

DARWIN'S LATEST CRITICS.

It is always pleasant to read anything that is written by the Bishop of Carlisle, because it is sure to be actuated by good feeling rendered in clear style. At the same time, when he deals with such subjects as 'Darwinism,' there is equally sure to be evidence of such a want of grasp as belongs to the hand of an amateur. And inasmuch as his recent review in these pages of Mr. Wallace's last book is not free from this defect, I think the occasion is a suitable one for considering in a popular way some of the more popular 'difficulties' regarding the theory of natural selection which he has reproduced.

'In the first place,' he says, 'objection may be taken to the phrase, *the fittest survive.*' And his objections are these. First, he says, 'fitness implies something of moral superiority.' But does it? Etymologically, to be fit means to be made; hence, to be suitably made, or adapted. And, in accordance with this originally passive signification, the term is primarily applicable to things inanimate. We may properly speak of a key as fitted to a lock, without implying that we regard the key as virtuous. Moreover, even with respect to things animate, ethical qualities are the very last to which the term comes to be applied. We more primitively speak of a man as fit to dig than we do of a man as fit to die; for in the former case we have reference to his *make* (he is suited to such work as a key to the unlocking of a lock); while in the latter case we have reference to his *making*, or to the thing which, as our words here imply, we believe him to have *made*—i.e. his *character*. All this, however, is merely a verbal quibble; and if the Bishop does not like Mr. Herbert Spencer's term 'survival of the fittest,' he is quite at liberty to substitute any other, such as *survival of the best adapted*. But, in the second place, he says,

It is not difficult to suggest examples in which the expression *survival of the fittest* manifestly breaks down. Sir Isaac Newton was, as is well known, a very delicate child, difficult to rear. Suppose that Newton and a powerful navvy, or coal porter, or grenadier, had been compelled to rough it as children at Dotheboys Hall, or some similar institution, which would have survived? Not Newton; and yet it may be fairly argued that in many respects he would have been the fittest.

Now, without question, in many respects Newton would have been the fittest; but, as the above argument itself shows, these respects would not have been those which had reference to survival in such an institution as Dotheboys Hall. In the phrase 'survival of the fittest,' we must of course understand 'the fittest' *in relation to given surroundings*, and this with exclusive reference to *survival in a struggle for existence*. Newton's superior fitness in the 'respects' of intellectual endowment would have had no reference to a struggle for life in such an environment as that supposed. Only when the environment was changed, so that the struggle for existence should have reference to the fitness supplied by such endowment, could it be possible that this particular kind of fitness would determine survival. And as regards that new environment—to wit, the 'institution' known as the University of Cambridge—the Bishop of Carlisle must be one of the very last men to underrate the severity of a struggle for existence, which in his time imposed the ordeal of selection in such a form that only one of the fittest could possibly survive as the Senior Wrangler of his year. In short, wherever the question is a question of survival, it is obvious that the qualities wherein the fitness consists must be taken to be the qualities which are best fitted to the conditions of the struggle: it may *not* be 'fairly argued' that the race ought to be to the strong, and the battle to the swift.

Again, it is said,

In the case of not a few creatures which have survived, it is difficult to give any good reason for their survival, except upon the assumption of their fitness, as proved by the very fact of their survival. Thus their fitness leads to their survival, and this survival leads to the conclusion that they must have been the fittest. Which is arguing in a circle.

But this is *not* arguing in a circle. If it be a fact beyond question (and this is allowed) that 'their fitness leads to their survival,' then the fact of their survival legitimately 'leads to the conclusion that they must have been the fittest.' As thus presented, indeed, the 'arguing' might be accused of tautology (fitness is the condition to survival: *ergo*, survival is conditioned by fitness), but not of circular reasoning; and, if the presentation implies anything, it is that the Bishop regards the fundamental doctrine of 'Darwinism' as self-evident. And this, I take it, is substantially his real opinion; for in the next paragraph he says, 'natural selection is a *vera causa*; the question is, What is the extent of its action? how much can it do?'

Turning next to this question the writer proceeds to adduce the following difficulties which have occurred to him while reading Mr. Wallace's book. 'I confess that I have never been able to perceive how the principle [natural selection] can be brought to bear upon

such phenomena as the architecture of insects—for example, that of bees and wasps.' For, he says, there is a difficulty 'in conceiving the original start of insects in the direction of architecture; and, secondly, in perceiving the connection between good architects and survival in the struggle for existence.' But in the *Origin of Species* Mr. Darwin has been at elaborate pains to anticipate both these questions, devoting an unusually large proportion of his space to a consideration of the cell-making instincts, and showing how, in different species of bees and wasps, there is a beautiful gradation from virtually 'the original start' through increasing 'economy' to 'the geometrical skill' in question. Moreover, he shows very clearly that economy of such precious material as wax must be a matter of no small importance in the struggle for existence between competing hives of the same species. Now, the Bishop of Carlisle does not allude to any of these facts and considerations; but merely asks, 'Can we get over these difficulties?' To the best of my judgment, Mr. Darwin has already got over them; but if anybody thinks otherwise, let him state wherein he supposes Mr. Darwin to have failed.

Precisely the same remarks apply to what the Bishop says with reference to protective colouring and mimicry; until he gives his reasons for dissenting from Mr. Darwin's treatment of the identical 'difficulties' which he adduces, there is no basis for discussion. Passing on, therefore, to what he urges with regard to the horse and its geological pedigree, he allows 'we are sure that *orohippus* has rightly been improved off the face of the earth in order to make room for *equus*; all this is, in the best sense of the phrase, in accordance with the principle of the survival of the fittest.' 'But,' he continues, 'I confess that I find it difficult to realise the transformation of *orohippus* into *equus* upon the pure and simple notion of advantageous variations in the struggle for life; for, in truth, if the question be one of mere survival, it is difficult to say, when the earth was inhabited by wild creatures, in what manner the possession of one toe instead of three or four should give *equus* any advantage over *orohippus*.' Now here, even more than in the previous cases, if he had referred to the literature of the subject, the Bishop would have found that there is no 'difficulty' at all. The monodactyl type of foot is greatly superior to the polydactyl where 'fitness' has reference to swift locomotion over the hard and level ground of open plains, to which 'environment' the whole organisation of the existing genus has clearly been gradually adapted. Therefore, if 'one can quite understand that a jury of Newmarket jockeys would decide that *equus* was fittest to survive,' I am quite unable to comprehend why 'in the absence of human judgment the conclusion is not so easy to reach.' Does the Bishop suppose that a jury of Newmarket jockeys have a better eye to the points of a horse in respect of 'fitness' than

is furnished by the ever-watchful vigilance of natural selection? If so, he and Darwin are on such totally different lines of thought, that it seems useless to hope they can ever be brought together.

And so it is with the next paragraph. For example :

May it not be, then, that the Eocene period of creation presented a condition of things out of which a higher condition was evolved, not simply by the perpetuation of advantageous variation, but much more by virtue of an internal principle of growth, similar to, or at least comparable with, the principle which develops the fœtus or which transforms tadpoles and caterpillars?

Does the present critic of 'Darwinism' suppose that Darwin invoked any transcendental 'principle' in order to explain the transformation of tadpoles and caterpillars into frogs and butterflies? Or does he think that Darwinists suppose any other 'principle' than natural selection to have been concerned in the fœtal history of an individual horse, when this is regarded by them as a necessary outcome of the whole ancestral history of the horse-like pedigree which the fœtus recapitulates?

To my mind the only 'difficulty' raised by such criticisms is that of understanding how they ever came to be regarded as criticisms at all. And this remark is not intended to apply invidiously or particularly to the Bishop of Carlisle: it is merely an honest expression of wonder at the generality of the misconceptions which are still so prevalent regarding the first principles of 'Darwinism.' Thus, for example, the pages of *Nature* have recently been burdened by a renewal of an already threadbare controversy upon a point which the Bishop touches, where he says:

It is certainly difficult to conceive of chance as being a principal factor, say, in the production of a horse. . . . The philosopher may still say, How comes it that the advantageous variations should occur? Must not this occurrence be the result of some pre-established principle or law of development?

Here we have the Duke of Argyll's doctrine of 'prophetic germs;' and seeing that he has presented it more clearly as well as uncompromisingly than anybody else, I may appropriately devote a few words to what he has said upon it. The argument as presented by the Duke is as follows:—

If the doctrine of evolution be true, then it follows of necessity that the primeval germs must have contained potentially the whole succeeding series. Moreover, if that series has been developed gradually and very slowly, it follows also, as a matter of necessity, that every modification of structure must have been functionless at first, when it began to appear. . . . Things cannot be selected until they have been first produced; nor can any structure be selected by utility in the struggle for existence until it has not only been produced, but has been so far perfected as to be actually used.

Now, this argument is at fault both in its premiss and in its conclusion. The premiss is not true; and, even if it were, the conclusion would not, as alleged, necessarily follow.

First, as to the premiss, it is not true that every modification must necessarily be functionless, when it first begins to appear. There are two very good reasons why such should not be the case in all instances, even if it should happen to be the case in some. Take, for example, what is perhaps the most wonderful instance of refined mechanism in nature—the eye of a vertebrated animal. Comparative anatomy and embryology combine to testify that this organ had its origin in modifications of the endings of the ordinary nerves of the skin. Now it is evident that, from the very first, any modification of a cutaneous nerve whereby it was rendered capable, in however small a degree, of being differently affected by light and by darkness, would be of benefit to the creature presenting it; for the creature would thus be able to seek the one, and shun the other, according to the requirements of its life. And, being thus useful from the very moment of its inception, the structural variation would afterwards be improved, stage by stage, as variations of more and more utility presented themselves, until not only would finer and finer degrees of difference between light and shade become perceptible, but even the outlines of solid bodies would begin to be appreciated, and so on, stage by stage, till from an ordinary nerve-ending in the skin is evolved the eye of an eagle.

Again, in the second place, and still having regard to the Duke's premiss, it very often happens that an organ which began by being useful for the performance of one function, after having been fully evolved for the performance of that function, finds itself, so to speak, accidentally fitted to the performance of some other and even more important function, which it thereupon begins to discharge, and so to undergo a new course of adaptive development. In such cases, of course, and so far as the new function is concerned, there is no difficulty arising from the first inception of the organ; for here the organ has already been built up for one purpose before it begins to discharge the other. For instance, the lung of an air-breathing animal was originally a swim-bladder, or float; and as such it was of use to the aquatic ancestors of terrestrial animals, in the same way as it still continues to be to numberless species of fish. But as these aquatic ancestors gradually become more and more amphibious in their habits, the swim-bladder began more and more to discharge the functions of a lung, and so to take a wholly new point of departure as regards its developmental history. But obviously there is here no difficulty at all as regards the inception of its new function, because the organ was already well developed for one purpose before it began to discharge another. Or, to take only one additional example out of hundreds that might be adduced, I suppose there are few structures in the animal kingdom so remarkable in respect of adaptation as is the wing of a bird or a bat; and at first sight it might well appear that a wing could be of no conceivable use until it had already

acquired enormous proportional dimensions, as well as an immense amount of special elaboration with respect to general form, size of muscle, amount of blood-supply, and so on. For, obviously, not until it had attained all these things could it ever begin to raise the animal in the air. But, now, observe how fallacious is this argument. Although it is perfectly true that a wing could be of no use *as a wing* until sufficiently developed to serve the purposes of flight, this is merely to say that until it has become a wing it is of no use as a wing. But it does not follow, 'as a matter of necessity,' that it was of no use for any other purpose. The first modifications of the fore-limb, which ended in its becoming an organ of flight, may very well have been due to adopting it as an organ for increasing rapidity of locomotion of other kinds—whether on land, as in the case of its now degenerated form in the ostrich, or in water, as in the case of the greatly expanded pectoral fins of the so-called flying-fish. Moreover, in the so-called flying squirrels we find the limbs united to the body by means of large extensions of the skin, so that when jumping from one tree to another the animal is able to sustain itself through a long distance in the air by merely spreading out its limbs after the manner of a parachute. Here, of course, we have not yet got a true wing, any more than we have in the case of the flying-fish; but we have the foundations laid for the possible development of a future wing somewhat upon the pattern which has been so wonderfully perfected in the wing of a bat. And through all the stages of progressive expansion which the skin of the squirrel (or the fin of the flying-fish) has undergone, the expansion has been of use, even though as yet the organ has not so much as begun to acquire the distinctive functions of a wing. Here, then, there is obviously nothing 'prophetic' in the matter, any more than there was in the case of the swim-bladder and the lung, or in that of the nerve-ending and the eye.

So much for the Duke's premiss—viz. that 'every modification of structure must have been functionless at first, when it began to appear.' This premiss is clearly opposed to observable fact. But, now, the second position is that, even if such were not so, the Duke's conclusion would not follow. This conclusion is, that if incipient structures are useless, natural selection can have had no part whatever in their inception. Now this conclusion does not 'necessarily' follow; for Mr. Darwin has shown, in considerable detail, that all parts of any given organism are so intimately bound together, or so mutually dependent, that when one part is caused to change, some other parts are very likely to undergo modification in consequence. This principle in organic nature is known as the correlation of growth; and, without waiting to give special examples of its occurrence, it is evident that in it we may find a conceivable explanation of the origin of such adaptive structures as could not have been originated by natural selection acting directly on the first beginnings of these

structures themselves : their first beginnings may have been due to natural selection developing other adaptive structures elsewhere in the organism ; and, if so, when once started in this way, the correlated structures, whenever they happened to prove of any use, would themselves have come under the *direct* action of natural selection, and so have had their further evolution determined with or without the correlated association which first led to their origin by the *indirect* action of natural selection. Hence, it does *not* follow, 'as a matter of necessity,' that even structures which at first *are* functionless cannot be developed by utility in the struggle for existence 'until they have been so far perfected as to be actually used,' and this is the only point with which we are now concerned.

I think, then, that these considerations effectually dispose of the doctrine of 'prophetic germs'—at all events to the extent of exposing the faultiness of the logic in which the doctrine has been presented. But with reference to a kindred difficulty, or that which arises from the presumably frequent—as distinguished from the necessarily universal—uselessness of incipient organs, I should here like to make one further statement of greater generality than any which has hitherto been advanced. This statement is that we ought to remember how large a stock of meaningless changes must be always arising in the course of specific modification, not only by correlations of growth, which we have just been considering, but also by the direct action of external conditions, together with the constant play of all the many and complex forces internal to organisms themselves.¹ In other words, important as the principle of correlation undoubtedly is, we must remember that even this is far from being the only principle which is concerned in the origination of structures that may or may not chance to prove useful. Therefore it is not only natural selection when operating indirectly through the correlation of growth that is competent to produce new structures without reference to utility. In all the complex action and reaction of internal and external forces, new variations are perpetually arising without any reference to future possibilities in the way of usefulness. Among all this multitude of promiscuous variations, the chances must be that some small percentage shall prove of some small service, either from the first moment of their appearance, or else after they have been developed to some extent through the continued operation of the causes which first originated them. Now, it is only these variations that are afterwards wrought up by natural selection into adaptive structures, or working organs ; and, therefore, what we see in organic nature is the net

¹ I present this consideration to those naturalists who depart from Darwin, and follow Wallace, in holding that all specific characters must necessarily be useful. In supporting this unwarrantable dogma, they are greatly strengthening the objection to Darwinism which arises from the inutility of incipient characters, as is apparent from the above argument.

outcome of the development of such happy chances in the way of variation. Thus it comes that the appearance presented by organic nature as a whole is that of a continual fulfilment of structural prophecies, when, in point of fact, if we had a similar record of all the other variations, it would be found that not one such prophecy in a thousand is ever destined to be fulfilled.

Of course if the question were with regard to the conceivable use, or the conceivable correlation, of any *particular* adaptive structures or organs at the time 'when they first began to appear,' the chosen instances would require to be considered upon their own merits; and the issue would then no longer be one having regard to general principles, but merely to special cases: the ground of discussion would no longer be logical, but biological. Such cases, however, have not been adduced either by the Bishop or the Duke; and therefore nothing more remains to be said upon this branch of their common criticism.

Both these critics of Darwinism, however, further agree in deprecating the idea of 'fortuity' as attaching to variation. But this head of 'objection,' although a very popular one, rests upon a mere misconception. When Darwinists speak of variations as arising 'fortuitously,' 'spontaneously,' 'by chance,' or 'by accident,' they do not mean—any more than Darwin meant—that they arise without adequate causes. What they mean is that in such cases the causes are 'accidental' in relation to any utility which may subsequently arise as a consequence. The ambiguity might perhaps be removed if we were to employ, more habitually than we do, the word 'promiscuous,' which would better convey the meaning of variations perpetually occurring in all directions, instead of in the 'pre-determined' directions of the Bishop, or the 'prophetic' directions of the Duke. The idea of variations as thus occurring only—or even chiefly—with any antecedent reference to utility, is not sustained by observation in any one department of organic nature; while the endless modifications which a cumulative artificial selection is able to produce in our domesticated plants and animals, in almost any direction that may be required, is a standing and incontrovertible proof of the very opposite—viz. that variation does not occur in pre-determined lines, but promiscuously in all directions. Therefore it ceases to be apparent that 'the philosopher may still say, How comes it that advantageous variations arise?' It comes because it would be nothing short of a 'pre-established' miracle if they did *not* arise. If among ten thousand variations in as many different ways there were not one which could be of the smallest advantage, then indeed 'the philosopher' might say, How comes it that advantageous variations should *never* arise?

A careful reading of the Bishop's article will show that only two other points remain to be considered. The first refers to the origin

of man, and the second to what he says touching my own theory of physiological selection.

With respect to the origin of man, he says:—

The most striking and interesting feature of Mr. Wallace's book, from what I may describe as the *human* point of view, is to be found in that part of his work in which he denies, and (as he believes) proves himself to be justified in denying, the application of the principle of natural selection to the evolution of the human faculties. This denial is a fact of the first order of magnitude; and I confess that I can see no ground for the language of strong depreciation in which Professor Romanes, in the article already referred to, describes this portion of Mr. Wallace's book. . . . No argument in the article justifies this condemnation . . .

Now, first of all to set myself right as regards this personal matter, I may remark that there were two reasons why, in the article referred to, I abstained from arguing the point in question. Not long before the appearance of that review I had published a book on *Mental Evolution in Man*, where the question of the 'Origin of Human Faculty' was dealt with at greater length and in more detail than it has been by any other writer. Of course the Bishop of Carlisle may deem my analysis of this question a failure, or perhaps he may not have read it; but if he has ever so much as seen it, one might have supposed he would have readily understood that in reviewing Mr. Wallace's book I had nothing further to say upon 'the evolution of human faculties.' Again, in the second place, so different was my estimate of Mr. Wallace's treatment of this subject from that which is expressed by the Bishop, that my respect for Mr. Wallace as a naturalist prevented me from dealing with what appeared to me—as it has appeared to so many other evolutionists—his deplorable weakness as a 'philosopher.' It is in the concluding chapter of his book, much more than in any of the others, that we encounter the Wallace of spiritualism and astrology, the Wallace of vaccination and the land question, the Wallace of incapacity and absurdity. The other Wallace—the Wallace of natural selection and geographical distribution, the Wallace of travel and observation, the Wallace of ingenuity and originality—we all agree in admiring. Therefore it was that in my review I devoted my space to considering the man of science, and refused to follow him where he became the man of nonsense.

In one part of his book—that which treats of hybridism—the essential elements of these two individuals blend, so as themselves to constitute a hybrid of the most extraordinary character. And here we touch the last point in the Bishop's article which still remains to be considered—viz. Mr. Wallace's opinions on the theory of physiological selection.

In January 1888 I published in this Review an answer to the criticisms which Mr. Wallace and others had, up to that time, advanced against this theory. In his *Darwinism*, Mr. Wallace now

reproduces his former criticisms, while totally ignoring my former answer to them. But this is the least remarkable part of his analysis. For, besides reproducing, with scarcely any alteration, his previous criticisms, without attempting to deal with my previous replies to them, he furnishes what he presents as an alternative theory to explain the same class of facts. *Yet this theory is purely and simply, without any modification whatsoever, a re-statement of the first principles of physiological selection, as these were originally stated by myself.* So that while on the one hand he professes, as the Bishop of Carlisle observes, the most uncompromising hostility to my views upon this subject, on the other hand he adopts these views *in toto*, and presents them as his own. A performance so remarkable on its literary, as well as on its scientific side, can only be explained to my mind by having regard to the dual character of my critic's—for I do not in the least suppose that his criticism is other than perfectly honest, or his plagiarism other than wholly unconscious. This is not a suitable occasion upon which to display in detail Mr. Wallace's complete adoption of my theory; but when this shall have been done elsewhere—probably within the present year—I will supply a separate article, which may serve the double purpose of furnishing a very remarkable psychological study, and of showing the readers of this Review the final outcome in Mr. Wallace's mind of the criticism which was first presented to their notice more than two years ago.

GEORGE J. ROMANES.