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## XII.—Wallace on *Natural Selection*.<sup>1</sup>

THOSE of our readers who have devoted any attention to the history of the development of the theory of natural selection are well aware that it was independently and almost simultaneously originated by Mr. Darwin and the author of the volume that stands at the head of this article. The public at large, however, who are little given to the accurate study of such subjects, can scarcely be expected to understand the relative claims of these two naturalists, and hence we think that Mr. Wallace has done wisely in republishing in this volume the essays in which he origi-

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<sup>1</sup> *Contributions to the Theory of Natural Selection; a series of Essays.* By ALFRED RUSSEL WALLACE, Author of "The Malay Archipelago," &c. London, 1870.

nally developed his views. The essay on which his claims to be a co-discoverer with Darwin essentially rests was written at Ternate, in the Malay Archipelago, in February, 1858, and published in the 'Journal of the Proceedings of the Linnean Society' for August of the same year; an outline of Mr. Darwin's views also appearing in the same number of the journal. We cannot sufficiently admire the modesty with which Mr. Wallace speaks of his own labours:

"The present work will, I venture to think, prove that I both saw at the time the value and scope of the law which I had discovered, and have since been able to apply it to some purpose in a few original lines of investigation. But here my claims cease. I have felt all my life, and I still feel, the most sincere satisfaction that Mr. Darwin had been at work long before me, and that it was not left for me to write 'The Origin of Species.' I have long since measured my own strength, and know well that it would be quite unequal to this task."

The earliest of the ten essays contained in this volume appeared in 1855, and the latest in 1869, and they are collected from the 'Annals of Natural History,' the 'Proceedings' and 'Transactions of the Linnean Society,' the 'Intellectual Observer,' the 'Journal of Travel and Natural History,' the 'Quarterly Journal of Science,' and from the 'Anthropological,' 'Quarterly,' and 'Westminster' Reviews. Our limited space will only allow us to notice a few of the most remarkable of these essays, and we shall begin with the second, "On the Tendency of Varieties to depart indefinitely from the Original Type," which may almost be regarded as a syllabus of the most important chapters of the then unpublished 'Origin of Species.' The author, after noticing the common belief "that *varieties* occurring in a state of nature are in all respects analogous to or identical with those of domestic animals, and are governed by the same laws as regards their permanence or further variation," states that the object of this paper is to prove

"that this assumption is altogether false, that there is a general principle in nature which will cause many *varieties* to survive the parent species and to give rise to successive variations, departing further and further from the original type, and which also produces in domesticated animals the tendency of varieties to return to the parent form."

Here we clearly have the idea of the formation of species by the method of natural selection, and the author establishes his case by the following line of reasoning. He begins by a reference to "the struggle for existence" in wild animals, and by briefly noticing the conditions which determine not only the population of a species but the excess or abundance of some species, while others closely allied to them are very rare. If we take birds, for example (and the remark applies

equally to all organized beings), we see that while they multiply in a constant and rapid succession — few birds producing less than two young ones in the year, while many have six, eight, or ten—the average number of individuals existing in any country does not increase; hence, on the lowest calculation, whatever be the average number of any species of bird in a given area, *twice that number must perish annually*, and as the individual existence of each animal depends upon itself, those that die must be the weakest — the very young, the aged, and the diseased; while those that can prolong their existence can only be the most perfect in health and vigour—those that are best able to obtain food regularly and avoid their numerous enemies. It is “a struggle for existence,” in which the weakest and least perfectly organized must always succumb. He proceeds to show that the abundance or rarity of a species is dependent upon its more or less perfect adaptation to the conditions of existence; that useful varieties will tend to increase, while useless or hurtful varieties will diminish; and that superior varieties will ultimately extirpate and replace the original species. The partial reversion of domesticated varieties is then explained, and the author shows how “domestic varieties, when turned wild, *must return to something near the original wild stock, or become altogether extinct.*” After pointing out how completely the view that he is propounding differs from Lamarck’s hypothesis, he concludes by expressing his belief that he has shown that

“there is a tendency in nature to the continued progression of certain classes of *varieties* further and further from the original type—a progression to which there appears no reason to assign any definite limits;”

and that this progression, by minute steps, in various directions, but always checked by certain necessary conditions, may serve to explain “all the phenomena presented by organized beings, their extinction and succession in past ages, and all the extraordinary modifications of form, instinct, and habits which they exhibit.”

In his essay on “Mimicry and other Protective Resemblances amongst Animals,” Mr. Wallace makes an important application of Darwin’s law or principle of utility. He begins by showing that the popular theories of colour in animals break down on examination, and by observing that it was reserved for the theory of natural selection to solve this question. In sketching the series of phenomena which may be classed under the head of useful or protective resemblances, he begins by noticing the importance of concealment as influencing colour, and, after quoting numerous illustrative cases, proceeds to consider special modifications of colour. If the lion is enabled by his sandy colour to conceal himself by merely crouching down upon the desert, how do the elegant markings of the tiger and many other large cats accord with this theory? The author replies to

this supposed question, that these are generally cases of special adaptation. The vertical stripes on the body of the tiger assimilate with the vertical stems of the bamboos and other plants amongst which he hides, while the spotted skins of the other large cats which are arboreal in their habits, serve to blend them with the foliage. Amongst birds the ptarmigan is a remarkable case of special adaptation, its summer plumage harmonising with the stones among which it delights to sit, while in winter its white plumage affords it similar protection on the snow. The colours of the woodcock, snipe, wood-dove, robin redbreast, &c., likewise present admirable illustrations of the same kind. The arboreal lizards and frogs are for the most part as green as the foliage amongst which they live, while there is a North American frog which so exactly corresponds in colour with the lichen-covered rocks and walls on which it is found as to be quite safe from detection as long as it does not move. Moreover, cases of the same kind occur among fishes. Passing over the familiar example of the flatfish of our own coasts, which exactly resemble the sea-bottom on which they rest, we may notice the Australian sea-horses (*Hippocampus*), some of which are of a brilliant red colour, and live amongst sea-weeds of precisely the same tint. It is, however, from the insect world that Mr. Wallace draws most of his illustrations. There is a beetle which is found only on a rough-barked tree on the Amazon, which so exactly resembles the bark that, until it moves, it is absolutely invisible! There are butterflies in India and Sumatra in which the exposed surface of the wings, when they are at rest on a twig, not only imitates a shrivelled leaf in form and venation, but the wings appear variously blotched and mildewed, as if they had been covered with minute fungi; "their size, colour, form, markings, and habits all combining to produce a disguise which may be said to be absolutely perfect." Most of our readers are probably conversant with the "walking-leaf insects," in which not only are the wings perfect imitations of leaves, but the thorax and legs are leaf-like; and with the "walking-stick insects," some of which are a foot long and as thick as the finger, in which the arrangement of the parts is such as to render them absolutely identical in appearance with dead sticks.

We now enter upon the discussion of another set of phenomena. Hitherto we have been noticing cases in which animals are protected by means of their colour either concealing them, or making them resemble vegetable or mineral matter. The essay now proceeds to consider creatures which are for the most part very conspicuous, and which owe their safety to their completely resembling in outward appearance some creature of quite a different group which usually happens to be unfit for food from its noxious taste, poisonous qualities, &c. This is now commonly known as *mimicry*, and although it was noticed by Kirby and Spence in a few cases as a protective agency,

its full bearing has only been recognised during the last few years by Bates, Murray, and the author of the present volume. From the investigation of a large number of cases, Mr. Wallace has deduced the following laws in relation to mimicry:

1st. That in an overwhelming majority of cases the creatures (or the groups) which resemble each other inhabit the same country and the same district, and in most cases are to be found together at the very same spot.

2nd. That such resemblances are not indiscriminate, but are limited to certain groups, which in every case are abundant in species and individuals, and can often be ascertained to have some special protection.

3rd. That the species which mimic these dominant groups are comparatively less abundant in individuals, and are often very rare.

From the vast collection of cases we can only find room for two or three illustrations. Certain families of our own day-flying moths so strongly resemble the stinging Hymenoptera that they have received the specific names of *apiformis*, *vespiformis*, *craboniformis*, &c. There is a South American longicorn beetle that derives its specific name from its resemblance to a small bee of the genus *Melipona*, its body and thorax being extremely hairy, and its legs tufted in a remarkable manner, while another is so like a small common wasp of the genus *Odynerus* that Mr. Bates tells us he was afraid of taking it out of the net with his fingers. There is a genus of small spiders in the tropics which feed on ants, and they are exactly like the ants themselves, while there is in South America a Mantis which exactly resembles the Termites on which it feeds, the similarity in these cases giving the mimickers an opportunity for securing their prey. Lastly, there is a large South American caterpillar which startled its discoverer, Mr. Bates, by its close resemblance to a poisonous viper, the first three segments behind the head being dilatable at pleasure, there being two large black pupillated spots in the position of the eyes, and the crown presenting an appearance of keeled scales produced by the recumbent feet, as the caterpillar threw itself backwards.

We must pass over the next five essays with the remark that those on instinct and on the philosophy and theory of birds' nests are especially deserving of notice, and shall conclude our observations on this instructive and very suggestive volume with a brief analysis of the author's theory regarding "the Development of Human Races under the law of Natural Selection." In this and in the final essay on "the Limits of Natural Selection as applied to Man," he diverges at a certain point from the rigid Darwinism which he has inculcated in the earlier part of the book.

While there is now a very general agreement regarding the question of the antiquity of man, there is still great diversity of opinion

regarding the question as to whether man is of one or many species. While one party resolutely maintain that man belongs to a *single species*, and that differences of colour, &c., are but local and temporary variations produced by the various influences and conditions to which he is exposed, the other party, basing their conclusions on the same facts, assert that man is a genus of *many species*, "each of which is practically unchangeable, and has ever been as distinct or even more distinct than we now behold them." It is the author's object in this essay, which originally appeared in 1864, to harmonise these conflicting theories by means of the law of Natural Selection. After summing up the arguments adduced in favour of the unity of mankind, and likewise those in support of the original diversity of man, he decides that "the best of the argument is on the side of those who maintain the primitive diversity of man." He then goes on to show that while Natural Selection exerts an undivided power upon the rest of the organic world—

"Man, in two distinct ways, has escaped the influence of those laws which have produced unceasing change to the animal world. (1) By his superior intellect he is enabled to provide himself with clothing and weapons, and, by cultivating the soil, to obtain a constant supply of congenial food. This renders it unnecessary for his body, like those of the lower animals, to be modified in accordance with changing conditions, so as to gain a warmer natural covering, to acquire more powerful teeth or claws, or to become adapted to obtain and digest new kinds of food, as circumstances may require. (2) By his superior sympathetic and moral feelings he becomes fitted for the social state; he ceases to plunder the weak and helpless of his tribe; he shares the game which he has caught with less active or less fortunate hunters, or exchanges it for weapons; he saves the sick and wounded from death; and thus the power which leads to the rigid destruction of all animals which cannot in every respect help themselves is prevented from acting on him."

Previously to the time when the social and sympathetic feelings of man came into active operation, he or his progenitor was under the same power of natural selection as other organisms, but *then* the form of his *body* became stationary, while his *head* and *brain* have alone undergone modifications such as occur in other animals generally. In the fact of man's physical structure ceasing, at the period above indicated, to be effected by the operation of natural selection, we have the clue to the origin of races; for those great modifications of external colour and form which—

"resulted in the development of man out of some lower type of animal must have occurred before his intellect had raised him above the condition of the brutes, and before he possessed the power of speech, at a period when he was gregarious, but scarcely social, with a mind perceptive but not reflective, ere any sense of *right* or feeling of *sympathy* had been developed in him."

This view enables or even requires us to place the Origin of Man at a much more remote ethnological epoch than has been yet thought probable. Mr. Wallace thinks that he may even have lived in the Miocene or Eocene period, when not a single mammal was identical in form with any existing species. For in the long series of centuries during which the primæval animals have been modified into their present representatives, the power that occasioned these changes in them would merely affect the brain and mental organization of man. We can thus understand how the celebrated Denise and Engis skulls agree so closely with existing forms, although their owners were contemporaneous with mammalia now extinct; while the Neanderthal skull may have belonged to one of the lowest races then existing, corresponding to the Australian of the present epoch.

Hitherto we have been looking back at the dark vistas of the mysterious *past*. Let us conclude with a cheering prophetic vision of the *future* of the human race. If our author's conclusions are correct, and no one can doubt that they have been most carefully worked out,

“it must inevitably follow that the higher—the more intellectual and moral—must displace the lower and more degraded races; and the power of ‘natural selection,’ still acting on his mental organisation, must ever lead to the more perfect adaptation of man's higher faculties to the conditions of surrounding nature, and to the exigencies of the social state. While his external form will probably ever remain unchanged, except in the development of that perfect beauty which results from a healthy and well-organized body, refined by the highest intellectual faculties, his mental constitution may continue to advance and improve, till the world is again inhabited by a single nearly homogeneous race, no individual of which will be inferior to the noblest specimens of existing humanity.”