REVIEWS.

THE ORIGIN OF SPECIES.*

TO give anything like an adequate analysis of Mr. Darwin's treatise would require a space far greater than that at our disposal. The volume itself is so extensive, the matter it contains is so compressed, and the arguments are so condensed, that nothing short of the book itself could lay the facts in favour of the doctrine of Natural Selection fairly before the public. The present edition is the fourth which has been issued since 1859; and it is not merely a reprint of the one which preceded it, but contains numerous additions and corrections.

Whatever be the accuracy of the theory which Mr. Darwin has so ably promulgated, it is surprising how many distinguished men of science in all parts of the world have given it their support and countenance. In this country, nearly all the naturalists of repute have admitted the force of Mr. Darwin's opinions; and though few of them are prepared to swear to the truth of the new doctrine, all are ready to admit that the hypothesis of Natural Selection has far more evidence in its favour than any other upon the same subject that has yet been published, and that, furthermore, it is in no way obnoxious to the facts of revelation. Among the more formidable opponents to Mr. Darwin's opinions is Professor Owen; at least, we may say *was*, for we are at present in considerable difficulty as to the formation of an idea concerning Professor Owen's views. And yet it seems as if the superintendent of the British Museum inclines towards the Darwinian theory, though he does not feel that he ought to adopt it. It was only through a recent letter of Professor Owen that this mental condition displayed itself. In May last an important notion of Professor Owen's treatise on Comparative Anatomy appeared in the pages of the *London Review*, in which the writer criticised with some severity, but with much justice, Professor Owen's comments on the theory of Natural Selection. To this review Professor Owen replied in a long and able letter, in which, among other statements, he remarked that, "No naturalist can dissent from the truth of your perception of the essential identity of the passage cited with the basis of that [the so-called Darwinian] theory, the power, viz., of species to accommodate themselves or bow to the influences of surrounding circumstances." This was quite sufficient to show that Professor Owen desired to be considered the author, or at least the suggestor, of the theory

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* "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. Fourth edition. London: Murray. 1866.

of Natural Selection; but a passage further on in the same letter places the matter beyond all doubt; in it Professor Owen speaks of himself as "the author of the same theory (Darwinian) at the earlier date of 1850." Clearly, whatever be Professor Owen's opinion as to the expediency of admitting the new theory, he at all events desires it to be thought that he anticipated Mr. Darwin in suggesting the basis of the Darwinian doctrine. Still it is tolerably clear, as Mr. Darwin has shown, that at the very time when Professor Owen alleges that he first suggested the essential principle of the theory of Natural Selection, he really denied that principle in the most unequivocal manner. The Professor states that he first gave the scientific world the idea in a paper read before the Zoological Society in 1850; but the following quotation from this memoir proves that Professor Owen at the time he put the theory forward (?) failed to understand its very essence. In this paper he said, "We have not a particle of evidence that any species of bird or beast that lived during the pliocene period has had its characters modified in any respect by the influence of time or of change of external circumstances."

It may be gathered, therefore, from the foregoing passage that the most formidable if not the only serious opponent of the Darwinian theory now wavers between the old and the new hypotheses. This circumstance seems to us of importance, because it shows that nearly all those who are capable of forming an opinion upon the subject side with Mr. Darwin.

As to the argument in support of the Darwinian hypothesis, there is little to be said that has not already in various forms been laid before our readers. The great principles on which the doctrine is based are, the tendency of what are called species to vary, and the tendency of external conditions to destroy all those individuals which have not sufficient natural protection. Thus, let us say that in any litter of animals there are certain individuals provided by the law of variation with appendages, offensive or defensive, which adapt them to the climate in which they live, or serve to give them more protection from the attacks of animals which prey on them, than is afforded to their fellows; it is clear that those individuals will in the ordinary struggle for existence, which every organism must go through, have a greater chance of protection, and hence of perpetuation, than their brethren. Thus, the stronger individuals—or, in other words, those best adapted to the conditions under which all are situated—live; and so with their successors: those of them possessing the parental characters of adaptation in the highest degree will crush their fellows to the wall and survive them; and thus an insignificant anatomical feature may become in ages a very important one, and species having different characters from those of the fortunate race become swept away or destroyed. The reader, however, will naturally raise this objection, Why do we not find intermediate forms? This is certainly a very difficult question to reply to, but still it can in part be answered. It may, for example, be urged that Geology affords us to some extent a series of connecting links of great value; and more than this cannot be expected, for every geologist must admit that never-ceasing denudation has annihilated the Geologic Record. Again: the period of time required for the transition from one specific form to another is so great as to render it quite intelligible why the connecting links exhibit themselves

as mere varieties. But if it be thought that at least all the connecting links between any series of forms ought to be present, if not in the fossil at least in the living state, it should be remembered that the very process of natural selection prevents this, each succeeding variety crushing out that which preceded it, because in this struggle for life it has the greater number of advantages. Two elements, however, in the argument are well sustained in the following passages. The first relates to the certainty of the struggle for existence :—

"There is no exception to the rule that every organic being naturally increases at so high a rate, that if not destroyed, the earth would soon be covered by the progeny of a single pair. Even slow-breeding man has doubled in twenty-five years. At this rate, in a few thousand years there would literally not be standing-room for his progeny. Linnæus has calculated that if an annual plant produced only two seeds, and there is no plant nearly so unproductive as this, and these seedlings next year produced two, and so on, then in twenty years there would be a million. The elephant is reckoned the slowest breeder of all known animals, and I have taken some pains to estimate its probable minimum rate of natural increase: it will be under the mark to assume that it begins breeding when thirty years old, and goes on breeding till ninety years old, bringing forth three pair of young in this interval; if this be so, at the end of the fifth century there would be alive fifteen million elephants, descended from the first pair."

The second passage which we quote from Mr. Darwin, shows in a popular manner, which must appeal to the reason of every ordinarily intelligent person, what an enormous length of time is required in order to produce even a moderate degree of variation, and bears forcibly upon the question which the opponents of Natural Selection so often put, "Why do we not find intermediate forms?"

"No one would expect to raise a first-rate melting pear from the seed of the wild pear, though he might succeed from a poor seedling growing wild, if it had come from a garden stock. The pear, though cultivated in classical times, appears, from Pliny's description, to have been a fruit of very inferior quality. I have seen great surprise expressed in horticultural works at the wonderful skill of gardeners in having produced such splendid results from such poor materials; but the art has been simple, and, as far as the final result is concerned, has been followed almost unconsciously. It has consisted in always cultivating the best known variety, saving its seeds, and when a slightly better variety has chanced to appear selecting it, and so onwards. But the gardeners of the classical period, who cultivated the best pear they could procure, never thought what splendid fruit we should eat; though we owe our excellent fruit in some small degree to their having naturally chosen and preserved the best varieties they could anywhere find.

"A large amount of change in our cultivated plants, thus slowly and unconsciously accumulated, explains, as I believe, the well-known fact, that in a vast number of cases we cannot recognise, and therefore do not know, the wild parent stocks of the plants which have been longest cultivated in our flower and kitchen gardens."

The phenomena which have been grouped together under the term *Instinct* have been a powerful weapon in the hands of those who combat the Darwinian doctrine. It is interesting, therefore, to observe how the author deals with this part of the subject. In trying to account for the instincts of animals, Mr. Darwin takes two courses: first he endeavours to show how, by the law of natural selection, what is called instinct is little more than *habit*,

the facts of electricity and magnetism, and of the theories which have been advanced concerning them. It is quite refreshing to go over its pages after putting down English translations of French works on the subject, and other works too evidently, though not admittedly, borrowed from our continental neighbours. For in its pages we find accounts of the researches and speculations of our own philosophers, and proper importance given to their labours. Not that there is any confessed or apparent effort of the author in this direction, but merely that it is a genuine compilation by a man versed in the literature of his subject. We have often felt pained to see English students with textbooks in their hands which leave the vast stores of philosophical knowledge contributed by their countrymen to the general stock unnoticed, and to know that there was no truly English textbook sufficiently comprehensive to offer in place of them.

The work is arranged in ten parts, one of which, filling a quarter of the volume, is devoted to the electric telegraph. The chapter in the first part, on atmospheric electricity, will be found very interesting. In it and the chapter on marine telegraphy, Professor William Thomson's beautiful electrometers are described, viz. the divided ring electrometer, the common house electrometer, and the portable electrometer. One important use of the first and last of these is the testing the insulating power of the insulating coat of short lengths of marine telegraph cable. This testing consists in estimating the rate at which the tension of a given charge of electricity communicated to the wire diminishes. We shall not attempt to describe these electrometers, but content ourselves by stating that the indicating needle is kept in metallic communication with the inside of a charged Leyden jar, by which its attraction and repulsion for the two manifestations of electricity in bodies is rendered much more sensitive and much more certain under the slight leakage of electricity which always takes place; that the needle oscillates over two half rings of brass (the divided ring), one in connection with the earth, and the other with the charged cable or other body to be tested; and lastly, that for continuous observation of the electric tension of the atmosphere, the motions of the needle are recorded by the photographic action of the light of a lamp reflected by a mirror connected with the needle, upon a cylinder covered with photographic paper and rotated by clockwork.

Dr. Noad gives us full accounts of even the most recent additions to our knowledge of the subject of which he is treating. His account of the telegraph is exceedingly interesting. The descriptions of the many instruments he has to notice are usually very clearly drawn out, and a comprehension of the text is materially simplified by the introduction of numerous woodcuts.

The enunciations of fundamental principles, and the definitions of terms, are, as a rule, usually unsatisfactory in a scientific point of view. Even these, however, are generally compiled from the writings of others, as stated by Dr. Noad himself. But the compiling here, as elsewhere, is a remarkable proof of the comprehensive and philosophical way in which the author handles his subject. And we venture to say that seldom has a scientific writer been more happy in throwing into a treatise on a given subject the most important of the investigations and the most correct of the views of the workers at it. Every student of physical science will undoubtedly be glad to possess it.
