derived from each other or from one common parent; so that each distinct species must have been originated by a distinct act of creative power. This act of creation is generally supposed not to have been limited

to the production of only one pair of each species, but to have produced a considerable number of the same species simultaneously in different regions; the names of *specific centres* being given to the districts in which creative power has thus been manifested. The opposite view, advocated by the author of "Vestiges of Creation," asserts on the contrary the complete mutability of species, and maintains that all species have originally descended from a common progenitor. The causes by which the necessary variation has been effected are not very distinctly stated, but are referred principally to the changes in the external conditions of life—such as climate, supply of food, &c.—to which the race of organised beings has been in the course of ages exposed. Mr. Darwin's theory approaches far more nearly to the latter than to the former of these views. He holds the same fundamental opinion of the complete mutability of species, and considers that they have all been derived by insensible modifications from one common stock; but he differs entirely from the author of the "Vestiges" in his view of the agency by which the necessary amount of variation has gradually been produced. According to him, species have been originated principally by *natural selection*; the meaning of which term we will now attempt briefly to explain.

The differences which exist between different varieties of domestic or cultivated animals or plants are so strikingly analogous to those by which natural species are distinguished from each other, that an examination of the causes by which the former are produced can scarcely fail to throw some light upon the origin of the latter. The primary cause of variability appears to be the action of any change in physical conditions upon the reproductive system: so that this system, if not rendered impotent, fails to produce offspring exactly like the parent-form. The laws by which variation is governed are little known, and probably very complicated. A variation, when once produced, is capable not only of being inherited, but also of being increased in subsequent generations to an almost unlimited extent. Man does not actually produce variability: but he causes it indirectly, by unintentionally exposing organic beings to changed conditions of life. When the variation has once been produced by nature, man can and does, by selecting for breeding those individuals in which it is most distinctly manifested, accumulate it to any extent and in any desired direction. This he may do, either methodically, with a view of altering the breed, or unconsciously, by merely preserving the individuals which are most useful to him at the time. It is by this process of selection that the different varieties of pigeons have been produced from one common stock—varieties which differ quite as much from each other and from their common progenitor (the rock pigeon) as many natural species do from one another. Thus, too, the breeder effects great final variation and improvement in his breeds of cattle, by the continual selection in each successive generation of variations so slight as to be quite imperceptible to the uneducated eye. "That many of the breeds produced by man have, to a great extent, the character of natural species, is shown by the inextricable doubts whether many of them are varieties or aboriginal species."

Now, since this principle of selection has acted so efficiently under domestication, why should it not also act under nature? If

human selection can produce such great effects, why should natural selection be regarded as impossible? There is abundant reason why such selection should be made by Nature. The rate at which organic beings increase and multiply on the earth is so enormously high that many more individuals are born than can by any possibility survive. This is a proposition, the truth of which no one will deny; but, in order to bring it home more forcibly to the mind, we may cite the minimum rate of increase calculated by Mr. Darwin in the case of the slowest breeder of all known animals, the elephant. Supposing it to breed at thirty years old, and to go on breeding to ninety, bringing forth in that interval three pair of young; at the end of the fifth century there would be alive fifteen million elephants, descended from the first pair. The natural causes by which the increase of organic beings is liable to be checked are many and various. The insufficiency of food for all that are born is one obvious cause; and another may be found in sudden changes of climate; but none is more important or less considered than the mutual checks arising from the complex relations which different organic beings bear one to another. Mr. Darwin cites an instance of this latter class of checks which is curious and interesting to no common degree. There is reason to believe that humble-bees are indispensable for the fertilisation of the red clover and the heart's-ease, since other bees certainly do not visit these plants; so that, if humble-bees were to become extinct in England, the red clover and heart's-ease would probably wholly disappear. The number of humble-bees in a district depends in great measure upon that of field-mice, which destroy their combs and nests; and the number of field-mice is regulated in turn by the supply of cats. So that it is quite credible that the presence of a feline animal in large numbers might determine, in any district, the frequency of certain flowers. From the high rate of increase of organic beings there necessarily follows a constant struggle for existence, in which some species or varieties increase in number, while others decrease, and finally become extinct. This struggle is most severe between individuals of the same species, since they come in all respects into the closest competition with each other; next, between varieties of the same species; and next between species of the same genus. The slightest advantage in one being, at any age or during any season, over those with which it is brought into competition, or the slightest better adaptation to the surrounding physical circumstances, will enable it to gain the victory in the struggle, and to survive. Now, the great physical changes to which geology bears witness must have produced as many individual variations in organic beings under Nature as have been caused by change of conditions under domestication. Any variation which was in any way useful to an individual in the great battle of life would be inherited by its offspring, and increased in successive generations, just as variations useful to man are perpetuated and increased by human selection; and any variation, in the least degree injurious, would, by the natural course of competition, be rigorously destroyed. It is this preservation of favourable, and rejection of unfavourable, variations which Mr. Darwin calls *natural selection*. Variations neither useful nor injurious would not be affected by natural selection, and would be left as a fluctuating element.

If man's imperfect selection can do so much, we may fairly expect Nature's selection to effect much more: for, while man can act only on external and visible characters, Nature can act "on every internal organ, on every shade of constitutional difference, on the whole machinery of life."

Besides this natural selection, strictly so called, there is another and less rigorous principle of selection at work, which Mr. Darwin calls *sexual selection*. "This depends, not on a struggle for existence, but on a struggle between the males for possession of the females; and the result is not death to the unsuccessful competitor, but few or no offspring." Generally, the most vigorous males will leave the most offspring; but victory often depends, not on general vigour, but on the possession of some weapon confined to the male sex, or, in the case of some birds, on the possession of some peculiar charm, either of plumage or of voice. Any slight variation in any of these directions would, in successive generations, be gradually increased; and it is to this principle of sexual selection that the great difference between the males and the females of several species, is, in all probability, mainly owing.

According to Mr. Darwin, therefore, there is no essential distinction between individual differences, varieties, and species: the distinction between them being one of degree rather than of kind. They are, in fact, conventional terms, applied, for convenience' sake, to denote successively increasing degrees of variation: and, in his view, a well-marked variety may be justly called an incipient species. This view enables us to understand many facts which, on the supposition of a distinct creation of each species, are not easily to be explained. We can see, for instance, why it is that no line of demarcation can be drawn between species which are supposed to have been produced by distinct acts of creation, and varieties which are acknowledged to have been produced by secondary laws. We can understand why the species of the larger genera in a country should generally present more varieties than those of the smaller genera: for, where the manufactory of species has been active, we might generally expect, considering the extreme slowness of the process, to find it still in action. The species of the larger genera resemble varieties more closely than those of the smaller genera: for they almost invariably differ from each other by a smaller amount of difference, and have generally, like varieties, a comparatively restricted range.

Not only can the origin of species be accounted for on the principle of natural selection, but those wider differences which distinguish genera and other higher divisions of the organic kingdom can be traced to the same cause. This depends upon the tendency of continued selection to produce gradually increasing divergence of character. We cannot express Mr. Darwin's views on this most important branch of his subject in more terse and comprehensive words than those which he has himself employed:

"As each species tends by its geometrical ratio of reproduction to increase inordinately in number; and as the modified descendants of each species will be enabled to increase by so much the more as they become more diversified in habits and structure, so as to be enabled to seize on many and widely different places in the economy of nature, there will be a constant tendency in natural selection to preserve the most divergent

offspring of any one species. Hence, during a long-continued course of modification, the slight differences, characteristic of varieties of the same species, tend to be augmented into the greater differences characteristic of species of the same genus. New and improved varieties will inevitably supplant and exterminate the older, less improved, and intermediate varieties; and thus species are rendered to a large extent defined and distinct objects. Dominant species belonging to the larger groups tend to give birth to new and dominant forms; so that each large group tends to become still larger, and at the same time more divergent in character. But as all groups cannot thus succeed in increasing in size, for the world would not hold them, the more dominant groups beat the less dominant. This tendency in the large groups to go on increasing in size and diverging in character, together with the almost inevitable contingency of much extinction, explains the arrangement of all the forms of life, in groups subordinate to groups, all within a few great classes, which we now see everywhere around us, and which has prevailed throughout all time. This grand fact of the grouping of all organic beings seems to me utterly inexplicable on the theory of creation."

Of the laws by which variation is governed, we know, as we have already said, very little. But, as far as we can see, the laws which have produced the lesser differences between varieties of the same species are identical with those which have produced the greater differences between species of the same genus. Something, though less than is generally supposed, is owing to the direct action of climate and other physical conditions: more, perhaps, to the effect of habit and of use in strengthening, or of disuse in weakening, various parts. More still is due to the correlation of growth, *i. e.*, to that strange bond by which the whole organisation is so tied together that, when slight variations in one part are accumulated by natural selection, other parts are gradually modified. Some of these cases of correlation are very curious, and quite inexplicable in the present state of our knowledge; as, for instance, the fact that blue-eyed cats are always deaf. Many of the observed facts connected with variation are more readily explained on the theory of natural selection than on that of distinct creation. One of these is the tendency which is exhibited both by varieties and species to revert occasionally to long-lost characters. How, for instance, can we explain the fact that striped specimens of the horse genus are occasionally produced, but on the supposition that all the species of this genus descended originally from a striped ancestor? Again, the specific characters in which the species of a genus differ are found to be more variable than the generic characters in which they agree: and when any part is developed to an extraordinary degree in only one species of a genus, that part is especially liable to variation. Both these facts admit of explanation, on the theory of natural selection: since those parts which have undergone most variation since the several species descended from a common progenitor may be expected to go on varying until they assume a constant character. When, however, they have been inherited for a sufficiently long period, they may be expected to assume a constant character; they become generic, or common to all the species of the genus, and are no longer so liable to subsequent modification.

Having thus given a brief sketch of Mr. Darwin's theory of natural selection, we now come to the objections which may reasonably be urged against it. The first of these is the very obvious one that, if all species

have descended from other species by insensibly fine gradations, we ought to be surrounded by innumerable transitional forms; whereas, in fact, all existing species are perfectly distinct from one another. To this Mr. Darwin replies by urging that we ought not, except in very rare cases, to expect to find forms directly intermediate between existing species, but only between each and some long extinct and supplanted form. Further, we must remember that areas which are now continuous may, in former geological periods, have been broken up into separate islands; and that each island may have become peopled with distinct species before the isolated portions were united into one continent. And even in areas whose continuity has never been broken, the intermediate links between two species will have been confined to a comparatively narrow space, and so, being fewer in number, will have gradually been exterminated by the more numerous species which they originally connected. Finally, the process of modification is so slow that we ought not to expect to find, in any one region and at any one time, many transitional forms. To the possible and very grave objection to this last argument, that we ought to find them in the fossil remains of former geological periods, we shall have occasion presently to recur.

The second objection is founded on the difficulty of supposing that so complex an organ as the eye could possibly have been perfected by natural selection. But Mr. Darwin shows that in some groups of organised beings we can trace considerable gradations in this very organ; and concludes that it is within the bounds of possibility that the perfect eye may have been gradually formed by this means. Again, it may be asked, if natural selection acts only on such variations as are profitable to the individual, how can we account for the origin of certain parts which seem to be of no importance whatever? To this Mr. Darwin replies that we are as yet much too ignorant of the whole economy of any one organic being to decide absolutely what parts are important and what are not; and further, that parts which are now useless to the species may, at some earlier period of its existence, have been of great use, and so have been matured by natural selection. In connection with this branch of his subject, Mr. Darwin makes the interesting observation that natural selection does not necessarily produce absolute perfection. It acts in each country chiefly through the competition of the inhabitants of that country; and so produces perfection, or strength for the battle of life, only according to the standard of that country. Hence, when the inhabitants of a more thickly peopled district, in which the competition is more severe, and the standard of perfection consequently higher, are introduced into a less numerously inhabited region, they will gradually tend by the process of natural selection to exterminate the original inhabitants.

The third objection is that we can hardly suppose that instincts can have been produced and perfected by natural selection. The chapter in which this objection is discussed will be, to the general reader, the most interesting in the whole book. Mr. Darwin urges that instincts, if (as they doubtless are) profitable to the race, may well have been perfected by natural selection. He selects three cases of instinct for detailed examination; that which prompts the cuckoo to lay her eggs in another bird's nest; the

slave-making instinct of certain ants; and the comb-making instinct of hive-bees. The probable reason for which the cuckoo deposits her eggs in other bird's nests is that she produces them at intervals of two or three days, and so, if she hatched them herself, she would have eggs and young birds of various ages all together in her nest—a state of things which would certainly be injurious to the well-being of the brood. The habit of getting their eggs hatched vicariously is, therefore, useful to the cuckoo race, and so may have been acted on by natural selection. With regard to ants and bees, Mr. Darwin shows that there are different gradations of the instincts to which he refers, they being possessed by different species in different degrees. There are ants which are only partially dependent upon the services of slaves; and there is a species of bee (the *Melipona*), intermediate in structure between the humble-bee and the hive-bee, which constructs its comb on a plan intermediate in ingenuity between the irregular cell of the former, and the marvellously accurate comb of the latter, insect. A still greater difficulty than any of these is the fact that distinct castes of working ants are sometimes found in one nest, all sterile, so that they cannot directly transmit their peculiarities, and differing in structure not only from their fertile parents, but even from each other. The sterility of these ants is a small difficulty compared with that of their difference of structure from the fertile members of the community. This, however, Mr. Darwin explains on the idea that selection may be applied to the family as well as to the individual, just as a breed of cattle always yielding oxen with unusually long horns, might probably be produced by carefully watching which individual bulls and cows, when matched, produced oxen with the longest horns. But the climax of the difficulty lies in these sterile ants differing in structure from each other. Mr. Darwin shows that in some kinds of ants different degrees of this difference exist; and he believes that in those cases in which the difference is now strongly marked, "a graduated series was first formed, and then the extreme forms, from being most useful to the community, were gradually produced in greater and greater numbers by the natural selection of their parents, until finally none of an intermediate structure were produced."

The fourth objection is that hybrids, or the offspring of two distinct species, are always sterile, while mongrels, the offspring of two varieties, are always fertile. In reply to this, Mr. Darwin maintains that the rule is far from being so universal as is generally supposed. Some species are fertile when intercrossed, and some varieties are sterile under the same conditions. Nor must it be forgotten that naturalists are prone to argue in a circle, and, whenever they find that two beings differing in structure breed freely together, to set them down as belonging, *ipso facto*, not to species, but to varieties. Moreover, those varieties which have been experimented on have generally been produced under domestication, and as domestication tends to remove sterility, we ought not to expect it to produce sterility. Mr. Darwin brings forward other considerations, from which he concludes that "this sterility is no more a special endowment than is the incapacity of two trees to be grafted together; but that it is incidental on constitutional differences in the reproductive systems of the intercrossed species. We see the truth

of this conclusion in the vast difference in the results when the same two species are crossed reciprocally; that is, when one species is first used as the father, and then as the mother."

*The Hellenics of Walter Savage Landor, comprising Heroic Idyls, &c.* New Edition, enlarged. (Edinburgh: James Nichol.)

HEROIC literature is out of date. The great and noble teaching of classic life is pronounced incompetent by an age which has banished beauty for utility, and has set up its gods among the wheels and oil-cans of a manufactory. Poetry, once so powerful as an influence over the mind and conduct of men, has now become mere rhymed biography, where no attempt is made to idealise or to elevate, and where the forms presented are in all the poor unloveliness of the barest realism. The chiton is exchanged for the modern paletot, and the golden tectix in the hair is debased to mock pearls and muslin flowers. As for the poet, no one now regards him as a teacher second only to the priest; nay, as priest and prophet himself, to whom is given the utterance of truths hidden from the shallower world, and whose thoughts are among the noblest heritages of his fellow-men. Everything is modernised to vulgarity and bad taste, and the poetic world is peopled with the respectable conventionalities who throng our drawing-rooms, and take all the loveliness out of our inner life. When we meet with one who holds himself apart from all this debasement, one, who, like Mr. Landor, is able to bring before us the power of Grecian poetry as it informed the lives of Grecian men and women; when we can escape from the gaslight of the theatre and the lecture-room, and stand beneath the sunshine in the court of the Athenian temple, or wander with the master by the banks of the silver Cephisos, then we are better able to measure the immense distance which lies between the present and the past, and can fathom with more precision the depths to which modern poetry has sunk.

Mr. Landor is the one sole classic poet of our day, and time has given him no successor. He is the only Saxon who understands the Grecian life as a fact, not merely as an abstract study; the only one who has made it his own, who has talked with *Ternissa* in the *Gyneconitis* and among the vineyards out beyond the city, who has drunk the amber-coloured Chian wine with the symposiarch, and held the basket while the maiden laid down her hair before the altar of *Artemis* in happy waiting for the bridal morrow, and heard the gods, when they sang love-songs to the nymphs through the woods and thickets; he is the only Saxon who has made himself a Greek, more Greek than the purest autochthone of them all. Who can ever forget the wonderful delicacy, tenderness, and beauty of his "Pericles and *Aspasia*?" and who, that has once read them, can turn from his majestic poems, where every line is like a piece of sculpture, as pure and as complete? Never in Landor do you find a word too much, never are dundant ornament, nor an image misfitted to its place. Every work is perfect in itself; and though for the most part his writings are eminently suggestive, they are never unfinished, nor do they leave the impression of haste or imperfection. Quick, but laborious, he preserves unimpaired the heat and life of the first warm sketch, while adding the