## DR. WALLACE'S 'WORLD OF LIFE'

*The World of Life.* A Manifestation of Creative Power, Directive Mind, and Ultimate Purpose. By ALFRED RUSSEL WALLACE, O.M., D.C.L., F.R.S., &c. (London: Chapman & Hall, Limited, 1910.)

EVEN a cursory glance over the pages of Dr. Wallace's new book is sufficient to awaken admiration for the veteran naturalist who within a couple of years of ninety could have produced so profound and elaborate a volume on a subject demanding the most rigid concentration of reasoning powers and a perfect familiarity with all the results of recent scientific research. It is the harvest of a long life of toil and thought, and demonstrates that work after all is one sure method of preserving vitality and enthusiasm to extreme old age.

The volume may be described as evolution up to date. Dr. Wallace is universally recognized as the Nestor of living evolutionists. Sharing with Darwin the distinction of having first given scientific form to the evolution theory, he became in a sense its guardian on the death of his more prominent comrade. It was natural, therefore, that he should feel it almost a duty to leave behind him a final statement of his views as to the bearing on evolution of those investigations in the domains of physics and biology which are exerting so powerful an influence on present-day science.

Those who are acquainted with the author's previous books, especially his *Darwinism* and *Man's Place in the Universe*, and who have read two or three such works as Professor Poulton's *Essays on Evolution* and Professor J. A. Thomson's *Heredity*, will not find much that is absolutely new; but even for students, and still more for the general

reader, it is an advantage to have the results of recent research and speculation brought together and systematized by one so eminently qualified for the task.

An additional motive which seems to have weighed with Dr. Wallace in the preparation of this volume was the desire to furnish an antidote to those monistic interpretations of the universe which have of late attained great prominence, for, as he himself declares, he was 'endeavouring to arrive at a juster conception of the mystery of the Life-World than that of Professor Haeckel, and by a very different method.' It is gratifying to observe how the whole book is dominated by the conviction of the unworkableness of mechanical explanations of life, while there are repeated affirmations of the necessity of a supreme directive Mind in nature's laws and phenomena.

Darwin's *Origin of Species* gave but little trace of any such views; but it appears from the *Life and Letters*, published after his death, that he had never doubted the necessity for an intelligent Cause of the universe, although he thought that the human mind had no powers equal to any adequate conception of that Cause. Even Herbert Spencer admitted 'an universal immanent force' as the antecedent of material and mental phenomena and the 'Unknown Reality which underlies both spirit and matter.'

But Haeckel, and monists in general, will not yield even this much. They seek to escape the necessity of admitting a First Cause by postulating the eternity of matter. It is an inconceivable proposition, but for those who want to say there is no God it has to suffice. And what then? What is this eternal matter? Is it inert, or does it possess some innate force? Without such force even Haeckel realizes that nature's progress could not be explained. Hence he drifts into his self-contradictory conception of 'cell-souls' endowed with sensation, perhaps with volition, yet unconscious! Now if from all eternity forces making for development have been in operation, must there not have been reached, an

eternity since, some perfect being equal to what we call God? True, replies the monist, if progress had been unfettered; but at a certain stage retrogression has taken place and the life-cycle has had to be gone through again. All this sounds very much like trifling, and indeed one can hardly reason seriously about the rank absurdities in which Haeckel is so hopelessly entangled.

Not only does Wallace insist on the necessity for an eternal Spirit guiding nature's changes and adaptations; he even ventures to indicate the ultimate purpose of all this, the supreme design by which all other manifestations of design are explained. His position here is so remarkable that we prefer to give his own words: 'This earth with its infinitude of life and beauty and mystery, and the universe in the midst of which we are placed, with its overwhelming immensities of suns and nebulae, of light and motion, are as they are, firstly, for the development of life culminating in man; secondly, as a vast school-house for the higher education of the human race in preparation for the enduring spiritual life to which it is destined' (p. 391).

We had supposed that this anthropocentric view of the universe had become quite obsolete among men of science, and Dr. Wallace himself surmises that it will prove distasteful to many. But the position can be fortified now with far better defences than it had of yore. So much in nature can now be adduced which has no other adequate explanation. Only a few of the chemical elements are needed for the atom, but what of all the rest? They are revealing one by one a specific relation to man's development in knowledge, art, science, and manufactures. How much the discovery of radium has done to demonstrate this! And the separation of still newer elements has had a good deal to do with making the spectroscope a more efficient instrument. Again, what innumerable treasures the vegetable kingdom continues to yield up, of which no creature but man can make use,—timber for building, a myriad forms of food, drugs, and perfumes,

many of which are of no service to the organism itself, and some of the most prized of which are by-products, and therefore only to be brought into existence at all by the exercise of human intelligence.

Dr. Wallace is careful to emphasize that the working out of this supreme purpose by an external spiritual agency is conditioned by those principles or laws of co-adaptation between organism and environment with which Darwin has made us familiar. And it is to the exposition of these laws in the light of post-Darwinian studies that much of the volume is devoted. It is not possible, of course, to do full justice here to the author's many elaborate arguments. We can only briefly indicate their nature and the line they take.

Since evolution implies co-adaptation of organic structure and environment, both of which are subject to constant and endless variations, it is necessary to explore the nature and extent of environmental changes, as well as to study the distribution of animals and plants and to observe their differences, if we are to apprehend aright the laws of development. An illustration of this which will be familiar to readers of Darwin is presented by the small, agile, dusky species of rabbits now inhabiting the island of Porto Santo, and known to have developed from a litter of ordinary rabbits introduced some centuries ago.

Wallace adds other examples, among which is the case of a swarm of sparrows which a dozen years ago were found benumbed after a great storm in Rhode Island. About half of them revived, and it was observed that in these the sternum or breast bone was longer than in those that died; that is, the fittest to survive were those whose bones and muscles concerned in flight were best developed. Many other instances of nature's operations in the manufacture of new species might easily be adduced.

Previous to Darwin it was supposed that species were fixed quantities. Variations were neglected as mere accidents or sports. It was known, of course, that many species had

become extinct and that others had taken their place. Geology bore witness to revolutions of both fauna and flora; as, for example, the substitution of the gigantic reptiles of the Secondary (Mesozoic) rocks for the invertebrates of the Primary (Palaeozoic), and the later triumph of the prolific Tertiary mammals; but science had found no solution of the enigma. When the *Origin of Species* appeared in 1859 order arose out of chaos. The struggle for existence was shown to have proceeded in harmony with inexorable laws. The fittest, that which was best adapted to its environment, survived. New species were the modifications of previous ones. It is still true in a sense that like produces like, but never exactly. No two individuals are precisely alike, no two human beings, not even two leaves. The variation which harmonized best with its conditions was the one that was destined to survive and to lay the foundation of a new species. Science was revolutionized, and Darwin was hailed as another Newton.

It soon appeared that Wallace had been led along similar lines to practically the same result, and Darwin accorded to him the full merit of originality. But his authority suffered somewhat from his exclusion of man from the operation of natural selection. He was taunted with holding the notion that man was 'God's domestic animal.' As every one knows, he soon retreated from this position, and now holds, we presume, to that conception of man's origin which Robert Browning with sufficient accuracy for humour has thus delineated—

> That mass man sprang from was a jelly lump
> Once on a time; he kept an after course
> Through fish and insect, reptile, bird and beast,
> Till he attained to be an ape at last,
> Or last but one.

Wallace does not argue the question of man's descent, though he takes pains to prove the evolution of most other creatures. The truth is that it is no easy matter to find evidence for man's development from the brute. Embryo-

logy furnishes the best testimony, but this is not Wallace's province. He therefore assumes man's affinity to the lower animals. To meet the demand for time for such an important development he suggests that our early anthropoid ancestor should be dated back as far as the Miocene or even the Eocene age, that is, soon after the beginning of the Tertiaries. This must undoubtedly be so if man has originated from the lower animals in the ordinary way of natural selection. It required that length of time for the present-day ape to develop from the Eocene lemuroids and even for the horse to be produced from the five-toed eohippus. But we are not to forget that there is not the slightest geological evidence of man's existence previous to the Pleistocene age (quaternary). Moreover, the oldest human fossils are still far in advance of the gorilla, even in regard to physical structure, to say nothing of mental and moral capacities. It remains one of the unaccountable 'imperfections of the geologic record' that whereas it enables us to construct a probable genealogy of the horse, the ape, and other animals, it yet furnishes no information as to man's origin, although the process of development must have been under almost identical conditions.

The various lines of argument by which this Darwinian interpretation of nature is made good—heredity, variation, powers of increase—are so generally known that we need not further follow Wallace's *résumé* of them. It will be more interesting to observe the way in which he incorporates the results of recent atomic and physiological studies with the general system of evolution.

No longer can we consider the atom as a simple unit, nor protoplasm as elementary. Atoms are declared to be complex systems of electrons, the units of electricity and of matter, and these electrons are in ceaseless movement within the limits of the atom, being held in combination by mysterious forces not very well understood. It is with the living cell, however, that the evolutionist has chiefly to do, for it

is in this that the beginnings of growth, variation, and reproduction are to be sought. The nucleus of this cell, by means of suitable staining and microscopical examination, has been made to yield up some of its most hidden secrets, and on the knowledge thus gained Weismann has based his well-known speculations concerning the continuity of the germ-plasm and heredity. The subject is too abstruse to be detailed here, nor does our purpose require this. Those who desire a technical account of the matter must have recourse to Weismann's *Germinal Selection*, first published in 1896, and his *Germ-plasm*, which appeared in 1892, where they will find some tolerably hard reading.[1]

The organic cell is now defined as 'a nucleated unit-mass of living protoplasm,' not a mere particle, but an organized structure. No better general description of it can be found than that which is given in Professor Lloyd Morgan's *Animal Life and Intelligence:* 'The external surface of a cell is (usually) bounded by a film or membrane. Within this membrane the substance of the cell is made up of a network of very delicate fibres (plasmogen) enclosing a more fluid material (plasm); and this network seems to be the essential living substance. In the midst of the cell is a small round or oval body, called the nucleus, which is surrounded by a very delicate membrane. In this nucleus also there is a network of delicate plasmogen fibres enclosing a more fluid plasm material. At certain times the network takes the form of a coiled filament or set of filaments, and these arrange themselves in the form of rosettes or stars' (p. 10).

This is a sufficiently simple explanation of the nature of a living cell, and the mechanics of growth. Another quotation from the same author's work on *Habit and Instinct*

[1] A very lucid exposition of Weismann's intricate system is given in Professor J. A. Thomson's *Heredity*, which Wallace describes as 'a most valuable and illuminating work.' With such help the reader may disport himself at ease among *ids*, *biophors*, and the like. *Idants* consist of *ids*, each of which contains a complete inheritance and consists of numerous primary constituents or *determinants*. A determinant is usually a group of biophors, the minutest vital units.

(p. 310) will show how these phenomena of growth are utilized in Weismann's theory of germinal selection: 'There is a competition for nutriment among those parts of the germ named determinants, from which the several organs or groups of organs are developed. In this competition the stronger determinants get the best of it, and are further developed at the expense of the weaker determinants, which are starved, and tend to dwindle and eventually disappear.'

This is the one great post-Darwinian extension of Darwinism, which is supposed to complete it and to furnish a solution of all the difficulties which beset the phenomena of heredity. The struggle for existence, in a word, begins not among species, nor even newly-originating organs, but in the primary constituents or determinants of the cell. There is probably more of speculation than of actual fact in the scheme, but then evolution itself is largely speculative even yet, and a speculative explanation of a speculative theory is at any rate spectacular.

It is by the help of these Weismannian theories that Dr. Wallace wrestles with the objections which still continue to be urged against natural selection. The strongest and most frequent of these objections has to do with the beginnings of new organs. As the earliest slight indications of these would be useless, it is argued that they would not survive. Darwin himself lived long enough to give a partial answer, and a further reply is borrowed by Wallace from Professor Poulton's *Essays on Evolution:* 'Organs are rarely formed anew in an animal, but they are formed by the modification of pre-existing organs; so that, instead of having one beginning for each organ, we have to push the beginning further and further back, and find that a single organ accounts for several successive organs, or at any rate several functions, instead of one.'

For example, the four limbs of vertebrates find their first beginnings in Palaeozoic times, and have been subsequently modified into fins for swimming, wings for flying, hands and feet. Similarly the five senses are all modifica-

tions of the sense of touch. The question as to how the ear or eye first began is irrelevant. We must go 'further and further back,' as far even as to the primordial protoplasm, which, as soon as it was endowed with life, the cause of organization, acquired the rudiments of all other modifications.

A second objection is that every variation requires other concurrent variations not likely to occur simultaneously. Herbert Spencer instances the neck of the giraffe. The lengthening of this would necessitate alterations in the legs to preserve the centre of gravity, with consequent changes in the chest muscles and even in the blood-vessels and nerves, all which must appear together or else none of the modifications could survive.

This difficulty has usually been met by the suggestion that among the enormous number of individuals which nature produces throughout a long duration of time there might easily appear one having all the necessary variations and that these would be rapidly strengthened by use. This answer, however, is far from satisfying. The whole force of the objection lies in the fact that all the modifications must appear simultaneously in one individual at least, which is as unlikely in the case of a million as it would be in the case of one, and no more probable yesterday than to-day. Here, again, recourse must be had to Weismann, as will be better understood from what we have to say in reference to the other objection of which our author treats.

This difficulty arises from the fact that there is frequently produced in nature an excess of some particular feature which goes beyond the requirements of utility and tends to the ultimate extinction of the animal possessing it. Many years ago Wallace dealt with this point in his *Natural Selection and Tropical Nature* (1878), and again in his *Darwinism* (1889), when he gave up the idea that sexual selection was an important factor of the problem.

Any excess, either of ornamentation or of bulk, becomes

a defect, hence we frequently find it displayed in species just previous to extinction, as exemplified in the abundant spines of the later trilobites and ammonites, the prodigious bulk of the small-brained saurians of Mesozoic times and the mighty mastodon of the Tertiaries, the intricately branched antlers of deer, the peacock's cumbrous tail, and the unwieldy gaudy wings of many moths.

On Weismann's lines all this is explained by the supposition, as Professor Thomson expresses it, 'that every independently heritable character is represented in the germplasm by a determinant.' The more vigorous the determinant, the more rapid will be the growth of the part or organ which it determines. In the course of generations the limit of utility may be passed, and then degeneration or even extinction of the species concerned occurs. Thus are explained the loss of the whale's hind limbs, the vanishing wings of apteryx and the absence of teeth in birds, as well as the extinction of the labyrinthodon, the mammoth, and the Irish elk. Probably the decorative peacock's tail might have acted similarly but for the intervention of man.

It is hoped that these illustrations of the character and modes of application of Weismann's theories will make them intelligible even to the non-scientific, as well as show the vast importance which those theories have gained in present-day scientific discussions. Time alone can reveal whether they will maintain that prominence and value which Dr. Wallace seems to attribute to them, but certainly they are an improvement on Darwin's ill-digested theory of pangenesis which they are designed to displace.[1]

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[1] Darwin explains his provisional theory of pangenesis in his *Variations of Animals and Plants under Domestication* (1875) (Vol. II. p. 369). Cells throw off minute gemmules which are transmitted from parent to offspring and circulate freely throughout the organism. Their development depends on their union with other partially developed gemmules which precede them in the regular course of growth. This may take place in the next generation, or the gemmules may continue dormant through several generations.

What remains for us to do now is to try to set before the reader some more definite account of Dr. Wallace's conception of the character and modes of action of that directive Power in nature for which, as we have said, he all along strenuously contends. The chapter on 'Birds and Insects as proofs of an organizing and directive life-principle' is, we consider, the finest in the whole book. The marvels displayed in the structure of feathers, the exquisite beauties of the microscopic scales on insects' wings, the mysteries of blood, the agency of those white corpuscles (phagocytes) by means of which the whole of the internal organs of larvae are liquefied into a creamy pulp which is to nourish the gradually maturing insect,—these and other kindred topics have a charm quite apart from the teleological use to which our author puts them. Especially it is emphasized that the forces at work in growth and reproduction are of a nature to require some power to guide them. Of this power and guidance no explanation is found in any of the mechanical or physiological interpretations of life and mind now current. 'To myself,' says Wallace (p. 295), 'not all that has been written about the properties of protoplasm or the innate forces of the cell, neither the physiological units of Herbert Spencer, the pangenesis hypothesis of Darwin, nor the continuity of the germ-plasm of Weismann, throw the least glimmer of light on this great problem.'

Such sentiments may not be entirely satisfactory to those who think that natural selection of itself explains everything in the universe, but they will be gladly received by theistic evolutionists. The truth is that thinking men are growing weary of the petrified materialistic philosophies which since the days of Comte have been obtruding upon the world their altogether unwarrantable claims to logical consistency and credibility. To the cry, 'Matter is all,' the antithesis is now becoming more and more clamant that 'Spirit is all.' Whether is it better to interpret the universe in terms of senseless matter or of intelligent spirit? Since Mme Curie's

marvellous achievements and the latest re-investigations of the atom, it has certainly become far easier to think of matter as spirit-force than of mind or spirit as nothing more than phenomena of matter; and if one of the two must be regarded as eternal, surely it is more rational to believe that spirit has always existed than that matter, even though possessed of volition, as Haeckel with incredible inconsistency postulates, should have been the eternally existing cause of all that is.

Among the attributes of this supreme guiding Power in nature, Dr. Wallace emphasizes the quality of benevolence. His chapter on the supposed cruelty of nature is very fine. Ever since Darwin's exposition of the struggle for existence there has been an under-current of belief that nature is rigidly merciless, 'red in tooth and claw.' Dr. Wallace gives his unique authority to more sane and moderate opinions. As the majority of lower animals have no nervous organization capable of intense sensation, and are not liable to those excruciating forms of mental anguish which belong exclusively to human beings, the objection loses half its force at one stroke. Besides, as Wallace points out, the 'red tooth and claw' are themselves in reality ministers of mercy. What lingering pain would be endured if there were no talon of bird, no claw of cat or tiger, to secure the wounded prey and ensure a speedy end to its fear and pain, or no poison fang or sting to benumb the creature which has been struck by the serpent or the scorpion!

Suffering and pain are of course realities. It is not necessary to demonstrate their absence from nature in order to establish the benevolence of the Creator. No one will affirm that mankind would be placed in more favourable conditions for progress if there were no capacity for suffering. It would have been better for some of the earlier experimenters with X-rays if they could have experienced some premonitions of the suffering that would ultimately ensue from the prolonged use of them. Pain is a necessary factor of evolution,

and even the lower animals must not be exempt from it if they are to advance to higher acquisitions. But pain is limited and temporary, while the beneficial results of it are enduring, perhaps eternal.

We wish that Dr. Wallace could have stopped here and contented himself with the sublime delineation of a supreme Mind in nature, originating and guiding all its processes, and actuated by the benevolent purpose to ensure universal happiness and perfection. But he has thought it necessary to introduce certain bizarre suggestions as to the precise mode of creation which will not only expose him to the antagonism of those who hold that all such speculations are beyond the proper province of science, but will also provoke opposition among those to whom he refers as 'the more or less ignorant adherents of dogmatic theology.'

It is disappointing, to say the least, after all the splendid affirmations of the absolute necessity of purpose and of a supreme First Cause in nature, which we meet with in almost every part of the volume, to find ourselves confronted with such passages as this: 'The organizing mind which actually carries out the development of the life-world need not be infinite in any of its attributes—need not be what is usually meant by the terms God or Deity' (p. 392). This does not mean that he denies infinity to the Deity, but only that infinity is not necessarily involved in all creational acts and in the processes of life-development.

A little further on is the still more startling statement: 'To claim the Infinite and Eternal Being as the one and only direct Agent in every detail of the universe seems to me absurd' (p. 400). In order to avoid this absurdity Wallace suggests that beings of a lowlier nature than that of the Deity may have been used as the agents of creation and may now be engaged in guiding all that is going on in nature. He supposes that these lower grades of beings, hierarchies of spirits or angels, may have had power to produce the primordial ether, from which another order of spiritual beings may

have formed distinct aggregations at suitable distances from each other. These eventually developed into suns and systems, into one or more of which, 'organizing spirits' introduced life, and by some sort of 'thought-transference' so acted upon the cell-souls as to enable them to 'perform their duties while the cells are rapidly increasing.' But because these organizers may not all be perfect in wisdom and skill there occur some defects in nature, evils which have to be remedied by further adaptations. Ultimately, however, the goal of perfection will be reached. All who give themselves to effort and struggle may hope to attain to that 'sublime height' whose splendours are described in a number of rhapsodical stanzas which we do not care to quote. Space and time will be conquered, the angel's invitation, 'Come up higher,' will be heard, and eternal happiness will be realized in—

> The land of Light and Beauty, where no bud of promise dies.

These speculations, originating from Wallace's well-known spiritualistic proclivities, are hazarded by him only as suggestions, and he would not claim that they add one feather's weight to the validity of his arguments for evolution or for the necessity of a directive Mind in nature; but as there is a danger lest their fanciful and occult character might for some be a reason for distrusting the author's views as to the reality of a supreme Creator of the universe, we regret their inclusion in a volume which otherwise is a valuable contribution to exact science and is pervaded by a genuinely religious spirit.

WILLIAM SPIERS.