

mena of organisation. Thus we have chapters on the struggle for existence, the variability of species of animals and plants in a state of nature, and under domestication or cultivation, on natural selection, the survival of the fittest, hybridisation, sterility, the objections to and the difficulties in the way of the full acceptance of the theory, and so forth.

#### THE COLOURATION OF PLANTS.

The reader, however, will find much new and interesting matter in the chapters on the colouration of animals and plants. This, when constant, must need be of some utility for protection, concealment, or as affording means of attraction and recognition. Adverting specially to flowers, Dr. Wallace has a chapter on the special colours of plants, their origin and purpose. He cites the case of *Mesembryanthemum*, and of an *Asclepiad*, so like the pebbles among which they were growing, as readily to be overlooked by predatory birds and insects. Similarly the colours of fruits, and the means provided for their dispersal, are of obvious utility. Here, it may be remarked that colour often exists where, so far as we know at present, it can be of no use. There are purple-skinned Potatos, Potatos with purple flesh, and others with yellow; Primrose stems are often purple though more or less buried in the soil; the germs of some plants are green while still within the seed-coats, and where no light can reach them. These facts may be and are co-related with others no doubt, but by themselves they seem of little utility.

The subject of the inter-relations between flowers and insects, of course, receives much attention at Mr. Wallace's hands, and he alludes to Mr. Henslow's observations on the vigour of self-fertilised plants, and to the notion that flowers of inconspicuous colour fertilised by wind-borne pollen, are not primitive forms, but degradations from other more brightly coloured flowers which were once adapted to insect-fertilisation. The facts of vegetable colouring, and those of close in-and-in breeding, or of cross-fertilisation, are truly, as Dr. Wallace says, complex, contradictory, and difficult of explanation. Referring especially to the colouration of flowers our author sums up as follows:—

"We thus see that the existing diversity of colour and of structure in flowers is probably the ultimate result of the ever-recurring struggle for existence, combined with the ever changing relations between the vegetable and animal kingdoms during countless ages. The constant variability of every part and organ, with the enormous powers of increase possessed by plants, have enabled them to become again and again readjusted to each change of condition as it occurred, resulting in that endless variety, that marvellous complexity, and that exquisite colouring which excite our admiration in the realm of flowers, and constitute them the perennial charm and crowning glory of Nature. . . . We cannot therefore deny the vast change which insects have produced upon the earth's surface, and which has been thus forcibly and beautifully delineated by Mr. Grant Allen. 'While man has only tilled a few level plains, a few great river valleys, a few peninsular mountain slopes, leaving the vast mass of earth untouched by his hand, the insect has spread himself over every land in a thousand shapes, and has made the whole flowering creation subservient to his daily wants. His Buttercup, his Dandelion, and his Meadowsweet grow thick in every English field; his Thyme clothes the hill side, his Heather purples the bleak grey moorland. High up among the alpine heights his Gentian spreads its lake of blue; amid the snows of the Himalayas his Rhododendrons gleam with crimson light. Even the wayside pond yields him the white Crowfoot and the Arrowhead, while the broad expanses of Brazilian streams are beautified by his gorgeous Water Lilies. The insect has thus turned the whole surface of the earth into a boundless flower garden, which supplies him from year to year with pollen or honey, and itself in turn gains perpetuation by the baits that it offers for its allurements.'"

Allowing for a little rhetorical licence this is substantially true, but it still leaves many contradictory

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## NOTICES OF BOOKS.

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**DARWINISM: AN EXPOSITION OF THE THEORY OF NATURAL SELECTION, WITH SOME OF ITS APPLICATIONS.** By Alfred Russel Wallace, LL.D., &c. (Macmillan & Co.)

(First Notice).

To those who have not familiarised themselves with the late Mr. Darwin's writings, or who were born in the post-Darwinian era, this volume will be very welcome, as containing an epitome of the doctrine of evolution and of the facts and phenomena upon which it is based. Such an epitome is likely to be welcome to the general reader, and it is specially valuable as being the work of one who must always share with Darwin the great honour of having forced the theory upon public attention, and eventually secured its general acceptance. Wallace arrived at his conclusions quite independently of Darwin, but from the employment of a like method, viz., the investigation and observation of plants and animals in various countries of the globe, and under varying conditions. Wallace, however, has not done so much in the way of confirmation of his views by actual experiment as Darwin did; he has not availed himself to so great an extent of the labours of the horticulturist; and, further, he differs from his great fellow-labourer on a most important point to which we shall subsequently refer.

Those of our readers whose memories enable them to realise for themselves the *status in quo ante* Darwin, and the prodigious effect that has been produced by the application of his theory or interpretation of the phenomena of Nature, will scarcely need to devote much time to the earlier chapters of Dr. Wallace's book. They constitute in substance—but of course with additions—an abstract or epitome of the chapters in the *Origin of Species* and of *Animals and Plants under Domestication*—those wonderful storehouses of facts concentrated and brought to bear upon the rational explanation of the pheno-

facts unexplained, as Dr. Wallace goes on to point out. His final conclusions on this subject are summed up in the following passage:—

"In studying the phenomena of colour in the organic world we have been led to realise the wonderful complexity of the adaptations which bring each species into harmonious relation with all those which surround it, and which thus link together the whole of nature in a network of relations of marvellous intricacy. Yet all this is but, as it were, the outward show and garment of Nature, behind which is the inner structure—the framework, the vessels, the cells, the circulating fluids, and the digestive and reproductive processes, and behind these again those mysterious chemical, electrical, and vital forces which constitute what we term life. These forces appear to be fundamentally the same for all organisms, as is the material of which all are constructed; and we thus find behind the outer diversities an inner relationship which binds together the myriad forms of life.

"Each species of animal or plant thus forms part of one harmonious whole, carrying in all the details of its complex structure the record of the long story of organic development; and it was with a truly inspired insight that our great philosophical poet apostrophised the humble weed—

"Flower in the crannied wall,  
I pluck you out of the crannies,  
I hold you here, root and all, in my hand,  
Little flower—but if I could understand  
What you are, root and all, and all in all,  
I should know what God and man is."

The chapter on geographical distribution is one of the most interesting in the book. We have to account for the presence of particular plants in particular countries. This is sometimes, of course, easy, and is explained by proximity and facility of diffusion and intercommunication by birds, winds, insects, &c. At other times it is hard indeed to account for the presence of like plants in areas widely sundered, and still more to understand their absence where existing conditions appear favourable to their presence. Madagascar and Africa are not remote, and yet we are told that their productions, vegetable and animal, are more unlike than are those of Japan and England. A like diversity exists in the productions of Australia and New Zealand, in spite of their proximity. On the other hand, the tapirs are found on the opposite sides of the globe, in the Malayan Islands and in the tropics of America respectively, but not in the intervening countries. The clue to some of these problems has already been mentioned, changes of climate, successive glacial periods, alternations of cold and heat, will account for a great deal; the comparative permanence of oceanic and continental areas, through enormous periods of time (contrary to what was once supposed), offers a satisfactory explanation of other points, especially when studied in connection with the distribution of fossil forms in Tertiary times.

All the oceanic islands of the globe are now known to be of volcanic or of coral formation, and the coral islands themselves probably rest on a volcanic basis.

#### MIGRATIONS OF PLANTS.

Such islands in either case must get peopled from other countries. The manner in which this migration is effected is illustrated by some remarkable cases cited from Mr. Hemsley and others. We may mention one.

"A very remarkable case of wind conveyance of seeds on a large scale is described in a letter from Mr. Thomas Hanbury to his brother, the late Daniel Hanbury, which has been kindly communicated by Mr. Hemsley, of Kew. The letter is dated 'Shanghai, May 1, 1856,' and the passage referred to is as follows:—

"For the past three days we have had very warm weather for this time of year, in fact, almost as warm as the middle of summer. Last evening the wind changed suddenly round to the north, and blew all night with considerable violence, making a great change in the atmosphere.

"This morning myriads of small white particles are floating about in the air; there is not a single

cloud and no mist, yet the sun is quite obscured by this substance, and it looks like a white fog in England. I enclose thee a sample, thinking it may interest. It is evidently a vegetable production. I think apparently some kind of seed."

"Mr. Hemsley adds, that this substance proves to be the plumose seeds of a Poplar or Willow. In order to produce the effects described—*quite obscuring the sun like a white fog*—the seeds must have filled the air to a very great height, and they must have been brought from some district where there were extensive tracts covered with the tree which produced them."

Dr. Wallace sums up what he has to say about geographical distribution by stating that the chief facts can now be sufficiently understood, and that cases of difficulty and anomaly are usually dependent on our ignorance of some of the essential factors of the problem, such as the distribution of the group in recent geological times, or the special methods by which the organisms are able to cross the seas.

#### GEOLOGICAL EVIDENCE.

Passing to the geological evidence of evolution, Dr. Wallace is able to show that the imperfection of the record on which Darwin insisted so strongly, is less marked now than it was, owing to the increase of knowledge, and the discovery of abundance of "missing links," whose existence was previously unknown, or whose significance was unsuspected. The pedigree of the horse, for instance, has been clearly demonstrated. The geological history of plants, though full of anomalies, is, on the whole, favourable to the evolution theory.

#### OBJECTIONS TO THE THEORY OF NATURAL SELECTION.

In the fourteenth chapter the author discusses some of the fundamental objections to the theory of evolution, alludes to the use and disuse of organs, to the direct action of circumstances, and discusses the views of modern naturalists like Herbert Spencer, Dr. Cope, Dr. Karl Semper, and Mr. Patrick Geddes, the latter of whom considers that much that has been imputed to natural selection may, in reality, be attributable to the natural antagonism of vegetative as compared with reproductive growth. Allusion is also made to the remarkable experiments of Mr. Galton, who seeks to establish a law of "regression towards mediocrity," showing that whenever there has been a variation by increase or by defect there is a tendency in the offspring to revert to a mean or average condition, and this "mean" appears to be not the mean of the actually existing individuals, but a lower mean, or that from which they had been recently raised by selection.

We cannot here follow Dr. Wallace in his arguments; suffice it to say that he dismisses the theories of the authors we have mentioned as inadequate to explain the phenomena, and while allowing them a measure of importance, concludes by saying that "natural selection" is supreme to an extent which even Darwin himself hesitated to claim for it.

(To be continued.)

absolutely identical that up to a comparatively late stage of development it is impossible to say from mere inspection whether the embryo will develop into a dog or into a man. All this may now be looked upon as certain as anything can be. The evidence is overwhelming and conclusive. But as to the faculties that distinguish man from the beasts of the field—conscience and the mental and moral nature—Dr. Wallace strongly opposes the notion that they have any continuity or relation to the phenomena witnessed in animals. This is not the place to enter at length into a discussion of so important a matter. It must suffice briefly to indicate the nature of the arguments made use of by Dr. Wallace. In the first place he alludes to the mathematical faculty, its almost total absence in savages, its sudden outburst, and its wonderful development in quite recent times, facts hardly compatible with the usual measured course of small beginnings, progressive development and adaptation. Similar remarks are made with reference to the origin and diffusion of the artistic and musical faculties, and to the possession of the faculty of wit and humour.

"The special faculties we have been discussing," continues Dr. Wallace, "clearly point to the existence in man of something which he has not derived from his animal progenitors—something which we may best refer to as being of a spiritual essence or nature, capable of progressive development under favourable conditions. On the hypothesis of this spiritual nature, superadded to the animal nature of man, we are able to understand much that is otherwise mysterious or unintelligible in regard to him, especially the enormous influence of ideas, principles, and beliefs over his own life and actions. Thus alone we can understand the constancy of the martyr, the unselfishness of the philanthropist, the devotion of the patriot, the enthusiasm of the artist, and the resolute and persevering search of the scientific worker after Nature's secrets. Thus we may perceive that the love of truth, the delight in beauty, the passion for justice, and the thrill of exultation with which we hear of any act of courageous self-sacrifice, are the workings within us of a higher nature which has not been developed by means of the struggle for material existence."

As to the difficulty on this view in conceiving the introduction and occurrence of new causes and influences in the chain of continuity, we are reminded that there are in all living beings three stages when some new cause or power must necessarily have come into action.

"The first stage is the change from inorganic to organic, when the earliest vegetable cell, or the living protoplasm out of which it arose, first appeared. This is often imputed to a mere increase of complexity of chemical compounds; but increase of complexity, with consequent instability, even if we admit that it may have produced protoplasm as a chemical compound, could certainly not have produced living protoplasm—protoplasm which has the power of growth and of reproduction, and of that continuous process of development which has resulted in the marvellous variety and complex organisation of the whole vegetable kingdom. There is in all this something quite beyond and apart from chemical changes, however complex; and it has been well said that the first vegetable cell was a new thing in the world, possessing altogether new powers—that of extracting and fixing carbon from the carbon dioxide of the atmosphere, that of indefinite reproductions, and still more marvellous, the power of variation and of reproducing those variations till endless complications of structure and varieties of form have been the result. Here, then, we have indications of a new power at work, which we may term vitality, since it gives to certain forms of matter all those characters and properties which constitute life.

"The next stage is still more marvellous, still more completely beyond all possibility of explanation by matter, its laws and forces. It is the introduction of sensation or consciousness, constituting the fundamental distinction between the animal and vegetable kingdoms. Here all idea of mere complication of structure producing the result is out of the question. We feel it to be altogether preposterous to assume that at a certain stage of complexity of atomic constitution, and as a necessary result of that complexity alone, an *ego* should start into existence—a thing that feels—that is conscious of its own existence.

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## NOTICES OF BOOKS.

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**DARWINISM: AN EXPOSITION OF THE THEORY OF NATURAL SELECTION, WITH SOME OF ITS APPLICATIONS.** By Alfred Russel Wallace, LL.D., &c. (Macmillan & Co.)

(Second Notice).

**DARWINISM APPLIED TO MAN. THE SPIRITUAL LIFE.**

By far the most interesting and novel chapter in the book is the last. It is the only one in which the author really, or apparently, breaks away from Darwinian principles. His former chapters have been exclusively devoted to the illustration or to the expansion of the theory of natural selection as expounded by Darwin; but in his chapter on "Darwinism as applied to Man," Dr. Wallace propounds different views. The material construction of man presents no fundamental difference from that of animals. Whether the notion is agreeable to him or not, the fact remains that man corporeally is an animal, his conformation is the same, the mode of his development and growth is so

Here we have the certainty that something new has arisen—a being whose nascent consciousness has gone on increasing in power and definiteness till it has culminated in the higher animals. No verbal explanation or attempt at explanation—such as the statement that life is the result of the molecular forces of the protoplasm, or that the whole existing organic universe from the amæba up to man was latent in the fire-mist from which the solar system was developed—can afford any mental satisfaction, or help us in any way to a solution of the mystery.

“The third stage is, as we have seen, the existence in man of a number of his most characteristic and noblest faculties—those which raise him furthest above the brutes, and open up possibilities of almost indefinite advancement. These faculties could not possibly have been developed by means of the same laws which have determined the progressive development of the organic world in general, and also of man's physical organism. These three distinct stages of progress from the inorganic world of matter and motion up to man, point clearly to an unseen universe—to a world of spirit—to which the world of matter is altogether subordinate. To this spiritual world we may refer the marvellously complex forces which we know as gravitation, cohesion, chemical force, radiant force, and electricity, without which the material universe could not exist for a moment in its present form, or perhaps not at all . . . and still more surely can we refer to it those progressive manifestations of life in the vegetable, the animal, and man, which we may classify as unconscious, conscious, and intellectual life . . .”

“We thus find that the Darwinian theory, even when carried out to its extreme logical conclusion, not only does not oppose, but lends a decided support to, a belief in the spiritual nature of man. It shows us how man's body may have been developed from that of a lower animal form under the law of natural selection; but it also teaches us that we possess intellectual or moral faculties which could not have been so developed, but must have had another origin; and for this origin we can only find an adequate cause in the unseen universe of Spirit.”

With this extract we must close our notice of a book which appeals to the curiosity, the intelligence, the sympathy of all readers.

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