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DR. A. RUSSEL WALLACE:  
PIONEER OF THE PRINCIPLE OF  
EVOLUTION.

IT is not often that an educational periodical can deal appropriately at any length with the career of a man of science, but the principle of evolution has become such a common factor in modern thought upon all subjects that we feel justified in devoting space to the work of a pioneer of its establishment upon a rational basis. Dr. A. Russel Wallace, whose death on November 7th, at ninety years of age, we regret to record, will be remembered not only as an independent discoverer of the influence of natural selection in evolutionary development, but also as one of the greatest naturalists of the nineteenth century. On several occasions recently a plea has been put forward on behalf of increased attention to the history of science in connection with the subjects taught in schools. The death of Dr. Wallace furnishes a reason for describing briefly in these columns to the history of the inception of a principle which has become current coin of the intellectual realm. An admirable account of Wallace's work appeared in *NATURE* of June 13th, 1912, as a contribution to its series of Scientific Worthies; and to that article we are partly indebted for some of the particulars here given.

Alfred Russel Wallace was born on January 8th, 1823, in Usk, Monmouthshire, of remote Scotch and Huguenot and of immediate English ancestry. His school life was uninspiring, and he owed more of his real education to the cultivating influence of his home in Hereford. At the age of sixteen we find him as a land surveyor in Bedfordshire, also making his first observations on plants; and these early and serious studies in botany, continuing for four years, prepared him for the plant wonders of the tropics. At the age of twenty-one he came to London; and in his

autobiography he says of himself at that time:—

I possessed a strong desire to know the causes of things, a great love of beauty in form and colour, and a considerable but not excessive desire for order and arrangement in whatever I had to do. If I had one distinct mental faculty more prominent than another, it was the power of correct reasoning from a review of the known facts in any case to the causes or laws which produced them, and also in detecting fallacies in the reasoning of other persons.

It was Darwin's "Journal," published in 1845, and read by Wallace at the age of twenty-three, which determined him to invite Bates to accompany him on his journey to the Amazon and Rio Negro, which filled the four years 1848-52. Throughout his whole career as a collector, Wallace had before him the problem of evolution and the cause of the origin of new species in animate nature. Before leaving for South America, in 1848, he wrote:—

I begin to feel rather dissatisfied with a mere local collection; little is to be learnt from it. I should like to take some one family to study thoroughly, principally with a view to the theory of the origin of species. By that means I am strongly of opinion that some definite results might be arrived at.

While at Sarawak, in 1855, Wallace was still pondering over the problem, which was rarely absent from his thoughts; and in a paper written at that time he concluded that every species which had come into existence in nature was closely related to a species which preceded it. This pointed clearly to evolutionary development, and suggested when and where new species would be introduced; but it did not indicate how they could be brought into existence. After the publication of his paper, Wallace was informed by his agent that several naturalists had expressed regret that he was "theorising" when what he was expected to do was to collect facts; nevertheless, he still continued to consider the reason why one species becomes changed either slowly or rapidly into another. Though the cause of the change was unknown, the utilitarian mind considered it more important to increase the size of a collection of birds and insects—of which Wallace himself had gathered nearly nine thousand separate species—than to discover how the various distinct forms had originated. How he was led to the solution of the great problem in 1858 is best described in his own words:—

At the time in question I was suffering from a sharp attack of intermittent fever, and every day during the cold and succeeding hot fits had to lie down for several hours, during which time I had nothing to do but to think over any subjects then

particularly interesting me. One day something brought to my recollection Malthus's "Principles of Population," which I had read about twelve years before. I thought of his clear exposition of "the positive checks to increase"—disease, accidents, war, and famine—which keep down the population of savage races to so much lower an average than that of more civilised peoples.

It then occurred to me that these causes or their equivalents are continually acting in the case of animals also; and as animals usually breed much more rapidly than does mankind, the destruction every year from these causes must be enormous in order to keep down the numbers of each species, since they evidently do not increase regularly from year to year, as otherwise the world would long ago have been densely crowded with those that breed most quickly. Vaguely thinking over the enormous and constant destruction which this implied, it occurred to me to ask the question, Why do some die and some live? And the answer was clearly, that on the whole the best fitted live. From the effects of disease the most healthy escaped; from enemies the strongest, the swiftest, or the most cunning; from famine, the best hunters, or those with the best digestion; and so on.

Then it suddenly flashed upon me that this self-acting process would necessarily *improve the race*, because in every generation the inferior would inevitably be killed off and the superior would remain—that is, *the fittest would survive*. Then at once I seemed to see the whole effect of this, that when changes of land and sea, or of climate, or of food-supply, or of enemies occurred—and we know that such changes have always been taking place—and considering the amount of individual variation that my experience as a collector had shown me to exist, then it followed that all the changes necessary for the adaptation of the species to the changing conditions would be brought about; and as great changes in the environment are always slow, there would be ample time for the change to be effected by the survival of the best fitted in every generation. In this way every part of an animal's organisation could be modified exactly as required, and in the very process of this modification the unmodified would die out, and thus the *definite* characters and the clear *isolation* of each new species would be explained. The more I thought over it the more I became convinced that I had at length found the long-sought-for law of nature that solved the problem of the origin of species.

We have already mentioned that Wallace was influenced by Darwin's "Journal" to take up collecting in South America. His personal relations with Darwin in connection with the principle of natural selection began in 1854, when he was introduced to him in the Insect-room of the British Museum. While living in Borneo in that year, Wallace wrote his paper, "On the Law which has Regulated the Introduction of New Species," which was published in the *Annals of Natural History* in the following year. Hearing that Darwin was preparing some work on varieties and

species, Wallace sent him a copy of this paper and received a long letter in reply, but no hint was given by Darwin of his having arrived at the doctrine of natural selection. Darwin had, however, actually written out a sketch of his theory in 1842; and in 1844 this sketch was enlarged to 230 folio pages, giving a complete presentation of the arguments afterwards set forth in the "Origin of Species." As we have said, Wallace arrived at the idea of the survival of the fittest as the operating cause of evolution in 1858, and immediately sent the outlines of this theory to Darwin, who brought the communication before Lyell and Hooker, and urged that it should be printed at once. Upon their advice, however, he consented to let an extract from the sketch of 1844 be presented to the Linnean Society with Wallace's paper on July 1st, 1858. "The one great result which I claim for my paper of 1858," said Wallace, "is that it compelled Darwin to write and publish his 'Origin of Species' without further delay."

The colouring of animals, as observed in the tropics and the Malayan Islands, was the subject in which Wallace made his most extensive and original contributions to Darwinism. The study of geographical distribution of animals also sprang from the inspiration of the Malayan journey. The natural trend of Wallace's thought as to the ascent of man is first shown in three anthropological essays of 1864, 1869, and 1870, contained in the volume, "Contributions to the Theory of Natural Selection." The papers mark a gradual divergence of his views from those of Darwin; for, in his opinion, natural selection was inadequate to account for several of the physical characteristics of man, as well as his speech, his colour sense, his mathematical, musical, and moral attributes.

Wallace's last work was "The World of Life," published in 1910, when he was in his eighty-eighth year. Five chapters in this work treat on the subject with which his name will be always honorably associated, namely, the distribution of plants and animals; and they included many novel facts and lines of treatment which had suggested themselves to Wallace since the publication of his earlier works. The contrast between the more uniform floras of temperate climes and the richly diversified floras of tropical lands is one of the interesting points discussed; and among the illustrations, extensions, and new applications of the theory of natural selection are discussions of "recognition marks," bird life, bird migration and extinction, and the relations of bird to insect life. We follow in this work the cycle of reflection beginning with adaptation as the great problem, adaptation as fully

explained by selection, and closing with adaptation in some of its phases as entirely beyond human powers of interpretation, not only in the evolution of mind and spiritual nature of man, but also in such marvellous manifestations as the scales of butterflies and the wings of birds.

Wallace's interest in nature grew with his years; and the mystery of its charms appealed to him to his last days. To the biology class of the University of Colorado, which sent him greetings on his eighty-ninth birthday, he replied:—

From the day when I first saw a Bee-orchis in ignorant astonishment, to my first view of the great forests of the Amazon; thence to the Malay Archipelago, where every fresh island with its marvellous novelties and beauties was an additional delight, nature has afforded me an ever-increasing rapture, and the attempt to solve some of her myriad problems an ever-growing sense of mystery and awe. And now, in my wild garden and greenhouse, the endless diversities of plant life renew my enjoyments; and the ever-changing pageants of the seasons impress me more than ever in my earlier days.

In the ninety-first year of his age, and the sixty-fifth year of active service and productivity, he has gone to his rest; and the nation mourns. Independent discoverer of a stimulating principle in biological thought, and indomitable champion of its claims; apostle of truth and righteousness; comprehensive observer and philosophic naturalist: his name is graven deeply upon the tablets of science. Though death has conquered the body, the spirit of Wallace's teaching is now universal, and by it knowledge will be extended in the generations to come.

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