Contribution to the theory of Natural Selection. By ALFRED RUSSEL WALLACE. Macmillan and Co., 1870.

THE series of Essays collected into one volume, under the above title, by the sagacious naturalist of the Malay Archipelago, has, with the exception of one Essay, been already published in various periodicals. The vein of thought which runs through them is so original and characteristic of the author, that it is well that they should be given to the public in this form, although some of these Essays seem to have little to do with the 'theory' which has of late occupied so much of the attention of naturalists; and the concluding ones raise a grave exception to the universal application of natural selection in the evolution of organisms. It is a rare luxury to read the works of a man who goes so directly to nature for his facts, and to his own experience for illustrations; who is so little trammelled by the preconception of others, and whose acquaintance with his subject is so wide and so minute that his speculations are always noteworthy if not convincing. In keenness of observation, in logical power, in courage, and in candour, Mr Wallace is only second to the author of the Origin of Species, who, coming after him, Mr Wallace is content should be preferred before him. By his clearness and vigour of thought and expression, he has succeeded in presenting the results of great labour in such a manner as to abstract all labour from the reception of them.

The first three Essays have already attracted a large amount of public attention. The first two mainly because Mr Darwin accredits the author with having arrived at almost exactly the same conclusions as himself on the origin of species; and the latter on 'mimicry,' because it was published in so popular a form and in so widely-read a publication as the *Westminster Review;* and also because of the great interest of the subject, and the intrinsic merit of the manner in which it was treated. It may safely be predicted that the study of the subject of 'Mimicry' will reveal a multitude of interesting and suggestive facts from fields already explored, as well as from every fresh hunting-ground of the naturalist; and that Mr Wallace's clear and masterly article will always be recognized as having furnished the impetus which gave direction to this line of enquiry.

In estimating the share which Messrs. Darwin and Wallace have respectively taken in enunciating the 'theory of Natural Selection,' we must exercise our own judgments, as each of these distinguished men manifests a generous desire to attribute to the other more than his due. The priority of publication is clearly with Mr Wallace. It was the second of these Essays, which Mr Darwin tells us precipitated the publication of his best-known work; although there is little evidence of precipitation to be found in its pages. The general

proposition that "every species has come into existence coincident both in time and space with a pre-existing closely allied species," which is the Q. E. D. of the first essay, coupled with "the tendency of varieties to depart indefinitely from the original type," which is the subject of the second, points directly to the derivative origin of species. In these two Essays the author may be said to have traced the chain of evolution from either end until the investigations overlap each other and have passed the point of junction. Nevertheless he has nowhere boldly grasped the idea of derivative origin—that idea which has proved such a nettle in the hands of others. His omission to do this when the facts seemed to point so directly to that conclusion, will be looked upon by some as a want of courage, and by others as an exhibition of commendable scientific caution. As, however, the only original and most valuable part of Darwin's work consists, not in the demonstration that variation may be exaggerated until it amounts to a specific distinction, but in the method by which this is accomplished; and this *modus operandi* is certainly distinctly sketched out by Wallace in lines of thought so parallel with those of the authors of the Origin of Species, as to have prompted an absolute identity in many of the phrases employed by both; we think that no insignificant share in the honour which attaches to the grand generalization belongs to the author whose merits we are now discussing.

We need scarcely make any comment on the 'Malayan Papilionidæ.' In this Essay the author occupies ground which is peculiarly his own. He thinks the study of this family of special value as applied to illustrate natural selection. His treatment of the subject, including the wonderful phenomena of polymorphism, dimorphism, and mimicry, is very similar and not a whit inferior to F. Müller's discussion of the wider group of crustacea in reference to the same theory.

The short chapter on instinct is admirably clear and sagacious; and his deduction that the capability of the savage to travel unerringly through unknown and trackless forests, is due to intelligence and not to instinct, is wholly convincing. Probably, however, thoughtful and scientific men have never thought otherwise. That the faculties of observation and memory may perform wonders by being long and almost exclusively directed to accomplish one end, is quite as well exhibited by the facts of the conjuror whose disciplined eye can detect in one instantaneous glance accurately and distinctly enough to inform the memory, the nature of a whole hand of cards, as by the savage at home in the wilderness. Both feats are no doubt due to education, which is exactly the element which is wanting in all instinctive acts. How this Essay on instinct is connected with natural selection may be traced in the two succeeding ones. In the first of these there is a very ingenious comparison between the construction of his habitation by man and the nesting of birds. An attempt is made to represent these as precisely parallel acts by attributing the building habit in man to the exercise of a lower faculty than reason, while in the bird it is referred to a higher mental power than instinct. Mr Wallace thinks the imitative habit, de-

pendent as it is on observation, memory, and that limited amount of reason which is exhibited both by animals and the human race, is sufficient to account for all habitable structures from the Doric temple to the rook's nest. We do not doubt that there is more analogy between the human and aërial architect than a *primâ facie* view of the case would indicate; but surely there is an *analogy* and not an *identity*. Although our instinctive acts are so dominated by our reason that they are with difficulty detected and circumscribed, yet we are conscious of both instinctive and intelligent acts. The building of our houses is not an instinctive act, while the nidification of birds certainly does appear to be the "performance of a complex act absolutely without instruction or previously acquired knowledge," which is Mr Wallace's own definition of instinct. Mr Wallace disputes the latter part of this assertion; and before offering a few remarks in support of it, it is only fair to admit that he has brought forward some striking facts and analogies which clearly strengthen his view of the case. We certainly should have supposed that the song of the bird was an instinctive, but experience proves it to be an imitative act. That birds alter their nests when altered conditions require it, is made familiar to us by the very various nests constructed by the house-sparrow, and this cannot be referred to an altered instinct, because these various nests are constructed at the same period by the same species. Mr Wallace also points out that his theory is capable of disproof, and challenges the experiment. "No one," says he, "has ever yet obtained the eggs of some bird which builds an elaborate nest, hatched these eggs by steam or under a quite distinct parent, placed them afterwards in an extensive aviary or covered garden, where the situation and the materials of a nest similar to that of the parent birds may be found, and then seen what kind of nest these birds would build." In a former Essay he writes he expects facts alone to be brought to disprove his theory, not *à priori* arguments against its probability. We sincerely trust some enthusiastic young naturalist will make the *experimentum crucis* indicated, but in the meantime does not nature supply us with a fact? Why does not the cuckoo before laying her eggs construct an exact facsimile of the hedge-sparrow's nest in which she was reared? The author seems to forget that his own theory is positive, and the converse experiment is necessary to complete its proof, and a "point which can be proved should not be assumed." It is true this might be allowed if instinct were a "totally unknown power," and unreasoning imitation a thoroughly explained propensity. The author however does not absolutely deny the existence of instinct. Indeed! he has defined and illustrated it. Instinct is therefore a *vera causa*, and unreasoning imitation is an unexplained phenomenon. Thus the question recurs; why do birds build a nest at all? Why does not the imitative propensity come into play at once and always, instead of at the period exactly before parturition? How is it that a bird builds without assay or failure! Why does she not build mimic nests as children construct grottoes and houses of cards? In man the inducement to build is personal and pressing. Sharp winds, drenching

rain, and scorching suns—to say nothing of unprotected property, and the person exposed to night attacks from enemies—are present evils which appeal to his reason for a prompt remedy. The feathered bird has no care for herself or the fragile egg she yet carries, unless she possess some faculty far other than those which prompt to purely imitative acts. If the author's theory be the true one, a bird must have the faculties necessary to correct imitation in far higher degree than man. How many of us, though we have lived in houses all our lives, could construct a habitation, even though we had the materials ready to hand, which would keep out rain or not fall in less than a twelvemonth, if we did not consult a professional builder? This is not because of the complexity of the structure. A child taken from a hut of wattle and daub could not construct a like one unless he was shown how to do so; or if by returning and examining it and pulling it to pieces he should accomplish this feat, it would be by the exercise of the reasoning powers. It may be safely stated that man builds his habitation by imitation far more than the bird. If he had to examine his dwelling and think for himself how each part was constructed and put together, the process would be laborious in the extreme; but, in fact, before he begins to build he not only looks on while other houses are built, but he is instructed how to put each part together. On the other hand, the bird has never seen its cradle woven. If it builds one like it, strictly speaking it is not an imitative act at all, but a series of deductive reasonings and constructive acts. Again, if the bird were bent on repeating a number of acts which it has never witnessed but only derived from a study of the results which lie around it, how could it distinguish which part of the structure it must supply and which part must be looked for ready made. The house-martin, unless it had a better estimate of the limits of its powers than young persons usually have, would begin to build the house before it placed the nest under the eaves. Why do not the American wren and purple martin, which are so constantly reared in the small cigar-boxes furnished by their kindly hosts, begin at the beginning, and frame, or endeavour to frame, the box first? Under this supposition, the European stork would become by this time an accomplished wheelwright, since it is the custom of farmers to place wheels in their outbuildings to lodge the nests of these birds. Of course these illustrations are extravagant, but they best exhibit the difficulty that according to this theory the bird has at the very outset of its undertaking to go through two processes of ratiocination, and determine first that the nest in which it was reared was made, and secondly that it can make one like it. The explanation of the above difficulties is to be found in the fact that man is prompted to build by reason, and builds as he does by imitation, while the birds build and are compelled to build by an impulse which is more akin to reflex action of the nervous system than to those acts which involve intelligence and will. We have some remnants of this strange impulse revealed to us by our own consciousness, and it is therefore not illogical to attribute the acts of animals which admit of no other explanation to this true cause. It

is singular that the province of instinct should be represented as so narrow and circumscribed by an advocate of the theory of natural selection; for the existence of habits, not based on any reasoning process, which nevertheless adapt their possessors admirably to existing, but not permanent, circumstances is one of the phenomena which are best explained by this theory.

The next Essay is devoted to the proof of the law that when both sexes of birds are of strikingly gay and conspicuous colours, the nest is such as to conceal the sitting bird; while, whenever there is a marked contrast of colours, the male being gay and conspicuous, the female dull and obscure, the nest is open and the sitting bird exposed to view. Notwithstanding the numerous exceptions to this law, which are very candidly presented, its existence as a rule or generalized truth must be admitted. Natural selection may operate in making the male bird conspicuous. It must, if it have any operation at all, tend to render the female who sits on an open nest inconspicuous. But we are brought by these considerations face to face with the problem of the beauty of organisms. The facts teach us that in the class Aves and the order Lepidoptera,—the two divisions which have most occupied the attention of the author,—there is a strong tendency, a *nisus*, towards the development of colours so varied, contrasted, and arranged into patterns, as to create in us the pleasurable sensation whose exciting cause we call beauty. The colour, contrasts, and patterns are so disconnected from the structures which lie beneath and so independent of the subjective vital functions, that they offer the best instances of beauty pure and simple (*i.e.*), beauty severed from use or advantage. The fitness which natural selection spares, as a sculptor leaves the statue by clipping away the remainder of the block, can only relate to concealment and conspicuousness. All must agree with Mr Wallace that concealment is a sufficient explanation of the plainness of the otherwise unprotected female; but will the advantage of conspicuousness account for all the variety and beauty displayed in the males throughout the groups referred to? It must be constantly remembered that there is no place for beauty, except as it is connected with advantage of some kind, in the Darwinian hypothesis. In order to account for beauty, the hypothesis of natural selection must be supplemented by that of sexual selection; and to this cause Mr Wallace confidently appeals in order to meet the Duke of Argyll's well-urged objections to the theory. Now, the theory of sexual selection of course is no part of the theory of natural selection. It involves considerations quite different from it, and it rests upon very imperfect and scanty information. The public is looking forward with keen interest to the further elucidation of this subject in Mr Darwin's promised work, but at present sexual selection is hardly established as a *vera causa*. Assuming its existence in the animal world it presents the following difficulties and anomalies:

1. We should certainly have expected that the operation of sexual selection in producing beauty would be manifested in the sex that is sought and pursued rather than in the pursuers, but this is

quite the reverse of the fact. Not only among birds where the author's law may sufficiently account for it, but throughout the whole animal kingdom, beauty, as estimated by the human æsthetic faculty, adheres to the male sex:—to the sex which chooses and not to the sex which yields.

2. In the rude commerce of the sexes among animals as we observe it, it is probable that an excess of strength, speed, and that vigour which gives persistency in the male, would have completely dominated the superiority in grace and beauty which can only succeed by commending itself to the fastidious taste of the female—the sex of whose passions it has been bitterly written, "Nature made them blinder motions bounded in a shallower brain."

3. If all beauty, so far as it is dissociated from advantage, is due to the modification which the æsthetic appetency imposes on the sexual passion, we must attribute to whole classes and orders of animals, and especially to the females of their species, as high or even a higher æsthetic capacity than that which is possessed by the most refined and cultured of the human race. If any one doubt this, let him go from the examination of a cabinet of butterflies or a case of humming-birds to gaze in the shop-windows where the latest fashions are exhibited in the most attractive form which the shopman can devise.

4. By this explanation of the appearance and retention of beautiful colours and patterns, the difficulty is shifted but not removed. To say that beauty exists because each sex appreciates beauty in the other, is to explain a mysterious entity in the physical part of the organism by calling in a more mysterious power in the mental phenomena which characterize a species. This is quite inadmissible in an advocate of 'natural selection' in its fullest scope, because this ought to explain not only the form and structure of animals but also all their instincts, habits, and appetites. To show that birds are beautiful because they love beauty, and that they must appreciate beauty because otherwise it could not have been produced, is reasoning in a circle.

If the suggestion of some of these difficulties could induce Mr Wallace, who is so well provided for the enquiry, to study the relation of beauty, and especially of colour, to use in organisms, it is certain that new light would be thrown upon this important and recondite subject. If, after the uses of colours have been made more apparent, and the nature of beauty resolved into elements more closely allied to advantage than we have hitherto supposed, there should yet remain evidence that it has been in itself an end which a Superior Intelligence may have placed before Him as an object, Mr Wallace has proved himself candid enough to admit such an inference. This is evident from the last two chapters of this volume, treating of natural selection as applied to man. It must have cost the author something to have written those chapters; because he was perfectly aware that if they were accepted, as they probably would be by a certain class of thinkers, they would be made use of as a lever to upset the whole theory of natural selection; and if they

were rejected, their inconsistency with the preceding part of the volume would be mercilessly exposed by Darwinians. M. E. Claparède has already headed the onslaught. No one can read these chapters in connection with those that come before them without feeling that the author, as a theorist, is involved in difficulties; but the admirable clearness and originality of the views he presents will be acknowledged by all. We have no time or space to examine in detail the considerations by which he shows how when man became social and sympathetic, and the fabricator of his own clothes and tools and weapons, natural selection ceased to modify his physical structure. He concludes that man was a homogeneous race at a period when he had the form but hardly the nature of man, when he possessed neither speech nor sympathetic or moral feelings. If such a being be called man, then man had a common origin; if not, then a multiple one. To this conclusion it may be objected that unless in the primitive race there was something which necessitated a higher development,—something prophetic of a glorious future,—it is improbable that all the several races of man should have progressed in so parallel a course that they should have arrived at the like powers and possessions which we now recognize as the commonwealth of man. When, reasoning concerning other races or species, we find that they all possess a number of qualities possessed by no other races or species, evolutionists inevitably arrive at the conclusion that all these sprang from a common ancestor *who possessed all these peculiarities*. Mr Wallace arrives at precisely the opposite conclusion, namely, that the common ancestor did *not* possess what was subsequently developed in all. To give consistency to this theory he advances in his last chapter some evidence of what we have spoken of above as the prophetic peculiarities of savage man. These are the superfluously vast brain, the skin naked along the midline of the back, the structure of the hands and feet, and the modulated voice. The full uses and capabilities of these are never fully evolved in savage life. They have therefore a prophetic function. Before we agree with M. Claparède that the chapters containing these words are the product of a blind anti-Darwinian, while the others proceed from an audacious Darwinian, we must call to mind that the theory of natural selection only accounts for the conservation and not for the production of variation. Some more general and fundamental law may underlie and yet be quite consistent with it. If a number of facts point directly either to something inherent in each species which shapes itself towards a future end, or even to the controlling intelligence of a Creator consciously aiming at results, in place of the blind *quaqua*-versal variation which is tacitly assumed by most evolutionists, the deduction may nevertheless be strictly scientific.