

SOME NEW BOOKS.

DARWIN AND AFTER DARWIN. An Exposition of the Darwinian Theory and a Discussion of Post-Darwinian Questions. By George John Romanes, M.A., LL.D., F.R.S. I.—The Darwinian Theory. 8vo. Pp. 460. London: Longmans, Green & Co., 1892.

THE undertaking originally planned by Mr. Romanes was sufficiently extensive. It was nothing less than a complete survey of the doctrine of organic evolution from its beginning in the earliest recorded times down to the present day. He intended to elaborate and expand the material of the course of lectures delivered by him in the Royal Institution in the years 1888 to 1890 into a systematic treatise in three separate volumes. The first part, dealing with pre-Darwinian evolution, is indefinitely postponed, wherefore the title "Darwin and after Darwin" has been substituted for "Before and after Darwin," the title of the series of lectures. The second part is contained in the volume before us, and is confined to the Darwinian theory, while the third part will follow soon under the sub-title Post-Darwinian Questions.

The author, in his preface, proceeds to tell us that the present volume is thus intended to be merely a systematic exposition of what may be termed the Darwinism of Darwin and that, as on this account it is likely to prove of more service to general readers than to professed naturalists, he has been careful to avoid assuming even the most elementary knowledge of Natural Science on the part of those to whom the exposition is addressed. One would suppose that the Darwinism of Darwin meant Darwin's own argument and his own illustrations, and would prepare to judge the book according to the soundness of the exposition and the force and lucidity with which it appeals to the average intelligence of those who have been unable to study, or unable to understand Darwin's own writings. But on reading the book itself we find that though it may be said to expound the Darwinism of Mr. Romanes, there is much in it which is not derived from Darwin, while much that is most characteristic of Darwin is only conspicuous by its absence.

In fact, in the introduction a different description is given of the purpose and character of the book. The author here states that he wishes to present the whole theory of organic evolution as he believes that it will eventually stand; that his endeavour is to exhibit the general structure of the theory in what he takes to be its strictly logical form, rather than to encumber any of its parts by a lengthy citation of facts. The present volume is concerned with the theory from the appearance of the *Origin of Species* in 1859 to the death of its author in 1882. It is to be a condensed and critical statement of the main evidences and the main objections which have thus far been published with reference to the distinctively Darwinian theory, the chief novelty being the pictorial illustration of the facts on which the arguments are based.

The book, however, does not correspond to this description much more exactly than to the other. Section I., which is more than half the volume, is devoted to what the author calls "the main evidences of organic evolution considered as a fact." The theory of organic evolution is not the distinctively Darwinian theory.

The view expressed at the commencement of the "Origin" is that, however cogent the evidence that organic forms have been evolved by descent, the demonstration of that truth would be unsatisfactory without an explanation of the manner in which adaptations and perfection of structure had been acquired. Accordingly, nowhere throughout the "Origin of Species" is the evidence for the occurrence of evolution considered apart from the evidence for Natural Selection; and the same thing is true in Darwin's other books. There were evolutionists before Darwin who knew nothing of Natural Selection, and many of his adherents and disciples have shown more interest in the course and the details of evolution than in its causes. The most prominent of these was Haeckel, and the first section of Mr. Romanes' book may with greater truth be described as Haeckelism than as Darwinism. The distinction between the occurrence of evolution and its explanation, is, of course, a most important one, but no one has pointed out more clearly and emphatically than Haeckel that Darwin's title to glory rests on his contributions to the latter, and not on his discovery or establishment of the former. It is astonishing that Mr. Romanes should have drawn so largely from Haeckel's writings, and in particular from his "Schöpfungsgeschichte," and yet have ignored the truth of the following paragraph which occurs in that work:—"Darwin's merit is over-estimated when he is regarded as the founder of the Theory of Descent, or of the whole of the Theory of Development. We have seen from the historical sketch in this and the preceding chapters, that the Theory of Development, as such, is not new; all philosophers who have refused to be led captive by the blind dogma of supernatural creation have been compelled to assume a natural development. But the Theory of Descent, constituting the specially biological part of the universal Theory of Development, had already been so clearly expressed by Lamarck, and carried out so fully by him to its most important consequences, that we must honour him as the real founder of it. Hence it is only the Theory of Selection, and not that of Descent, which may be called Darwinism."

In expounding the evidence on which the Theory of Descent is based, Mr. Romanes, like Haeckel, also endeavours to disprove the theory of Special Creation. This was natural enough in Haeckel's work, which included a survey of the history of the subject; but Mr. Romanes makes no attempt at historical treatment. He contrasts the logical consequences of the two theories with one another, and with the facts of organic nature; but it is doubtful whether the proof of the evolution theory is in any degree made logically stronger in this way. My own opinion is that it is not. As the creation theory has no strictly logical basis, so it has no strictly logical consequences. Let us take, for instance, one example of Mr. Romanes' method—his discussion of the controversy between Mivart and Darwin concerning the eye of the octopus. He says, when it is proved that the eye of the cephalopod is of quite a different plan of structure from that of the vertebrate, the special creationist can only reply that it may have pleased the Deity to form a certain number of ideal types and never to allow the structures occurring in one type to appear in any of the others. He argues, then, that in that case we should

expect the same typical structures to be always present within the limits of the same type; and, as this is not the case, the hind limbs being absent, for instance, in the whales, the assumption of the creationist must be abandoned. But this is obviously a *non sequitur*. It would be equally true to say that the absence of hind limbs in the whale proves that the animal does not belong to the vertebrate phylum.

Even if we consider the facts of embryology, which are the most striking evidence of the truth of evolution, it is not possible to show that they are absolutely incompatible with the creation doctrine. The creationist may say, if he pleases, that when man was created it was ordained that he should pass through fish-like stages in his embryological development, so that the ideal unity of the vertebrate phylum might be more perfectly maintained. It is impossible to disprove such an assumption. The logical reply to the creation hypothesis is that it assumes a multitude of miraculous occurrences for which there is absolutely no room in Nature, so far as we know it by human observation and reasoning; while at the same time the hypothesis as upheld by naturalists in Darwin's time, including a succession of creative epochs, could lay no claim to support from supernatural revelation.

Mr. Romanes' restatement of the argument for evolution is divided into five chapters, containing the evidences from Classification, Morphology, Embryology, Palæontology and Geographical Distribution respectively. Of these, the chapter on Embryology is by far the worst, being unfortunately crowded with errors and inaccuracies. The first case described of the persistence of ancestral organs in the embryo, is that of the external gills of the foetus of the Alpine Salamander. This case is mentioned by Darwin on the somewhat unsafe authority of G. H. Lewes, who wrote that the gills of the foetus had no reference to the future life of the animal, nor any adaptation to its embryonic condition, that they had sole reference to ancestral adaptations, and repeated a phase in the development of its progenitors. Mr. Romanes still supposes that this is a correct account of the matter, although it must be evident to anyone who has studied Fraülein von Chauvin's paper on the subject that the foetal branchiæ have been specialised and enlarged for the purpose of intra-uterine respiration. It is true that the foetal branchiæ are capable of aquatic respiration outside the body of the mother, but it is also true, although not mentioned by Mr. Romanes, that the great size and delicacy of these branchiæ were the actual cause of death to all the larvæ with which Fraülein von Chauvin experimented except one, and that one escaped the fate of its brethren only by getting rid of its uterine gills and growing new ones of more serviceable size and character.

A large number of pages are next devoted to a detailed discussion of the relations of the Metazoa to the Protozoa, a discussion which it is very difficult to criticise. It is certainly interesting, but it also certainly belongs in many respects to the post-Darwinian, not the Darwinian period. The discussion is difficult to follow, and I fear will not be thoroughly intelligible to the general reader who is destitute of even the most elementary knowledge of Natural Science, for it requires some acquaintance with Weismann's theories to understand the author's meaning. He says, for instance, that not only the individual development but also the powers of asexual reproduction on the part of multicellular organisms are all ultimately due to the specialised character of their germ-cells. He points to the karyokinesis of the segmenting ovum and the formation of the polar

bodies as evidence of this specialised character, and then proceeds to consider to what extent these peculiar complicated phenomena are represented in the Protozoa. Of the expulsion of polar bodies, he says that nothing resembling it has ever been observed in any of the Protozoa—an unjustifiably dogmatic statement, inasmuch as portions of the nucleus have been observed to be ejected in the conjugation of the Ciliata. One of the general conclusions drawn from the discussion is that no line of real demarcation can be drawn between growth and reproduction, even of the sexual kind. But the course of the argument has by no means succeeded in filling up the chasm of difference between the division of one cell into two, which is growth, and the union of two cells into one, which is sexual reproduction.

The rest of the chapter is devoted to the embryogeny of the Metazoa beginning from the fertilisation of the ovum. In the description of the characters of ova an unfortunate error is made, the pores of the zona radiata in the Mammalian ovum being referred to the same category as the micropyles of other ova.

The majority of the instances of embryological correspondence described are derived from Haeckel's more imaginative writings, but Mr. Romanes is placidly unconscious that doubt has been thrown on the objective reality of any of them. He does not even quote Haeckel's fascinating, though sometimes unfortunate, speculations with strict accuracy. On one page he figures the gastrula of the zoophyte *Gastrophysema*, and on another gives two figures of *Prophysema primordiale*, an extant gastrula-form, all "after Haeckel." As far as I have been able to discover, Haeckel never used the name *Prophysema* at all. The figures described under this name are copied from those of *Halophysema primordiale* in Haeckel's paper "Die Physemarien," and were proved 12 years ago to represent an organism specially created by Haeckel himself, *Halophysema* being really a reticularian Protozoan. *Gastrophysema* was another genus of Haeckel's imaginary extant Gastræa, and I have been unable to discover where among Haeckel's works Mr. Romanes found a reference to the gastrula of a zoophyte called by the same name.

It is stated that probably all the Metazoa pass through the gastrula-stage, which is correct, if by the latter term is merely meant the diploblastic condition. But only one process by which this condition is reached, namely, invagination, is described, and the gastrula of Olynthus, "after Haeckel," is figured without any mention of the fact that it is not produced by invagination. Another figure is described as the "gastrula of an Arthropod (*Nauplius*)," as though *Nauplius* were a genus.

Still more extraordinary, however, is the foot-note on p. 139, which states that in most vertebrated animals the process of gastrulation has been more or less superseded by another process called delamination, but that even in the higher Vertebrata embryologists are pretty well agreed as to delamination having been merely a later development of, or possibly an improvement upon, gastrulation. Perhaps the author has confused Professor Lankester's theory that gastrulation is originally derived from the delamination observed in some Coelenterata, with some faint reminiscence of the modified epibolic gastrulation of fishes and birds. The rest of the chapter is still more strongly permeated with Haeckelism. We have the figure of Haeckel's ideal primitive vertebrate, and two pages of the well-known somewhat ideal figures of embryos of fish, pig, man, etc. On p. 147 we note the peculiar statement that the gill-slits are supported

internally by gill arches, or the blood vessels which convey the blood to be oxygenised in the branchial apparatus. It is really a pity that the author was not more careful to prevent misconception on the part of the general readers for whom his book is intended. Mr. Romanes claims to belong to a class of naturalists whom he calls specialists in Darwinism, and says that the opinion of those who have done good work in other departments may be destitute of value in questions of evolution. However this may be, it is certain that the specialist in Darwinism who undertakes to expound the embryological argument for evolution should not rely almost exclusively on the writings of Haeckel. He would find Balfour's "Comparative Embryology" a safer guide. Mr. Romanes would have been wise to submit this unfortunate chapter to the revision, if not of a specialist in embryology, at any rate of some zoologist with a competent knowledge of that department, for instance to that of his friend Professor Lankester, whom he quotes with great admiration.

The second more truly Darwinian section of the book is much more satisfactory than the first. The theory of Natural Selection is clearly and fairly stated. It is pointed out that in its main elements the theory is merely a statement of observable facts, the fact of the excessive rate of reproduction leading to the constant pressure of numbers in each species, the fact of competition, or struggle for existence and consequent survival, the facts of hereditary transmission and individual variation. We welcome the candid admission that the theory only explains changes in organisms so far as these changes are of use; in other words, that it is a theory of the origin of adaptations, not of species. This admission occurs in an interesting discussion of misconceptions of the Darwinian theory which are current, not among its opponents, but among its supporters. Another of these misconceptions is that the theory can explain all cases of modification, whereas in some cases it is not logically possible that it can apply; others are that it follows deductively from the theory itself that Natural Selection must be the sole means of adaptive modification, and that all hereditary characters are necessarily due to Natural Selection.

In the chapter on the evidences of the Theory of Natural Selection we have three general or main arguments:—The observed fact of the extermination of forms in the struggle for existence; the consideration that we cannot find an instance of a structure or instinct developed for the exclusive benefit of another species; and, thirdly, the facts of domestication. This last class of facts is illustrated by fourteen pages of figures drawn from actual specimens of domestic breeds, illustrations which form the most novel and distinctive feature of the book. These figures, although not very beautiful, are certainly of great practical use, and enable one to appreciate the peculiarities of the several races better than the most elaborate description without figures. As far as we can judge, they are not only vigorous, but accurate.

Then follows a discussion of some of the detailed applications of the theory to the explanation of adaptations, the author having decided to select all his instances from a single class, namely, that which may be generically termed defensive colouring. This choice is, it seems to me, extremely unfortunate at a time when so many popular treatises have just been produced on the same particular subject. As we have so recently had to study Mr. Poulton's discussion of the subject on one side, and Mr. Beddard's on the other, it would have been a relief to find in Mr. Romanes' book the exposition

of some other class of adaptations. Mr. Romanes has little that is new or original to say on this familiar subject, and we find the well-known cases treated in the same familiar way. The resemblance of the butterfly *Kallima* to a leaf is illustrated once more, here in an uncoloured figure, which contrasts to great disadvantage with the splendid chromo-lithograph in Mr. Beddard's book. As usual, no information is given concerning the actual habits of *Kallima* in its natural environment, the particular leaves which it resembles, or the enemies which it deceives. The last sensational discovery by Mr. Sclater, described by Mr. Poulton, of a homopterous insect whose body mimics a leaf-cutting ant, together with the leaf it carries, is here reproduced; but, as in the original description, no attempt is made to show that the mimicry is of any advantage to the insect which exhibits it. Another case given is the imitation of a venomous snake by a non-venomous one, and considering the difficulty, even to a naturalist, of distinguishing at first sight the innocence or otherwise of any snake met with in its native home, it would have been by no means superfluous if this case had been clearly proved to be one of true mimicry.

Chapter IX. is devoted to criticisms which have been put forth of the theory of Natural Selection, and to some at any rate the most interesting part of this chapter is that which deals with the electric organ of skates and rays. Here the author, after giving an interesting and detailed account of the structure and relations of these organs, and discussing very impartially how its evolution can be explained on the theory of Natural Selection, confesses with a candour which does him the greatest credit that in the present state of our knowledge such an explanation is quite impossible. He even goes so far as to say that if a number of such cases could be produced, the theory of Natural Selection would have to be discarded.

The last chapter deals with the theory of Sexual Selection, which the author warmly defends against Mr. Wallace's criticisms. Mr. Wallace's chief objection is that if the secondary sexual characters supposed to be due to Sexual Selection are not necessarily correlated with that fitness which nature selects, then the fit that do not possess them would be selected, while if they are so correlated then it is nature which really selects them and not the opposite sex. Mr. Romanes states what in his judgment would have been Mr. Darwin's reply, and in so doing presumably gives his own. It amounts essentially to this: that secondary sexual characters are of too definite and elaborate a kind to be regarded as the mere concomitant of that exuberant health and vigour which are the result of Natural Selection. It may be admitted, says the author, that a general brilliancy of colour might accompany a general increase of vigour, but it does not follow that the particular disposition of colours in the form of ornamental patterns, and also elaborate special structures, can thus be accounted for by Natural Selection. In this contention we entirely agree. But Mr. Romanes is by no means successful in avoiding the other horn of the dilemma. He merely says that "in the phenomena of decorative colouring (as distinguished from merely brilliant colouring), of melodious song (as distinguished from merely tuneless cries), of enormous arborescent antlers (as distinguished from merely offensive weapons), we have phenomena which cannot possibly be explained by the theory of Natural Selection; and, further, that if they are to be explained at all, this can only be done, so far as we can at present see, by Mr. Darwin's supplementary theory of Sexual Selection." It seems to us that a much more

forcible answer than this can be made, to wit the following: Mr. Wallace has been to some extent misled by the influence of language, Natural Selection and Sexual Selection being unconsciously conceived by him as independent powers or causes. He has forgotten that, however successful an individual male may be in the struggle for existence, he cannot bequeath his superior endowments and faculties to offspring unless some female appreciates him sufficiently to grant him the favours of sexual intercourse. Mr. Wallace argues as though the superior male, *facile princeps* in the competition for a living, could found a line of descendants inheriting his own health and vigour without female assistance, and could afford to scorn and ignore the petty female standards. On the contrary, the fact is that there is competition in love as well as in life. It is an observed fact that males, in very many instances, fight together for the possession of the females, and, in other cases, compete with one another by the display of adornment or the efforts of song for the favour of the opposite sex. It is also an observed fact, in many cases, that where this sexual competition is most conspicuous there the secondary sexual characters are most developed, and that competition is conducted solely in respect of these characters. A male that excels in the struggle for existence is a complete failure, so far as the species is concerned, unless he can succeed also in finding mates. In view of the fact that competition for mates occurs among those males which have already survived the process of Natural Selection, and are all able and eager to beget offspring, it is a certainty that those will leave most offspring to succeed them who are most able, either by force or charm, by weapons or adornments, as the case may be, to constitute themselves the fathers of the next generation. Without going so far as Mr. Romanes, and saying that this is the argument that Darwin would have used, I venture to think it is more consistent with the Darwinian method and doctrine than that employed by Mr. Romanes himself. At the same time, the formulation of the argument is not intended to imply any admission that we regard the actual selection of individuals as the essential and most important result in sexual any more than in "natural" or general competition.

Subsidiary objections of Mr. Wallace's are, that there is no evidence that hen birds, for instance, are charmed by the beauty or voice of the males, and that, if there were, it would be necessary to the theory that the taste of the females should be uniform in all individuals and constant throughout many generations. Mr. Romanes' reply is practically what he condemns in another place as the argument from ignorance. We do not know, he says, what sentiments may be in the mind of a hen, and as for the constancy and uniformity, we know very little about the psychology of the lower animals. Here, again, I would venture to suggest a better reply. We do not require to assume an æsthetic sense in the hen birds. Without going deeply into psychology it is obviously probable that it is simply the sexual desire which is alone concerned in Sexual Selection. This desire is usually not easily excited in the female, and the function of subsidiary sexual organs and their display or exertion is probably enough the excitement of this desire, without which that of the male cannot be gratified. And the explanation on this view of the constancy of the selection in the same species is merely heredity. The sexual desire of the female has a hereditary association with certain sensory stimuli, and the means of furnishing these stimuli are constantly reproduced and improved by inheritance in the males. I will not develop these considerations further. They are, perhaps, too much beyond the

scope of the distinctively Darwinian theory to be relevant to Mr. Romanes' book.

The volume concludes with an appendix and notes, of which the former is a criticism of objections to evolution on palæontological grounds.

After noticing the salient features of the book at such length, it is unnecessary to add much concerning it as a whole. I will, therefore, simply finish with the opinion that while it is scarcely to be recommended to the unscientific reader as an introduction to the general philosophy of biology, it contains, notwithstanding its defects, much that is interesting and suggestive to the biologist.

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