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THE LITERARY WORLD. BOOK REVIEWS AND NEWS. 'Darwinism Restated.'

"DARWINISM. An Exposition of the Theory of Natural Selection with Some of Its Applications." By Alfred Russel Wallace, D.C.L., LL.D., F.R.S. With Maps and Illustrations. London and New York: Macmillan & Co. 1889.

It was quite time for a careful restatement of Darwinism. In the thirty years that have passed since the publication of that epoch-making book, "The Origin of Species," a considerable body of new facts, zoological, botanical, geological, has been accumulated, and not a few of them have a more or less direct bearing on the truth of the theory that Darwin promulgated. What has been the effect of this new knowledge on the validity of the theory? Is Darwinism strengthened or weakened thereby? These are questions that the advance of biology makes it necessary to put and answer. They are questions that Darwin himself foresaw and, characteristically modest as he was, holding his theory only tentatively pending the acquisition of further knowledge, no one would have been more prompt than he to insist that each new discovery by the naturalists should be allowed its full weight on the statement of his theory.

A great deal has been said in the last few years about the insufficiency of Darwinism to account for the phenomena of evolution, even in the material world. No naturalist of much repute any longer hesitates to accept evolution itself as a working hypothesis for study, investigation and teaching. It is admitted on all sides that the supposition that species have been derived one from another is the only supposition on which, in the present state of human knowledge, we can give a rational explanation of the phenomena of life. But when it comes to the theory that this change of species has been brought about mainly through the agency of natural selection, there are not a few objections, and some that to the ordinary mind seem to have no little weight.

It must be clear, then, that there is reason, and need also, for a new statement of Darwin's theory of evolution from the standpoint reached after thirty years of discussion and investigation and in view of the weaknesses, real or fancied, that have been charged against his argument. And perhaps there is no one better qualified for the task than Alfred Russel Wallace, who shares with Darwin the honor of having conceived the doctrine of the evolution of species. Everybody knows the story of these two men, how, working independently and on opposite sides of the world, they arrived simultaneously at a conclusion whose novelty startled the world and which was destined to give a new turn to human thinking in all its branches. Since then, though unfortunately possessing less leisure than Darwin for the working out of great problems, he has devoted much of his life to the study of the doubtful points that Darwin left unsolved and has given special attention to seeking among wild species for those proofs of the changes wrought by natural selection which Darwin mainly sought among domesticated animals. While he can hardly be described as a pupil of Darwin, and, indeed, differs from the latter in several minor and one important particular, he is yet the most thorough-going Darwinian of the times—in some respects, in fact, more loyal to the principles set forth in the "Origin of Species" than its author himself was in the last years of his life.

No one, therefore, could be much better qualified either to explain the real meaning of Darwinism to the non-scientific reader or to defend that theory, so far as it can be defended, against the criticisms of

scientists. In the book now under consideration he has done both with remarkable success. It is an exposition of the doctrine of natural selection which it requires no exceptional knowledge of biology to understand, and it is a defence of that doctrine which the followers of Moritz Wagner, of Nageli and of Mivart, the Neo-Lamarckians, the laboratory naturalists and the members of the other schools of modern evolutionists will find it no easy task to break down. His book is marked, as a rule, with admirable clearness, and is written with a simple beauty of style which gives it an attractiveness far beyond that usually possessed by scientific works. Its tone is elevated and dignified, and in the controversial parts shows that same freedom from personal bitterness which was pre-eminently characteristic of Darwin himself.

To the general reader the book makes an especial appeal, because of its remarkable wealth of plant and animal life. Merely as a collection of the wonder stories of nature, it would be singularly fascinating, and the curious and interesting facts presented would make it exceedingly readable and instructive, apart from the weight of these facts as proof of the correctness of any theory. It is, however, as an exposition and defence of Darwinism that the book is put forth, and as such it ought to be judged. But to decide on the value of the defence it will be necessary in the first place to get a clear idea of what Darwinism really is.

As cannot be too often repeated in view of the misapprehensions generally prevalent, Darwinism must not be confounded with evolution; they are not synonymous terms.

Evolution is one of three possible hypotheses for explaining the present order and past history of nature. We live in the midst of and in intimate relation with a vast system of things of great diversity and complexity which we are pleased to call nature. When men, looking around on this system, have attempted to account to themselves for its existence they have naturally taken a great variety of views, all of which, however, are reducible to three comprehensive ways of interpreting the universe. We may say, as so many of the ancients held, that the order now obtaining has existed from all eternity. But as a matter of fact, nobody does take that view of the matter in these days, since circumstantial evidence absolutely negatives the conclusion. We may say, in the second place, that the present order of things has had only a limited duration, and that at some past period it came into being, either as a whole or in parts at intervals, precisely as it now exists, and without any precedent condition out of which it might naturally have arisen. This is the doctrine of special creation—a doctrine which modern scientists are forced completely to reject, though a doctrine to which no inconsiderable portion of non-scientific people still try to cling. Without re-examining the arguments on which this doctrine rests, it is proper to say, as it can be said without fear of disproof, that the evidence brought to bear by the special creationists is not scientifically conclusive. The doctrine is very far from being sufficient to account for the facts of nature as we find them. Indeed, the universe is full of facts that are entirely inconsistent with such doctrine, and which, on the supposition of a special creation, must reflect on the intelligence, the beneficence or the ability of the Creator. When the special creationists are asked to explain these facts they can only respond with the Oriental ultimatum, “Mashallah: it so pleases God!”—an explanation, it is needless to add, which does not satisfy the human mind with its present development of reasoning powers.

In seeking for a more sufficient and reasonable explanation the scientists of the nineteenth century have come to accept the hypothesis of evolution. This hypothesis, like that of special creation, regards the present order of life as having had but a limited duration, but it supposes that present forms have in some way been developed from antecedent forms and these, again, from other antecedent forms, and so back. On this supposition the history of life has been one vast progression, with no break of continuity, and is precisely analogous to the process every day going on under our eyes by which, from the simple egg is developed the complicated organism of one of the higher animals. Fully stated, in its extreme logical

form, the evolution hypothesis is that all plants and animals have, by a gradual process and by strict natural laws, been developed from one parent form.

Naturalists have come to accept this view of nature rather because it affords an explanation of things otherwise unexplainable than because it is demonstrable. Indeed, no one holds that this view can be proved correct with anything like conclusiveness. To prove its correctness it would be necessary to produce artificially or to observe in a state of nature such wide variations of varieties within species as to amount to the actual development of a new species, infertile when crossed with its parent species. That, however, is out of the question, if for no other reason than the lack of time. But while we cannot have direct and absolutely conclusive proof, there is an abundance of indirect evidence that all tends to establish the correctness of this hypothesis, since all the facts of the organic world appear to be in conformity with the belief that species have been evolved from species. There is neither space nor necessity for going over this evidence now. It is sufficient to say that whether we turn to comparative anatomy, palaeontology, embryology, or the study of the geographical distribution of animals, everywhere we find facts and laws of growth which are readily explainable on the hypothesis of evolution, but are utterly unintelligible on any other hypothesis as yet conceived by man.

If it be true, then, as the late Dr. Youmans once declared, that while practically all men of science accept evolution, not one in a thousand of them can tell why he is convinced of its truth, it is because they have not been convinced by reason, but have been forced to accept it because of its extreme probability and its necessity as the only means of sufficiently explaining the facts with which they deal. It is not yet a proved fact; it is only a working hypothesis. Every year, however, new evidence is accumulating, almost every discovery strengthens the truth of the hypothesis, and scientists almost universally believe that before many years the fact of evolution will be unquestionable. Indeed, this is regarded as so certain that for some time now, in scientific circles, less attention has been paid to evolution itself than to the question as to how the fact of evolution—assuming it to be a fact—has been brought about.

Now, Darwinism, distinctively so-called, is nothing more or less than an offered answer to this question. It is not evolution, but a theory of evolution, an attempt to account for the supposed fact that species have been evolved, and to show how the evolution has been brought about. There are, also, at least seven other theories of evolution, each supported by larger or smaller schools of scientists. But Darwinism is the best known, the most elaborately formulated and the widest held. Of late, however, grave questions have been raised as to whether this theory is entirely sufficient to explain the facts it assumes to explain; and so marked has been the disposition among many scientists to reject Darwinism in whole or in part, that it has sometimes seemed as if this theory were about to be supplanted by some other. It is for further light on this question that we turn to Wallace's chapters.

Darwin himself was, as usual, exceedingly modest and cautious in the statement of his theory. In the concluding passage of the introduction to the "Origin of Species," he puts it as follows:

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

His theory is, therefore, a theory of natural selection. It rests on two main classes of facts which, applying to all organized beings without exception, can consequently be ranked as fundamental principles

or laws. The first is the power of rapid multiplication in a geometrical progression; the second, that offspring always vary slightly from parents, though generally very closely resembling them. From the first law there follows, of course, a constant struggle for existence because, while offspring always exceed parents, and generally to an enormous extent, the total number of living organisms in the world does not, and cannot, increase year by year. Out of this struggle, though something may be left to chance, on the whole the fittest will survive, and this “survival of the fittest” is what Darwin termed Natural Selection.

To prove the validity of the theory it must be shown, by a wide and comprehensive array of facts, that animals and plants do perpetually vary in the manner and to the amount requisite, and that this takes place in wild animals as well as in those which are domesticated. It is also necessary to prove that all organisms do tend to increase at the great rate alleged, and that this increase actually occurs, under favorable conditions. And it must be proved, furthermore, that variations of all kinds can be increased and accumulated by selection, and that the struggle for existence actually occurs in nature, leading to the continued preservation of favorable variations even to the extent of developing a new species.

Proof on each of these points must be sought, of course, in the collection of a vast number of facts; and this was the work that Darwin began and Wallace and others have continued. The value of the evidence, however, lies in the whole body of facts and not in any one case or group of cases, so that it is quite impossible to rehearse here the testimony presented in Wallace’s book. It may be said, however, that there is no difficulty in establishing the fact that a severe struggle for existence is all the time going on in the animal and plant kingdoms. The common flesh fly, for example, produces 20,000 larvae, and these grow so quickly that they reach their full size in five or six days, so that each parent fly might be increased ten thousand fold in a fortnight. If they went on increasing at this rate during only the three summer months, there would result one hundred millions of millions of millions for each fly in existence at the beginning of summer—a number greater probably than exists at any one time in the whole world. The same thing goes on with every species of wild animal and plant, from the lowest to the highest. All breed at such a rate that in a few years the progeny of any one species would, if allowed to increase unchecked, completely monopolize the land. But all alike are kept within bounds by various destructive agencies, so that while the numbers of each may fluctuate, they can never permanently increase except at the expense of some others, which must proportionally decrease.

Nor, of course, is there any difficulty in showing the variability of species. The existence of varieties within species was, indeed, recognized by the older naturalists, and the facts of variation and artificial selection were given full and convincing exposition in the two remarkable volumes on the subject which Darwin published. But of the facts of variation among wild animals and plants comparatively few, and those the less important, were known even so late as Darwin’s last edition. To this matter, therefore, Wallace gives especial study, collecting a vast array of facts which show that individual variability is a general characteristic of all common and widespread species of animals and plants, and that this variability extends to every part and organ, external or internal, as well as to every mental faculty. His numerous illustrations, drawn to scale, and exhibiting the actual variations in inches, help the student to an understanding of this branch of the subject, and while it makes it impossible to deny either the generality or the amount of the variations.

Now it is perfectly well known that every species of animal and plant life is exposed to numerous and varied dangers throughout its entire existence, and that it is only by means of the exact adaptation of its organization to its surroundings that it is enabled to live until it produces offspring that may take its place. Only a small portion of the annual increase can survive. If, therefore, the physical and organic conditions of a country remain unchanged, the only effect of the struggle for existence will be the survival of the

best, strongest and most perfect specimens of each species. The species itself will remain unchanged, but preserved in its most perfect health and vigor.

But if, on the other hand, the physical or organic conditions do change, then variable species struggling together for existence are certain to undergo some modification, since the change of conditions cannot fail to be beneficial to some species and hurtful to others. When the change of conditions was slight the ordinary effect would be, of course, that some species would increase and others would diminish. In cases where a species was already small in numbers extinction might readily follow. This would give room for an increase of other species, and thus a considerable readjustment of the proportions of the several species might take place. But when the change of conditions was of a more important character, it might so directly affect the existence of many species as to render it difficult for them to maintain themselves without some considerable changes in structure or habits. In that case, the species being variable, would accomplish the necessitated change by a process of variation and natural selection, and thus new varieties and new species would be formed, consequent on the need of providing new means of self-defence in the ceaseless struggle for existence.

There can be no question, of course, that great changes in physical and organic conditions have occurred throughout all geological time and in all parts of the world. Land and water have been continually shifting their positions. Climate has changed again and again, and along with these have come not less important changes in the distribution of animal life. As it is clear that because of these changes many species must either become modified or cease to exist, as it is known that species in a wild as well as in a domesticated state are capable of variation, and as it is evident that in the struggle for existence it is the fittest—that is, those best adapted to their surrounding conditions that alone can hope to survive, therefore it is concluded that, by the variations brought about through the natural selecting out of the fittest, new species have been evolved from time to time in the world's history in proportion as changing conditions have invited, and even necessitated, new forms of life to take the place of or supplement those for whose existence circumstances were less favorable.

This, briefly stated, is Darwinism. It is a theory of evolution which its author called “natural selection” because it leads to the same results in nature as are produced by man's selection among domestic animals and cultivated plants. The theory has been the more widely accepted, no doubt, because when applied to the interpretation of the complex phenomena presented by the organic world it is found to afford a better explanation, as a rule, of existing facts than any other theory can give. It is not the least interesting feature of Wallace's book that he makes this application to many branches of biological inquiry, touching, in the process, a great variety of exceedingly curious facts of animal and plant life. But in these applications we may not follow him. Neither is it necessary here to consider his replies to the more ordinary objections to Darwinism, like those raised on the score of the smallness of known variations and the infertility of hybrids. But there are certain more recondite difficulties, affecting such fundamental questions as the causes and laws of variability, which must be considered, because so much has been said of late regarding the probable supplementing of Darwin's theory of evolution by some new theory especially formulated to meet those difficulties.

There is no section of scientists to-day who attempt to deny the evolution of species. But there is at the same time among many scientists of the first repute an unmistakable tendency—stronger perhaps than Wallace is willing to admit—to minimize the action of natural selection in the production of that evolution. Foremost among them is Mr. Herbert Spencer, whose views are clearly set forth in his “Factors of Organic Evolution.” While fully recognizing the importance and wide range of the principle of natural selection, he yet maintains that sufficient weight has not been given to the effects of use and disuse as a factor in evolution or to the direct action of environment in determining or modifying organic structures.

These somewhat tentatively expressed views of Mr. Spencer have been carried much further by many American naturalists, who have attempted to work them out in great detail, and who constitute a school of Neo-Lamarckians of which Dr. E. D. Cope of Philadelphia is the best representative. Besides these, there is Prof. Geddes's theory of variation in plants, founded on the well-known antagonism of vegetative and reproductive growth, and Prof. Weismann's new theory of heredity founded upon the "continuity of the germ-plasm." But both of these are of too recondite a nature to permit an intelligible summary of them for other persons than those familiar with modern embryology.

Neither may we follow Wallace through the details of his argument against the soundness of the Spencerian views to supplant Darwin's theory. It must suffice to quote his conclusion:

"The direct action of the environment as set forth by Mr. Herbert Spencer, Dr. Cope and Dr. Karl Semper, even if we admit that its effects on the individual are transmitted by inheritance, are so small in comparison with the amount of spontaneous variation of every part of the organism that they must be quite overshadowed by the latter. And in such direct action may, in some cases, have initiated certain organs or outgrowths, these must from their very first beginnings have been subject to variation and natural selection, and their further development have been almost wholly due to these more potent and powerful causes. The same remark applies to the views of Prof. Geddes on the laws of growth which have determined certain essential features in the morphology of plants and animals. The attempt to substitute these laws for the action of variation and natural selection has failed in cases where we can apply a decisive test, as in that of the origin of spines on trees and shrubs; while the extreme diversity of vegetable structure and forms among the plants of the same country and of the same natural order of itself affords a proof of the preponderating influence of variation and natural selection in keeping the many diverse forms in harmony with the rapidly complex and ever-changing environment.

Lastly, Professor Weismann's theory of the continuity of the germ-plasm and the consequent non-heredity of acquired characters, while in perfect harmony with all the well-ascertained facts of heredity and development, add greatly to the importance of natural selection as the one invariable and ever-present factor in all organic change, and that which can alone have produced the temporary fixity combined with the secular modification of species. While admitting, as Darwin always admitted, the cooperation of the fundamental laws of growth and variation, of correlation and heredity, in determining the direction of lines of variation or in the initiation of peculiar organs, we find that variation and natural selection are ever-present agencies, which take possession, as it were, of every minute change originated by these fundamental causes, to check or favor their further development, or modify them in countless varied ways, according to the varying needs of the organism. Whatever other causes have been at work, Natural Selection is supreme to an extent which Darwin himself hesitated to claim for it. The more we study it the more we are convinced of its overpowering importance, and the more confidently we claim, in Darwin's own words, that it has been the most important, but not the exclusive, means of modification."

As for the correctness of this conclusion it is certainly to be said that Wallace succeeds in showing that the recent theories, so far as they are intended for substitutes for Darwinism, cannot stand; and so far as they are intended to supplement that theory they only give added proof of its validity. But that is not showing that these theories are not themselves valid and may not in time come to be considered co-ordinate with Darwinism as the factors of evolution. Darwin himself never contended that his theory was all-sufficient, and less thorough-going advocates than Wallace would probably admit that it is somewhat farther from being all-sufficient than the argument of this book tends to show. At any rate not a few scientists of the very first rank are looking forward now to the time when natural selection will be, not discarded of course, but ranked as one of several modes through which evolution has worked itself out. And there is the less need of extravagance in asserting the sufficiency of Darwinism because, whatever coming investigation may disclose regarding the means of evolution, the fame of Darwin as the greatest scientist and one of the few really great men of the nineteenth century cannot be shaken.

There is only space for a few words regarding the final chapter of the book, a chapter that, though quite as interesting as any in the volume, has no bearing on the main argument. It is rather a sort of appendix, a separate essay on “Darwinism Applied to Man.” As is well known, Darwin and Wallace were not in agreement as to the influences which have been at work to raise man to his present advanced stage of development. They agreed, of course, in rejecting the theory of a special creation for man, and in maintaining the essential identity of man’s bodily structure with that of the higher mammalia, and his descent from some ancestral form common to man and the anthropoid apes. But Darwin also derives the moral nature and mental faculties of man from the lower animals by a process of gradual modification and development, and here Wallace parts company with him.

The whole purpose of this last chapter is to prove that at some point in the evolution of man some other force than natural selection has come in—a force supernatural or spiritual in its nature, and which accounts for the vast difference, in other than physical respects, between men and their nearest relations in the animal scale. Just what this force is, when and how it came in, and in what manner it made itself felt—these are questions that Wallace cannot be said to answer. His chapter on this subject is the least satisfactory of any in the book, and is very far from being thoroughly scientific. It may, however, reassure and comfort some persons to know that the most thorough-going of living Darwinians is unable to find in Darwinism a sufficient explanation of the present development attained by man. Nor is it because of any timidity or mistaken religious considerations that he takes that view. Science, he may not improperly say, forbids him to take any other. For while the difference between man, psychologically considered, and the highest apes may not be, as Mivart once said, so great as to “transcend the difference between an ape and a blade of grass,” it is certainly too great for Darwinism yet to bridge. But whether this is because of the inherent insufficiency of Darwinism, or merely because of the insufficient number of intermediate facts now known—this is a question on which future investigations may throw some light, but which the cautious men of to-day would prefer to be excused from answering.

F. N. L.