

II. THE PROGRESS OF THE DOCTRINE OF DEVELOPMENT.*

AMONG the general public, and even to some extent among men of Science who are not biological specialists, it is too commonly supposed that Evolutionism sprang at once into full maturity from the brain of Mr. Darwin; that Darwinism and Evolutionism are convertible terms; and that the doctrine is accepted with but little scrutiny by the majority of modern naturalists more as an article of faith than a scientific truth. Nothing could be farther from the real state of the case. The theories of Mr. Darwin are regarded as a mere tentative sketch, to be revised, emended, filled in, or even cancelled, as future observation and experiment may dictate. To this process they are being constantly submitted, and the general result may be stated to be that while the belief, or rather the conviction, of the truth of Evolution as "God's mode of Creation" is gaining ground, the precise agencies by which Mr. Darwin supposed such Evolution to be mainly effected are looked upon by many with doubt, or are at least relegated to a more subordinate position.

It is well known that Mr. Darwin, along with many of his more immediate followers, ascribes the development of species as we actually find them to two causes—both slow, gradual, and uniform in their action. These are Natural Selection and Sexual Selection, the former an utterly unconscious, but the latter a conscious, agency. To Sexual—or, as it has been not unhappily styled, Female—Selection he attributes not indeed the origin of any new form of life, but the ornamentation, and especially the colours, of the higher animals, such as the vertebrates and insects, and especially the generally brighter hues and the decorative appendages which characterise the male sex. He argues that the females having for ages past given the preference to the most beautiful males of their respective species, these have had a better chance of leaving a numerous offspring than their less brilliant rivals, and have transmitted their

* Tropical Nature and other Essays. By ALFRED R. WALLACE. (London: Macmillan and Co.)

All the Articles of the Darwin Faith. By the Rev. F. O. MORRIS, B.A. (London: Moffatt, Page, and Co.)

Zur Entwickelungs-Geschichte der Menschheit. By L. GEIGER. (Stuttgart.)

attractions to their male posterity. Thus, by the secular action of this principle, he contends that the gorgeous hues and exquisite designs of the wings of butterflies, the train of the peacock, the secondary wing-feathers of the Argus pheasant, the gorgets and crests of humming-birds, have been elaborated. This hypothesis certainly harmonised with a considerable number of striking facts previously unexplained, and seemed at first glance to agree with many more. Mr. Wallace, however, has long held this portion of Mr. Darwin's views to be erroneous, and brings forward against it certain exceedingly weighty arguments. In an earlier work, with which every naturalist ought to be familiar,* he has shown that in female birds the need of protection, especially during the season of incubation, has repressed those bright colours which would otherwise be produced by general laws in both sexes alike. He now further argues that high colouration, if not directly due to, is yet correlated with, vital intensity. "The very frequent superiority of the male bird or insect in brightness or intensity of colour, even when the general colouration is the same in both sexes, seems to me to be primarily due to the greater vigour and activity and the higher vitality of the male. The colours of an animal usually fade during disease or weakness, while robust health and vigour add to their intensity. This is a most important and suggestive fact, and one that appears to hold universally. In all quadrupeds a dull coat is indicative of ill health or low condition, while a glossy coat and sparkling eye are the invariable accompaniments of health and energy. The same rule applies to the feathers of birds, whose colours are only seen in their purity during perfect health; and a similar phenomenon occurs even among insects, for the bright hues of caterpillars begin to fade as soon as they become inactive preparatory to undergoing their transformation." Whenever there is a difference of colour between the sexes the male is the darker or more strongly marked, and the difference of intensity is most visible during the breeding season, when vitality is at its maximum. It is undoubtedly true that female birds do exercise a choice, but the bulk of the evidence on this point, as collected by Mr. Darwin himself, far from proving that such choice is determined by colour, points in a directly opposite direction. The "most vigorous, defiant, and mettlesome male" seems to be preferred. These attributes may be, and in a majority

* Contributions to the Theory of Natural Selection.

of cases doubtless are, correlated with intensity of colour. But, if so, it is persistency and energy, rather than mere beauty, to which success is due. Three eminent breeders of poultry—Messrs. Hewitt, Tegetmeier, and Brent—informed Mr. Darwin that they “did not believe that the females prefer certain males on account of the beauty of their plumage.” Mr. Tegetmeier is convinced that “a game cock, though disfigured by being dubbed and with his hackles trimmed, would be accepted as readily as a male retaining all his natural ornaments.” Old hens, and those of a pugnacious disposition, as Mr. Darwin states, quoting Mr. Brent, “dislike strange males, and will not yield until well beaten into compliance”—certainly a curious kind of “Female Selection.” Mr. Darwin himself admits that, “as a general rule, colour appears to have little influence upon the pairing of pigeons.” The case of the hen canary “who chose for her mate a greenfinch, in preference to either chaffinch or goldfinch,” also tells against Mr. Darwin’s hypothesis. Nor is the instance of Sir R. Heron’s peahens more fortunate. If these birds preferred a pied cock to one normally coloured their conduct was a strange anomaly, because, as Mr. Wallace remarks, “pied birds are just those that are not favoured in a state of Nature, or the breeds of wild animals would become as varied and mottled as our domestic varieties.” But if there is no sufficient evidence that female birds in the choice of mates are influenced by the beauty of the opposite sex, the case is still more decided as regards butterflies. Here the males surpass the most splendid male birds at once in brilliance of colouration and in elegance of pattern, whilst the females in a multitude of cases are comparatively plain and obscure. Yet there is no evidence to prove that the female is at all influenced by this beauty, “or even that she has any power of choice.” Mr. Darwin himself can find no more satisfactory argument than the following:—“Unless the female prefer one male to another the pairing must be left to mere chance, and this does not appear probable.” Yet we observe the males fight and jostle each other in pursuit of a female, who submits herself with indifference to the victor. Mr. Darwin admits that in the case of the silk-moths “the females appear not to evince the least choice in regard to their partners.” Would not the same rule be found to hold good with any other Lepidopterous insect, if only observed as extensively? Here, as among birds, “the most vigorous and energetic, the strongest winged, or the most persevering, wins the object of his pursuit.” Mr. Wallace adds that “Natural

Selection would here act, as in birds, in perpetuating the strongest and most vigorous males, and, as these would usually be the most highly coloured of their race, the same results would be produced as regards the intensification and variation of colour in the one case as in the other."

But now comes the question, why, if the females are not attracted by the beauty of their mates, do the males make such a striking display of the brilliance of their plumage? Of the fact of such display there can be no doubt whatever. But the main point—the question whether the choice of the females is at all influenced by shades of colour or slight differences in design—is totally unproven. There is no evidence that the females admire, or even notice, the display. "The hen, the turkey, and the pea-fowl go on feeding while the male is displaying his finery." The flutterings and dancings, the erection of tails and crests, are probably a mere result of the exuberant energy with which the male at this season is overcharged.

Mr. Wallace, however, founds his strongest argument on the interference and opposition of Natural and Sexual Selection. He says—"Natural Selection, or the survival of the fittest, acts perpetually, and on an enormous scale. Taking the offspring of each pair of birds as on the average only six annually, one-third of these at most will be preserved, whilst the two-thirds which are least fitted will die. At intervals of a few years, whenever unfavourable conditions occur, five-sixths, nine-tenths, or even a greater proportion of the whole yearly production, are weeded out, leaving only the most perfect and best adapted to survive. Now, unless these survivors are on the whole the most ornamental, this rigid Natural Selection must neutralise and destroy any influence that may be exerted by Female Selection. The utmost that can be claimed for the latter is that a small fraction of the least ornamented do not obtain mates, while a few of the most ornamented may leave more than the average number of offspring. Unless, therefore, there is the strictest correlation between ornament and general perfection, the more brightly coloured or ornamented varieties can obtain no permanent advantage; and if there is (as I maintain) such a correlation, then the sexual selection of colour or ornament, for which there is little or no evidence, becomes needless, because Natural Selection—which is an admitted *vera causa*—will itself produce all the results. In the case of butterflies the argument becomes even stronger, because the fertility is so much greater than in birds, and *the weeding out of the unfit takes place, to a great*

extent, in the egg and larva state. Unless the eggs and larvæ which escaped to produce the next generation were those which would produce the more highly-coloured butterflies, it is difficult to perceive how the slight preponderance of colour sometimes selected by the females should not be wholly neutralised by the extremely rigid selection for other qualities to which the offspring in every stage are exposed."

The above considerations, we submit, fully warrant naturalists, if not in the utter rejection of conscious Sexual Selection, at any rate in placing it in a kind of suspected position, to be condemned except some unexpected piece of evidence should be brought to light in its favour.

But we may venture farther, calling especial attention to the words we have italicised. No one who has made observations with even moderate care, upon any department of the animal kingdom, can doubt the sharpness of the struggle for existence, or can deny that of the eggs deposited by a female butterfly but a very small fraction ever come to maturity. Many no doubt, as Mr. Wallace states, perish as such without ever seeing the light at all. But how is this effected? Every egg of the whole brood is equally and similarly helpless in case of the approach of a devourer or a parasite. None of them can escape by dint of any strength, swiftness, or cunning which it may possess in excess of the rest. Without absolutely saying that no variation can ever be traced among the eggs laid by one mother, we are warranted in declaring that any difference, either in colour, shape, odour, or other properties, which may cause egg *a* to be less easily perceived, or when perceived by an enemy to be more readily rejected, than eggs *b*, *c*, and *d* must be exceedingly trifling, and that the immunity thus gained must be regarded as a mere vanishing quantity. For one that escapes in virtue of such properties ten will owe their survival to what—humanly speaking—must be pronounced mere chance. One egg, without possessing any attribute of superiority or greater fitness, may have been deposited by its mother in a less conspicuous place than the rest. One egg may have perished, not from any comparative imperfection or want of fitness on its part, but because some ovivorous or parasitical insect chanced to pass over the particular leaf to which it was attached. Numbers of other causes might be mentioned—as far as we can judge perfectly accidental—upon which the quickening or the death of an egg may depend. Here, therefore, is no selection, no weeding out, but a destruction of one portion

and a preservation of the rest with as little reference to any properties they possess as if the momentous question had been decided by lot.

From the egg we pass to the larva. Here there are undoubtedly greater individual differences. We can well admit that one caterpillar may have keener senses to perceive the approach of danger, greater agility in escaping, more cunning in concealment, an odour less attractive to enemies than have others, and may thus derive an advantage over them in the struggle for existence, and may thus fairly be pronounced more fitted for the conditions under which it must exist, and better adapted to survive. But here also a vast number of cases must occur in which chance alone can decide. The totally accidental matter of position at some momentous time may be of far greater consequence for the life of a larva than a slight variation in any of the points just enumerated. Thus an ichneumon may oviposit in the bodies of caterpillars *a, b, c, &c.*, whilst caterpillar *x* may escape from the simple fact that the enemy's stock of eggs ready to be deposited was exhausted before she reached it. Or two larvæ upon two different plants may each be threatened by the approach of an ichneumon. But the one invader may become entangled in the web of a spider or be snapped up by a bird, whilst the other meets with no hindrance and effects her purpose. In the pupa state, again, no small portion of the deaths take place; and here we have a reversion almost to the conditions of the egg. Without any reference to attributes of their own, some pupæ may have been discovered by birds, by field-mice, by hedgehogs, and by other of the numerous birds, beasts, or insects who consume such prey with readiness, whilst others by pure accident may have escaped. Whatever effect the first small steps of variation may have had in determining the survival of any given individual, it seems insignificant compared with the effects of chance. The condition of a Lepidopterous insect, from the egg to its emergence as imago, seems very much like that of the inmates of a town under the infliction of a heavy bombardment. It may perish or it may survive, neither alternative being so much determined by its own peculiar attributes as by the position which it occupies at some given moment. With the mature butterfly the case is different. We can well conceive that variations in point of speed, not relatively greater than such as are well known to occur between individuals of one species, may turn the scale for life or for death, and can thus imagine the gradual

elimination of the slower and the preservation of the swifter forms.

From butterflies we pass to birds. In a work containing much with which we are unable to agree,* the author, contending that over-preserving and the extirpation of hawks have not led to the multiplication of weak and sickly grouse, which formerly would have been improved away, and have left more scope for their stronger and healthier fellows, argues that it is not the weaker and slower birds which fall victims to the falcon. The celerity of this destroyer is so tremendously in excess of that of the fleetest grouse that all differences in speed among the latter birds utterly vanish. The strongest-winged and most vigorous moorcock, if once espied in the air by the enemy, has practically no greater chance of escape than a feeble and sickly bird. On the contrary, the boldest and most energetic grouse, who may fairly be assumed to be, as a rule, the healthiest, will fall victims more frequently than their weaker brethren, from the mere fact that they are more active and venturesome, and hence more likely to be on the wing. The effects of the co-existence of falcons and grouse in any country will be, therefore, not the development of a form of the latter better adapted for rapid flight, and ultimately, in the course of many generations, endowed with longer and more pointed wings, but merely a thinning of numbers, which will tell equally upon the strong and the weak, and which in some cases may even give an advantage to the latter.

This argument of Mr. Morant's concerning the influence of the falcon upon the development of the grouse appears to us applicable not merely to this individual instance, but to every case where a bird or a beast has to struggle for existence against enemies greatly its superiors in speed, in strength, or in general resources. Slight increments of swiftness or force, trifling improvements in offensive or defensive arms, would be absolutely thrown away under such circumstances, however valuable they might be as against an enemy but slightly superior to the original form. Hence there are numbers of cases where it must become questionable how, on the principle of Natural Selection, advances in these important directions are to be effected. If variation proceeds not at one uniform rate and by gradations almost imperceptible, but occasionally by more rapid movements, the matter is entirely different. Nor are considerations of

* "Game-Preservers and Bird-Preservers." See *Quarterly Journal of Science*, vii., 145.

speed and strength isolated in this respect. Something very similar will prevail concerning the advantage which animals gain by their so-called "protective" resemblances, either to other species or to their inanimate surroundings. Let us suppose a creature ill-adapted to escape from its enemies by speed or strength; conspicuous in its form and colouration, and therefore unable to conceal itself; and, lastly, attractive to the smell and taste of rapacious animals, and consequently eagerly sought for by them as food. If, now, one individual of the species varies in colour from the normal standard in a direction slightly verging towards a protective hue, the advantage that it will hence derive in the struggle for existence will be equally trifling, even although a multiplicity of steps such as it has just taken might finally render the modified form scarcely perceptible to its enemies. Or we may suppose that one individual of the persecuted species takes the first step towards the development of a repulsive odour. Here, also, its chances of existence will not be perceptibly increased, though its devourer, if able to reflect so far, may perhaps think that the morsel was not quite so good as usual.

We submit, therefore, that under a multitude of circumstances, if variations of colour or odour, or augmentations of speed, are to give the individual thus modified a greater chance of survival, they must either occur simultaneously in a considerable number of specimens, or they must be advances in the required direction, not slight and scarcely perceptible, but well-marked.

There is another and a different consideration which in our opinion must not be overlooked, as powerfully tending to modify the influence of Natural Selection. It has been argued that individuals favourably modified in any way, but especially as regards strength or swiftness, will stand a much better chance, not merely of escaping their enemies or securing their prey, but also of obtaining mates and leaving offspring. Yet, so far as birds are concerned, this advantage, be it great or small, appears to be neutralised. In Mr. Wallace's work we find the following passage:—
"Again, the evidence collected by Mr. Darwin himself proves that each bird finds a mate under any circumstances. He gives a number of cases of one of a pair of birds being shot, and the survivor being always found paired again almost immediately. This is sufficiently explained on the assumption that the destruction of birds by various causes is continually leaving widows and widowers in nearly equal proportions, and thus each one finds a fresh mate, and it

leads to the conclusion that permanently unpaired birds are very scarce ; so that, speaking broadly, every bird finds a mate and breeds."

Mr. Morant also remarks that there must exist somewhere "an establishment for unmarried female falcons."

Mr. Wallace very justly argues that this fact must counteract the effects, if any, of Sexual Selection. But it is scarcely less hostile to the action of Natural Selection. Granting that the pairs, as first formed, are composed of the strongest and most vigorous males and of the finest and healthiest females. But after a short time of the non-selective slaughter carried on, if not by man, yet by hawks, ravens, wild cats, weasels, snakes, and other bird-destroyers, the rejected of either sex find themselves mated, and of course become parents, substantially to as great a degree as their more favoured rivals. It may of course be contended that this indiscriminate slaughter falls equally upon the mated and the unmated. We doubt the correctness of this supposition : birds in the various operations connected with nest-building, hatching, and feeding their young, have to expose themselves necessarily more to danger than their bachelor and spinster neighbours. Among the lower animals, as well as among mankind, the pleasures and advantages of married life have, it seems, to be paid for.

Hence, without at all seeking to deny the existence and working of Natural Selection as a force effecting modifications in organic life, which may often extend to the formation of what we call species, we feel bound to admit that its influence is checked and modified in a variety of manners.

In Mr. Wallace's work another interesting question is discussed with results which further strengthen us in the belief that Evolution must have other—and probably more powerful—causes, and has at all events not always been effected by uniform and imperceptible gradations.

We are here reminded that the progressive development of the senses—a point scarcely as yet sufficiently investigated—is one of the most efficient ways in which animals may become modified in harmony with varying circumstances. An individual bird or beast, if possessing sharper sight, more delicate hearing or scent, than the bulk of its fellows, must plainly have a great advantage in the struggle for existence. It will be sooner warned of the approach of an enemy ; it will more readily detect the presence of its prey, and will escape a number of subtle dangers to which it might otherwise succumb. Thus most of our readers

will be familiar with the curious case of the pigs in Virginia mentioned by Mr. Darwin. All white pigs, it appears, were destroyed by feeding upon a certain root which took no effect upon black pigs. This remarkable phenomenon is ascribed by Mr. Darwin to a constitutional peculiarity connected with the dark colour, the black animals enjoying a perfect immunity from the effects of a poison which was fatal to all of the white variety. Dr. Ogle, however, gives a different and more probable explanation. He remarks that we have no evidence that the black pigs partook of the root at all. He considers that it possessed an odour or a flavour offensive to their senses, while the white pigs—endowed with less acute and discriminating smell and taste—ate it and perished. This fact is an admirable instance of the importance of acute senses to the preservation and multiplication of a species. Yet at the same time an advance in this respect can rarely be assumed to modify the structure of an animal or cause it to develop into a new species, even though acuteness or dulness of the senses may be respectively correlated with certain colours.

With the acuteness of the senses and its progressive development is naturally connected the history of colour, odour, and flavour in the world. Have the faculties and their objects been evolved in mutual harmony? Especially was colour existent before the colour-sense of animals had become able to recognise it—a process which, as we learn from the existence of colour-blindness, is even yet not complete. Are we to expect further advances as in the faculty, so in what it perceives?

Mr. Wallace considers that “when the sense of sight was first developed in the animal kingdom, we can hardly doubt that what was perceived was light only, and its more or less complete withdrawal. As the sense became perfected, more delicate gradations of light and shade would be perceived. At what grade in animal development the new and more complex sense—which takes cognizance not merely of the quantity of light, but also of its quality—first began to appear we have no means of determining.” It was a somewhat prominent tenet of the old Natural History that the phenomena of colour, and indeed of ornamentation, in Nature, existed mainly in reference to man and with a view to his delectation. Mr. Wallace by no means agrees with many leading modern naturalists in the complete rejection of this assumption. He asks—“And even now, with all our recently acquired knowledge of this subject, who shall say that these Old-World views were not intrinsically and

fundamentally sound; and that, although we now know that colour has uses in Nature that they little dreamt of, yet the relation of those colours—or rather of the various rays of light—to our senses and emotions may not be another, and perhaps more important, use which they subserve in the great system of the Universe." Elsewhere he remarks that "the extreme diversities and exquisite beauties of colour seem out of proportion to the causes that are supposed to have produced them, or to the physical needs to which they minister." And again:—"It is hardly conceivable that the material uses of colour to animals and to ourselves required such very distinct and powerfully contrasted sensations; and it is still less conceivable that a sense of delight in colour, *per se*, should have been necessary for our utilisation of it. The emotions excited by colour and by music alike seem to rise above the level of a world constructed on purely utilitarian principles." Yet at the same time he declares, and truly, that he has shown reasons for believing that the presence of colour in some of its infinitely-varied modifications is more probable than its absence, and that variation of colour is an almost necessary concomitant of variation in structure, development, and growth. On the colour-sense in animals he remarks "that the higher vertebrates, and even some insects, distinguish what are to us diversities of colour, but this by no means proves that their sensations of colour bear any resemblance to our own. An insect's capacity to distinguish red from blue or yellow may be (and probably is) due to perceptions of a totally distinct nature, and quite unaccompanied by any of that sense of enjoyment, or even of radical distinctness, which pure colours excite in us. Mammalia and birds, whose structure and emotions are so similar to our own, do probably receive somewhat similar impressions of colour, but we have no evidence to show that they experience pleasurable emotions from colour itself when not associated with the satisfaction of their wants or the gratification of their passions."

There is here, it appears to us, some little assumption. We have certainly no evidence that birds and beasts experience pleasurable emotions from colour alone. But what evidence have we to the contrary? The capacity of an insect to distinguish colours *may* be accompanied by any of that sense of enjoyment which pure colours excite in us. But why should we pronounce this probable? Still more, why should its power to *distinguish* colours be unaccompanied by a sense of radical *distinctness*? Quite admitting that the

sight-organs of insects may differ from our own no less in mode of action than they do in structure, we should be prepared to expect that their perceptions may in nicety and accuracy surpass our own. Mr. Wallace himself, in his "Contributions to the Theory of Natural Selection," says "their [insect's] sight may far exceed ours both in *delicacy* and in range." In the present work, also, Mr. Wallace treats of colour as affording a means of mutual recognition, of especial value to insects, though he adds that "in birds such marked differences of colour are not required, owing to their higher organisation and *more perfect* senses." Now we have certainly no facts to prove that the sense of smell in birds ever attains anything like the delicacy and accuracy which are evinced in the case of certain insects—those, for instance, who are caught by the stratagem of "sembling."*

The brilliant and striking colouration of many berries Mr. Wallace considers may subserve the dissemination of the species. Birds attracted by the colour swallow the berry, and void the seeds in localities where they may take root. The same brilliant hues occur also, however, in larger fruits, where the seeds are never swallowed. Both birds and insects show that they are perfectly able to distinguish a ripe cherry, plum, or peach from one that is still green, and generally confine their attentions to the more highly coloured sunny side; but the stone is left hanging on its stalk. Consequently the possession of striking colours by the fruit, and the recognition of such colours by birds, wasps, butterflies, &c., does not aid in the multiplication of the tree.

Mr. Darwin and Mr. Wallace both seem to agree that the highly-coloured spots on the wings of butterflies, being generally placed remote from any vital organ, may have a protective effect, causing birds to strike at these parts rather than at the head or body. If, however, we carefully consider the flight of a butterfly, we shall be inclined to doubt whether a blow aimed at the tips of the wings might not be quite as likely to fall upon the body.

Public attention has lately been drawn to a point in the history of colour-perception in our own species, which at first sight seems to have an important bearing upon the antiquity of man and the rate of his intellectual development, as well as to throw a useful side-light upon sexual selection, upon mimetism, and other phenomena among the lower animals. It is well known that a large proportion of

* Quarterly Journal of Science, vol. viii., p. 304 (July, 1878).

living men and women in modern civilised nations (according to some authorities about 5 or 6 per cent), whilst perfectly able to distinguish by the eye the outline and texture of any object placed before them, its apparent distance, and its degree of illumination, fail more or less completely to recognise colours. To such persons scarlet and green are respectively undistinguishable, and are both liable to be confounded with grey. In other cases the eye perceives no difference between blue and yellow, and in some extreme instances the solar spectrum appears merely as a band lighter in some portions and darker in others, and all objects are viewed as if by a monochromatic light.

But imperfect as is the human colour-sense at the present day, there is, in the opinion of some, evidence that it has distinctly advanced within the brief span known as "historical time." Philologists have been struck with the fact that in the most ancient writings extant, such as the Bible, the Vedas, the Zendavesta, and the poems of Homer, no definite nomenclature for colours can be traced.

The phenomena of colour seem to have attracted less attention at the times when the above writings were produced than at the present day. One and the same term is applied to blue, to green, and to black objects. Iron is called by Homer "violet-coloured." In the autumn of 1877 an article by Mr. Gladstone on the colour-sense, as exhibited in the poems of Homer, appeared in the "Nineteenth Century," and has since been reproduced in the "Revue Internationale des Sciences." The writer there formally undertakes to show that the few colour-terms used by Homer are applied to objects so different among themselves "that they cannot denote colours as we perceive and differentiate them, but seem more applicable to different intensities of light and shade. Thus, to give one example, the word *porphureos* (ordinarily rendered purple) is applied to clothing, to the rainbow, to blood, to a cloud, to the sea, and to death, and no one meaning will suit all these applications except comparative darkness." In other cases the same object has varying colour-terms applied to it, the meaning of these being indicated merely by a reference to other objects fluctuating in themselves, so that the difficulty of determining what hue the writer meant in any particular case is insuperable. "Mr. Gladstone concludes that archaic man had a positive perception only of degrees of light and darkness, and that in Homer's time he had advanced to the discrimination of red and yellow, but no further, the green of grass and foliage and the blue of the sky being never once referred to."

But the very same want of reference to definite colours and the same poverty of colour-terms may be traced in literature very much later than the epoch of Homer. Thus Latin authors who flourished as late as the first century of the Christian era apply the word *cæruleus* to sky-blue, to steel-blue, to the colour of the human eyes, to the olive tree, and to dark grey and black objects; *viridis*, commonly rendered green, is used by Virgil for the colour of the human face when turning pale, and by Pliny for the hue of the clear heavens; *purpureus* is applied to the poppy, to the rainbow, to the violet, the rose, the willow, the human hair, the sea, and to the face when blushing. The colour of the sky is never mentioned in the Koran, and, according to Geiger, is first clearly alluded to in an Arabic work of the ninth century.

Now, that the vision of man, and indeed of all animals, was at one time monochromatic, and has gradually reached its present stage of development by a passage through some of the phases of what we now call colour-blindness,—which must be regarded as a reversion to an earlier condition,—we feel no difficulty in admitting. But that the human colour-sense should remain in a condition so rudimentary down to the days of Homer, and even of Aristotle, Pliny, and Vitruvius, and should then advance by “leaps and bounds” to its present condition, is an assumption difficult to realise, and scarcely compatible with our modern evidence concerning the antiquity of our race.

Mr. Wallace, with his usual acute insight, detects an error in the conclusion to which Mr. Gladstone has been led. He remarks:—“These curious facts, however, cannot be held to prove so recent an origin for colour-sensations as they would at first sight appear to do, because we have seen that both flowers and fruit have become diversely coloured in adaptation to the visual powers of insects, birds, and mammals. Red being a very common colour of ripe fruits which attract birds to devour them, and thus distribute their seeds, we may be sure that the contrast of red and green is to them very well marked. It is indeed just possible that birds may have a more advanced development of the colour-sense than mammals, because the teeth of the latter commonly grind up and destroy the seeds of the larger fruits and nuts which they devour, and which are not usually coloured; but the irritating effect of bright colours on some of them does not support this view. It seems most probable, therefore, that man’s *perception* of colour in the time of Homer was little, if any, inferior to what it is now, but

that, owing to a variety of causes, no precise *nomenclature* of colours had become established. One of these causes probably was that the colours of the objects of most importance, and those which were most frequently mentioned in songs and poems, were uncertain and subject to variation. Blood was light or dark red, or when dry blackish; iron was grey or dark, or rusty; bronze was shining or dull; foliage was of all shades of yellow, green, or brown; and horses or cattle had no one distinctive colour. Other objects—as the sea, the sky, and wine—changed in tint according to the light, the time of day, and the mode of viewing them; and thus colour, indicated at first by reference to certain coloured objects, had no fixity. Things which had more definite and purer colours—as certain species of flowers, birds, and insects—were probably too insignificant or too much despised to serve as colour-terms; and even these often vary, either in the same or in allied species, in a manner which would render their use unsuitable.”

Mr. Wallace might here have added that the attention of the Oriental and Mediterranean nations was always turned towards man rather than to external nature. Hence their comparative indifference to beautiful scenery, their neglect of landscape painting, their failure in physical science, and their contempt for the industrial arts—so remarkable if we consider their degree of civilisation and the high intellectual development to which some of them had attained. That such nations should have no very precise nomenclature for colours—a nomenclature chiefly required in the pursuit of Natural Science and in certain manufactures—affords no proof that their colour-sense was not as perfect as our own. Hence it cannot be contended that the facts signalled by L. Geiger and by Mr. Gladstone enable us to draw any trustworthy inference as to the antiquity of the human race.

This brings us in contact with the subject which we are only just learning to discuss with scientific calmness and candour. The day is scarcely over since the dreams of Archbishop Usher and his coadjutors were supposed to be founded upon the direct testimony of Revelation. The notion that the world was “created in autumn 4008 years before the vulgar Christian era,” and that our species had consequently not existed for quite 6000 years, was accepted as a main point of faith. Facts and arguments which pointed to a longer date raised gratuitous alarm among Christians, and exultation no less gratuitous among atheists. These mists and clouds are now clearing away, and thinkers

of unimpeachable orthodoxy now admit that there are no theological grounds for a denial either of the antiquity of man or of the doctrine of Evolution, and that the Church may watch the contest between the Old and the New Schools of Biology as calmly as she did that between the Phlogistian and the Lavoisierian Schools of Chemistry. But Mr. Wallace puts in a word of caution which cannot be deemed useless. He reminds us that the hypothesis now dominant in scientific circles, that man has been gradually developed from some lower animal form, and that he has existed upon the earth from the Miocene epoch, possibly even from the Eocene, is not unbeset with difficulties. In the interests of Science these should receive full and fair consideration, and not be ignored, as were till recently the facts incompatible with the chronology of Usher. It is recognised as a curious circumstance that, notwithstanding the care with which pre-historical human remains have been sought for in all civilised countries,—notwithstanding the incidental facilities for research afforded by railway excavations, mines, and other engineering operations,—little if any light has recently been thrown upon the time or the mode of man's origin. "Amid the countless relics of a former world that have been brought to light, no evidence of any one of the links that must have connected man with the lower animals has yet appeared." Professor Mivart, in his well-known work "Man and Apes," has shown, by a most careful structural analysis, that man is related not exclusively and specially to any one of the anthropoid apes now existing, but almost equally to the orang, the chimpanzee, the gorilla, and the gibbon. Hence, on the evolutionist hypothesis, he is descended not from any one of these, but from an extinct and as yet unknown form which must have branched off at an exceedingly early date from the common stock. "As far back as the Miocene deposits of Europe we find the remains of apes allied to these various forms, so that in all probability the special line of variation which led up to man branched off at a still earlier period. And these early forms, being the initiation of a far higher type, and having to develop by natural selection into so specialised and altogether distinct a creature as man, must have risen at a very early period into the position of a dominant race, and spread in dense waves of population over all suitable portions of the great continent—for this, on Mr. Darwin's hypothesis, is essential to developmental progress through the agency of natural selection."

Such being the case, it is asked why we find no relics of

earlier forms of man in company with those of other animals which were, *ex hypothesi*, less abundant? We reply that not one-hundredth part of what is now dry land has hitherto been satisfactorily explored. Possibly the extinct anthropoids may have mainly inhabited some of the regions which existed where now there roll wide, though shallow, seas. Living, as we might expect, among low-land tropical forests, their bodies, when dead, would be fully exposed to all the destructive agencies of Nature. Perhaps their habits were specially unfavourable to the preservation and fossilisation of their remains. Perhaps cannibalism was widely prevalent in those days. The order Primates is hitherto but sparingly represented among the fossil Mammalia. Nay, leaving the geological ages out of the question, and coming down the stream of time to within historical days, let us take some country which we know to have been densely peopled from four thousand to three thousand years ago, and ask how many human remains of such dates could be there discovered? We naturally except Egypt, and any other country where it was customary to embalm the dead. Is there some cause why the skeletons of the anthropoids and of man are more perishable than those of the lower forms of vertebrate life? Some writers have suggested that as the *Quadrupedia* are now almost exclusively tropical, and the anthropoid species even equatorial, we should look for the earliest ancestors of man in such regions as the Malay Islands or Western Africa. To this Mr. Wallace replies that existing anthropoid apes are confined to equatorial regions because there only can a perennial supply of fruits suitable for their nourishment be found. But as in the Miocene epoch Southern Europe possessed an almost tropical climate, this restriction as to locality might then not have existed. Still experience shows us that a species is not necessarily found wherever conditions suitable for its existence are present.

We must, however, admit that if further geological exploration fails to place in our hands a greater number of human remains from the pre-historic ages, and especially anthropoid forms lower than the existing races of man, though higher than any existing apes, the views now dominant in scientific circles concerning the origin and early history of our race will stand in need of a careful revision. We shall apparently have to admit that man, however ancient, can scarcely have been formed by that slow and uniform process of development which must result from the operation of Natural Selection. It will be, as Mr. Wallace

declares, "at least a presumption that he came into existence at a much later date and by a much more rapid process of development. In that case it will be a fair argument that just as he is in his mental and moral nature, his capacities and aspirations, so infinitely raised above the brutes, so his origin is due in part to distinct and higher agencies than such as have affected their development."

But is it necessary that the process of Evolution, by whatsoever agencies effected, must always have maintained a uniform degree of speed? We have no desire to recur to "catastrophism," geological or biological, or to represent unknown and immeasurable forces as being arbitrarily introduced into action and again as arbitrarily withdrawn. But we find in phenomena governed by forces strictly natural, and even measurable, changes occurring more rapidly at certain stages than at others. To take a simple and familiar instance, the progressive increase of the length of the day in spring and its corresponding decrease in autumn is much more rapid at the equinox than at any other time. Or, turning to a region much more closely connected with the subject in hand, if we observe the development of an individual man—or indeed of any other animal—from birth to maturity, we do not find equal amounts of progress effected in equal successive portions of time. We know that in the life of a youth there is a period when, in stature and in the development of his mental and bodily powers, he appears almost at a standstill for two or three years, this lull being followed by a period of intensified growth, in which he shoots up at once into manhood. Is it not at least possible that a similar want of uniformity may be traceable in the evolution of species? Prof. Leconte argues that every organism will oppose a certain amount of resistance to agencies calculated to effect a change. This resistance being once overcome, change will be for a time rapid, until a state of approximate equilibrium is again reached. Hence we may expect that at certain points where a great change has taken place certain "links"—the intermediate forms—will be missing. Their career is likely to be exceedingly short, not running to many generations, and for the same reason the number of individuals must be limited. Hence the probability of the fossil remains of such "links" being preserved for our inspection is infinitesimal indeed. When, on the other hand, the equilibrium is re-established, species exist with little change for centuries, possibly for thousands of years; they spread over every accessible land suitable to their requirements, and increase in numbers as far as the

supply of food and the other conditions of existence will allow. The probability is, then, that of the multitudes of individuals who successively flourish some will die under circumstances favourable to the fossilisation of their remains.

The differences of opinion we have been considering on the mode in which Evolution is effected, its main causes, and the laws of its action, are not surprising in view of the extent, the complexity, and the difficulty of the subject. Mr. Darwin has not so much solved the great problem of organic life as shown the way in which its successful study and its ultimate solution are possible. But whilst the greatest naturalists of the day are eagerly and patiently devoting themselves to this task, there are others who still feel free to introduce into the question extraneous difficulties, and to appeal to the passions and prejudices of an unscientific public.

Whilst waiting for an unpunctual train, at Dartford Station, our eye was caught by Mr. Morris's pamphlet. We read it through with equal feelings of surprise and regret. It is a work which might have been pardoned if it had appeared ten years before its actual date (1875), and if it had been from the pen of some journalist, novelist, barrister, &c., who could scarcely distinguish a humming-bird from a Sphinx-moth; but the Rev. F. O. Morris is himself a naturalist of merit, and, had he been so minded, might surely have criticised Mr. Darwin's theories, if unfavorably, still in a manner more useful to Science and more creditable to himself. As it is he sins equally against good taste, logic, and facts. Here is a specimen taken at random:—"I believe that such persons, in former times, as Sir Isaac Newton, Herschell, Lord Bacon, Dr. Johnson, Milton, Locke, Sir Matthew Hale, &c., who were believers in the Bible, were far behind me in intellect and knowledge. I believe, in like manner, that others in the present time, who are believers also as they were, such as Sir Roundell Palmer, Lord Hatherley, Lord Shaftesbury, Faraday, Sir David Brewster, &c., and others who like them have taken the highest honours in the Universities, and distinguished themselves in the highest departments of art, science, and politics, are quite beneath me in mind and attainments, for if I am right—as I must be, and therefore am—they of course must be wrong."*

* It might be asked in what University Faraday graduated, till the day when he conferred rather than received honour by accepting degrees? We might also inquire in what "highest departments of art" Sir Roundell Palmer Lord Hatherley, or Lord Shaftesbury has distinguished himself?

What is all this but the old stale sneer which for ages has been levelled against every inventor and discoverer, who is taunted with setting himself up to be wiser than all the eminent men of the past! But Mr. Morris "double-banks" the fallacy. None of the distinguished men he mentions are biologists at all, and therefore, as far as the subject is concerned, they are all immeasurably inferior in knowledge and attainments to Mr. Darwin. Further, there is the gratuitous assumption that Mr. Darwin, as an Evolutionist, must necessarily reject the Bible. We know many Evolutionists who unhesitatingly accept the Bible as a moral and spiritual revelation, though they do not manipulate it into a geological text-book, or believe in the human traditions—chronological especially—which have sprung up around it. But Mr. Morris not merely accuses Mr. Darwin of Infidelity, but, if we do not misunderstand him, of a formal and conscious Infidel propagandism. "I have done all I could to make others as wretched as I am myself." "I do my little best or worst to shake their faith," &c. Need we put on record our solemn conviction that the aims of Mr. Darwin, Mr. Wallace, and of the majority of the naturalists of the new school, have been purely biological, and that to furnish arguments to the Infidel was no part of their plans? Need we remind Mr. Morris that charges closely analogous to those which he insinuates against Mr. Darwin were brought against Sir Isaac Newton, and with quite as much plausibility? Need we repeat that he who thinks to decide a scientific controversy by such foul play forfeits, *ipso facto*, all claim to the treatment of a gentleman and a scholar, and should at once be handed over to a very different court than that of the reviewer?

As a "supplement" to his curious collection of imputations and travesties, Mr. Morris gives certain extracts from the daily papers! We should have hoped that every man of science in England, or rather in Europe, must be fully aware of the gross blunders made by political and literary journals whenever they condescend to discuss a scientific question. One daily paper not long ago informed the world that "all gases explode far below redness, leaving nothing but a few particles of dust." A journal that displayed such ignorance on a question of history, of law, or of theology, would be well-nigh laughed out of existence. But an error in physics, or chemistry, or biology is detected by few, and therefore the proprietors of political papers do not think it worth their trouble to refer the criticism of a scientific treatise or a presidential address before the British Associa-

tion to an expert. If Mr. Morris finds it necessary to call in the aid of "Punch," the "John Bull," or the "Globe," he only betrays his own "plentiful lack" of sound argument. But there is yet a final court of appeal: the authority is invoked of one who, we suppose, is no less distinguished by his candour, his courtesy, and his strict regard for truth, than by his vaunted "thinness of skin," his freedom from egotism, and the typographical eccentricities of his works, where italics and small capitals cover a multitude of sins. The pamphlet is, it seems, dedicated to "The Right Honourable the Common Sense of the People of England." We have more than once been compelled to point out that "common sense" is the name under which many worship their own ignorance. We were partly in the wrong: it is the name they invoke when they seek to utilise the ignorance of others.
