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INSTINCT AND NATURAL SELECTION.

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HOWEVER far from a true understanding of evolution we may yet be, one result of inestimable value has accrued from its hypothetical statement. It has sent the men of the study back to nature with an urgent and pressing errand. While the scientific explorer can hardly help becoming a philosopher, the philosopher *must* concern himself with the facts and theories of science. Especially is this true in the department of psychology.

Probably, no one of all the artificial barriers that have hitherto obstructed the progress of thought, is less able to give a rational account of itself than that which has separated by a hard-and-fast line between man and the lower animals, on the ground that the one is a creature governed by reason and intelligence, while the other, devoid of reason and intelligence, is governed exclusively by instinct. The removal of this conventional distinction has been like the bursting of a speculation-proof dam, by which two worlds of thought, hitherto held apart, have been permitted to flow together, and modify each other. Psychology is no longer, as under the influence of Descartes, exclusively the science of the *human* mind. It has become the science of mind in general. This has come to pass, not alone through the recognition of the undoubted exercise of intelligence by animals, but equally, by the recognition of the fact that instinct plays an important part in the life of man. While, therefore, for a fuller understanding of the nature and origin of intelligence, we extend our research into the realm of animal life: on the other hand, for a better knowledge of the

nature and origin of instinct, we study the conditions of its appearance and modification in the human mind.

Unquestionably, *evolution*, the great troubler of repose in every department of thought, must be credited with having greatly hastened, if it has not altogether brought about, this way of looking at things. But if psychology has been dragged into a new field by upstart evolution, it does not follow that it is simply to play the part of a passive recipient when once it is there. Evolution may be a great modifier of our old sciences. But, on the other hand, it is no secret that it also stands in great need of modification and amplification. Its most able supporters claim only that Mr. Darwin has elaborated one side of the doctrine. The major factor in the great world process, the source of variation, is still seeking an explanation; and evolution interrogates every ancient science which it wakes up, as to its ability to throw light on this problem. While, therefore, psychology questions evolution as to its bearing upon the nature and origin of those radical impulses to action which we call instinct, and of those convictions which have been regarded as the ultimate *data* of thought; evolution, in its turn, questions psychology as to the information it may be able to give concerning the source of variation. So long as mind is recognized as an originating force in any sphere, the question as to the extent of that sphere will always be one of the most interesting in the whole range of the sciences.

The influence of Mr. Darwin's work has been greatly to extend the realm within which the intelligence of the creature is recognized as an agency in bringing about the results of evolution; for, while holding "that instincts are as important as corporeal structures for the welfare of each species, under its present conditions of life," he, in many cases, traces the origin of instinct directly to intelligence. Within a limited sphere, therefore, comparative psychology is credited with having supplied to evolution an explanation of its mysterious major factor. But

natural selection is apparently a jealous mistress; and, as if seeking compensation for having been overshadowed in one part of the field, it asserts a more absolute sway over another part, to which, as yet, no superior right has been proved. It cannot, indeed, be said that this tendency to magnify the office of natural selection was one which gained strength in the mind of Mr. Darwin. On the contrary, he distinctly tells us, in one of his later works,[1] that in the earlier editions of the Origin of Species he "probably attributed too much to the action of natural selection, or the survival of the fittest." But in a very recent discussion of the origin of instinct, by Mr. G. J. Romanes, the intimate friend and literary executor of Mr. Darwin, we are confronted with a statement of the influence of natural selection which seems to endorse the most extreme interpretations of the Darwinian theory made by its opponents.

Mr. Romanes' position is a very absolute one. After making a valuable distinction, by which instincts are divided into two classes,—those which are known to have been derived from intelligence being classed as "secondary," and all others as "primary,"—he affirms the "uncompounded cause" of the latter class to be "natural selection" acting upon fortuitous variations. Thus, while conscious reason is recognized as an undoubted cause of many important instincts, the origin of that great class, which includes not only some of the most complex instincts of the higher animals, but also (though Mr. Romanes does not say so) that supreme impulse to action which we call the moral sense of man, is traced to the agency of a purely negative influence, acting upon chance variations. This view is specially deserving of attention, because it expresses, within a limited sphere, just that view of natural selection which has been popularly supposed to be Darwinian, but which is repudiated by Professor Huxley, and other prominent evolutionists.

[1] The Descent of Man, vol. i. p. 146.

The substance of Professor Huxley's interpretation of the Darwinian theory of the causes of evolution is as follows: "Species have been evolved by variation, a natural process, the laws of which are for the most part unknown, aided by the subordinate action of natural selection."[1] Probably more than one reader of this sentence has paused with astonishment and asked himself whether indeed the writer, who somewhere calls himself the "under-nurse" of Darwinism, has not been betrayed into seeing in his nurseling that which must forever elude less partial eyes. It is certainly the fact that an impression the reverse of the above has been produced upon the great majority of Mr. Darwin's readers; and is still produced by a class of writers who are supposed to represent his views, —the impression, namely, that species have been evolved by natural selection acting upon chance variations.

The tendency to variation is indeed everywhere recognized as the *sine qua non* of evolution; but this recognition does not go beyond that which we concede to the raw material of the most elaborate and artistic fabric. We never think of attributing causation primarily either to the materials of which a thing is made or to the mechanical force by the aid of which it has been constructed. But I think I do not overstate in saying that variations and the tendency to variation always, in Mr. Darwin's treatment of the subject, occupy a position with reference to the elaborated products of nature which suggests these subordinate agencies, and nothing more. When therefore a writer of Mr. Romanes' ability and personal proximity to the author in question gives an unqualified endorsement to this impression, a warning notice seems to be posted right across the way of one who, in reliance upon Professor Huxley, would attempt to justify Darwinian evolution as not destructive of the idea of design.

In Mr. Romanes' statement the tendency to vary is presented to the mind as energy running to waste till natural

[1] Critiques and Addresses, p. 299.

selection intervenes, with its system of cut-offs, to shape its course and force it into useful channels. The artificer is as unintelligent as the stream of energy directed, as purposeless as the material used: and the impression produced is that, so far as detail is concerned, there is no such thing as positive constructive purpose to be discerned in all this grand process of evolution, that is, there is no such element, until we come to the conscious intelligence of the creature. I would therefore invite the reader to a consideration of this view, and the arguments which support it.

Mr. Romanes' *definition* of instinct first demands our attention; for his arguments in support of the agency of natural selection depend very much upon this: and it has seemed to me that the weakness of his case is made manifest from the beginning, by the exceedingly elaborate and involved character of this definition. It is as follows: "Instinct is the name given to those faculties of mind which are concerned in consciously adaptive action, prior to individual experience, without necessary knowledge of the relation between means employed and ends attained; but similarly performed under similar and frequently recurring circumstances by all the individuals of the same species." Now, I would submit, that the truest and best definition of instinct, for all purposes, is the widest. The word has been used loosely, in the past, to designate a very extended range of actions, but it has in all cases stood for a certain quality in these actions, which was recognized without difficulty. *Instinctive* is therefore a much less uncertain word than instinct; for different actions may partake little or much of this quality. We say that an action is purely instinctive when it is performed in response to stimuli, without any conscious intention or effort on the part of the actor. We say, again, that it is partially instinctive when the impulse which gives rise to it comes to a certain extent, but not fully, into the region of conscious purpose and will.

I therefore make the word "instinct" include all the

adaptive actions of sentient beings which are not mainly dependent upon conscious intelligence for their performance. To use the word in this way does not prevent our making all the distinctions necessary for an intelligent discussion of the subject. We may qualify instinct to any extent, as more or less plastic, as purely impulsive, as primary or secondary, as associated with reason or the reverse. But to restrict a word that has done duty so long, and so well, to some one part of the field which it has hitherto occupied is seriously to embarrass ourselves, not only in the intelligible use of language, but, what is worse, in the matter of clear thinking. I have called particular attention to this, because Mr. Romanes seems to me to have obscured a subject upon which his wealth of facts is calculated to throw much light, by the elaborateness of his definitions and restrictions. All those efforts of an organism which are supposed to be unaccompanied by consciousness he would have us regard as sufficiently explained by "reflex action." Instinct in its lowest form is then defined as "reflex action into which an element of consciousness has been imported." In the second place instinct is intended to be rigorously marked off from intelligence. "I shall always," he says, "speak *of intelligence and intellect in antithesis to instinct.*"

It is almost impossible not to believe that the author has been led into this definition by the effort to exclude two views of the origin of instinct which conflict with his own: that, on the one hand, of Mr. Herbert Spencer, who, confining his attention to the physical basis of instinct, identifies it with reflex action, and who sees in the most elaborate cases only an increased complexity of such action; and, on the other hand, the view of Mr. Lewes, who makes all instinct to have originated through intelligence. But the result has been a definition that nearly reverses the generally received and accepted idea, namely, that instinct is an action from which consciousness seems to be missing, but in which intelligence of a mysterious kind

seems to be present. The consequences of this reversal are, as I have said, conspicuous both in confusion of language and in derangement of thought;—in confusion of language because many other words such as "intelligence," "adaptive action," "perception," and "consciousness" are put to unaccustomed uses while waiting upon this new conception of instinct. Thus while the *word* intelligence is excluded from the definition, the *idea* of conscious intelligence is still present whenever instinct is contrasted with reflex action. Consciously adaptive action implies a great deal more than simple consciousness. "A reflex action into which consciousness has been imported" would be a sufficient definition were it not so. But, when we are searching for the causes of things, reflex action with consciousness as a merely *incidental* element is not worth distinguishing from ordinary reflex action. For then the consciousness appears to be, as Professor Huxley has claimed, "related to the mechanism of the body simply as a collateral product of its working, and to be as completely without any power of modifying that working as the steam-whistle which accompanies the work of a locomotive engine is without influence upon its machinery."[1]

But Mr. Romanes, while emphasizing the difference between instinct and reflex action, implies a great deal more than this. He, in fact, distinctly tells us that cases of true instinct are those in which "consciousness is *necessary to the performance of an action*, which but for the occurrence of consciousness would be properly classified as a reflex action:"[2] and further he inadvertently reveals the fact that the idea of intelligent consciousness is the soul of his phrase "consciously adaptive" by using it, at least on one occasion, in its stead. When discriminating between two similar actions, one of which he wishes us to regard as instinct and the other as reflex action, he uses the words

[1] Science and Culture, p. 243.

[2] Mental Evolution in Animals, p. 259.

"intelligent consciousness"[1] to designate the former. But, on the other hand, when he approaches the boundaries of Mr. Lewes' theory, which, from the side of mind, threatens the domain reserved for the exclusive agency of natural selection, "consciously adaptive action" means nothing so far as causation is concerned. The difficulties of this position have farther led Mr. Romanes into making distinctions which seem very much like rebuilding the things which Darwinism has helped to destroy. We used to draw the arbitrary line separating intelligence from non-intelligence between man and the animals below man; but now Mr. Romanes draws the same line farther down on the biological scale. With such a distinction we are not, it is true, as badly off as we were before. The higher animals have been, so to speak, emancipated, they have been admitted into the circle of intelligent beings. But the lower are still unrecognized as having any thing in common with them, so far as mind is concerned.

But we need not go beyond the pages of Mr. Romanes' books to be convinced that the distinction between the lower and higher animals in this respect is just as unsatisfactory and as embarrassing as that which formerly separated a man from his companion, the dog. The same inconsistency of attributing like phenomena to radically different causes is as inevitable in the one case as in the other. If actions which bear all the marks of intelligence, and which in an animal of higher organization would have to be ascribed to a *high degree* of intelligence, occur in an amœba,[2] it is not permitted to draw the same inference, because the amœba is so very low down in the scale of being. The infelicity of this arrangement is recognized by our author, but he accepts the situation without flinching. "The giving of suck to young by mammals," he tells us, "must be regarded as a truly instinctive act," but

[1] Mental Evolution in Animals (American edition), p. 259.

[2] Animal Intelligence (American edition), p. 21.

when this act is performed by a jelly-fish we must refuse to acknowledge it as any thing more than reflex action.

"McCready describes a species of Medusa which carries its larvæ on the inner side of its bell-like body. The mouth and stomach of the Medusa hang down like the tongue of a bell, and contain the nutrient fluids. McCready observed this depending organ to be moved first to one side and then to the other side of the bell, in order to give suck to the larvæ on the sides of the bell—the larvæ dipping their long noses into the nutrient fluids which that organ of the parent's body contained."

Mr. Romanes' comment upon this is as follows: "If this case occurred in any of the higher animals, where we might suppose *intelligent consciousness* of its occurrence to be present, it would properly be regarded as a case of instinct. But as it occurs in an animal so low in the scale as a jelly-fish, we are not warranted in assuming the presence of an intelligent perception of the process, and therefore, in my view, we must classify the case, not as one of instinct, but as one of reflex action."[1] By reflex action Mr. Romanes does not mean purely mechanical action; but the difference between the giving of suck by a jelly-fish and by a cow is said to be the presence in the latter of a psychical element. The only scientific reason for the assumption that such an element does not exist in the jelly-fish and the amœba is the lack of organization, to serve as the physical basis of intelligence. But the same method of reasoning excludes equally the hypothesis of reflex action; for to produce the phenomena under consideration, the reflex action must be exceedingly complex, and for the existence of this a highly complex organization is as necessary as for intelligence. For instance, the amœba appears to be simply a speck of jelly, without any discoverable organization; but the following illustration, quoted from Mr. J. H. Carter's Annals of Natural History, gives some idea of the puzzle which it presents:

"In the evening of the 2nd of June, 1858, in Bombay, while looking through a microscope at some *Englenæ, etc.*, my eye fell upon a stalked and triangular *acineta*, around which an amœba was creeping and lingering, as

[1] Mental Evolution in Animals, p. 260.

they do when they are in quest of food. But knowing the antipathy which the *amœba*, like almost every other infusorian, has to the tentacles of the *acineta*, I concluded that the *amœba* was not encouraging an appetite for its whiskered companion, when I was surprised to find that it crept up the stem of the *acineta*, and wound itself round its body. This mark of affection did not long remain without interpretation. There was a young *acineta*, tender, and without poisonous tentacles (for they are not developed at birth), just ready to make its exit from the parent, an exit which takes place so quickly, and is followed by such rapid bounding movements of the non-ciliated *acineta*, that who would venture to say, *a priori*, that a dull, heavy, sluggish, *amœba* could catch such an agile little thing? But the *amœba* are as unerring and unrelaxing in their grasp as they are unrelenting in their cruel inceptions of the living and the dead, when they serve them for nutrition; and thus the *amœba*, placing itself around the ovarian aperture of the *acineta*, received the young one, nurselike, in its fatal lap, incepted it, descended from the parent and crept off." [1]

In commenting upon this, Mr. Romanes recognizes the difficulty of the case, but his only response is an exclamation of wonder "that these movements should be exhibited by such apparently unorganized creatures, seeing that as to the remoteness of the end attained, no less than the complex refinement of the stimulus to which their adaptive response was due, the movements in question rival the most elaborate of non-mental adjustments elsewhere performed by the most highly organized of nervous systems." The glaring fact is that it is just as easy to account for the phenomena in question on the supposition of intelligence as on that of complex reflex action. The lack of organization is, in either case, the absolute contradiction of the presuppositions which we bring to the investigation; and we are shut up to one of two conclusions, either that organization exists which our microscopes fail to reveal, or that something closely resembling intelligence exists without organization.

With regard to the part which reflex, or purely mechanical, action is made to bear in this discussion there is not room to say much in this connection; but all that need be said may be put in few words. There is nothing in the whole range of assumed scientific deduction more utterly

[1] Animal Intelligence, p. 21. I have slightly abbreviated the quotation.

unscientific than that which postulates any vital action as *purely* mechanical. The physical basis of all mental and vital processes has a close resembance to mechanism from one point of view. But to jump from the fact of this resemblance to the assumption that such processes are ever purely mechanical is simply to substitute analogy for fact; to import from the realm of inorganic life a term to express the phenomena of organic life, and then affirm that there is no difference between the two. Mr. Romanes does not allow himself to fall into this error. In one of his introductory chapters he carefully guards himself against the suspicion of it. Yet when he assigns one great class of phenomena to a distinct mode of action which he declares to be devoid of mental quality he certainly suggests it; and it is only in so far as this idea of pure mechanism is suggested that the assignment of reflex action as a cause satisfies the mind. To dwell longer upon this question would compromise the main object of this discussion, which is *to estimate the value of the principle of natural selection, as an explanation of instinct.*

Mr. Romanes' division of instinct into two classes, *primary* and *secondary*, cannot fail to be recognized as constituting a real and very helpful distinction. Secondary instincts are those which can be directly traced to the experience and intelligent effort either of the individual or of his ancestors. When a dancer responds to music almost automatically, going through the most elaborate movements without conscious effort, his mind in the meantime occupied by other things, we truly call his action instinctive. The still more elaborate and rapid movements of the hands of the performer on the piano that regulates and stimulates the dancer may be of the same nature. But in both cases we know the instinct to have been acquired by attention and painstaking effort in the beginning. All such instincts, acquired by the individual or transmitted after having been acquired by ancestors, we may leave out of our present inquiry. Being well acquainted with their

origin we class them as "secondary," or "lapsed intelligence." There then remains to be accounted for that form of instinct which is termed "primary."

A primary instinct may be defined as that mysterious spring of action which seems to imply intelligence, but which, for certain reasons, we hesitate to ascribe to the intelligence of the creature. The origin of all primary instincts is said by Mr. Romanes to be natural selection acting upon fortuitous variations. His reasons, negative and positive, are as follows: First, "many instinctive actions are performed by animals too low in the scale to admit of our supposing that the adjustments which are now instinctive could ever have been intelligent"; second, these cannot be classed simply as reflex action because they contain a mental element; third, since a cause distinct from either of these must be sought, we may entertain the hypothesis that this class of instincts has arisen accidentally. We are familiar with the fact that individuals are distinguished from each other by tricks of manner, that many such peculiarities are strongly marked, and further that these sometimes lead to useless and capricious actions which have all the strength of incipient instincts. "If," therefore, "among a number of meaningless habits, all more or less hereditary and more or less variable, any one should happen from the first to be, or afterwards vary so as to become, accidentally beneficial to the animal, then we are bound to believe that natural selection would fix this habit or its beneficial variations."

Now, although I do not approve Mr. Romanes' definition of instinct, I would call attention to the fact that every part of it applies equally well to that which he regards as the raw material of instinct, with one exception. Until natural selection has done its work by eliminating those individuals of a forming species that either do not develop, or develop only feebly, a given instinct, it cannot perhaps be true that it characterizes "all the individuals of the same species." This condition of uniformity, and also

the degree of perfection attained, we may believe is brought about by the agency of natural selection. But all that can be credited to this agency has been accomplished by the rule of subtraction. It has originated absolutely nothing: and here, as elsewhere, the attempt to make it account for beginnings is a failure. The real origin so far as it is exhibited in this treatise is to be sought in those conditions which natural selection may influence. These are "actions which, although never intelligent, happen to have been of benefit to the animals which first chanced to perform them." At the very beginning, therefore, before natural selection has had any thing to do, we find the animal upon whose progeny it is to operate, performing habitually, or at least with persistent repetition, an action which is actually beneficial to its existence. The fact that the animal performs other actions which, so far as we can see, are without any beneficial result must not obscure the fact that this one *is* beneficial.

What we have therefore, as the result of this account of derivation, is so close to the thing itself which we are trying to analyze, that the question arises whether there has really been any analysis at all. Nothing has been done except to take us back to a less established form of instinct, a form which is quite as wonderful and mysterious as that which is more developed. Natural selection does for this rudimentary faculty just that which contact with environment does for all immature rudimentary organic forms. It, together with other influences, modifies, strengthens, and, so to speak, solidifies that which, at its advent, was comparatively weak and pliant. To say that these actions which actually conduce to the well-being of the creature, and which are persistently repeated, have never been intelligent, is simply to assume that which admits of no proof: and this assumption I conceive to be a particularly unfortunate one in view of that particular portion of Mr. Romanes' definition of instinct in which he says, "Instinct is the name given to those faculties of mind

which are concerned in consciously adaptive action." For if those actions which have been gradually forced into developed and established instincts through the operation of natural selection, were not consciously adaptive in the beginning, it is most unscientific to suppose that they could have become so.

Natural selection can give no account of such a transformation. On the contrary, that process over which it stands guard, but into which it can introduce no new factor, has just the opposite tendency from the one here implied. The oftener a given action is repeated, and the more it becomes incorporated into the constitution of a species, the more does it tend to become automatic. Actions which were originally intelligent are continually passing over into actions which are non-intelligent and in one aspect mechanical. This therefore involves the reversal of all our experience; for, so far as our experience goes, intelligence and consciousness arise in response to new, that is to say, hitherto unexperienced, stimuli. This is clearly recognized by our author; for, in a chapter on general principles, he declares, "we know by immediate or subjective analysis that consciousness only occurs when a nerve-centre is engaged in such a focusing of varied or comparatively unusual stimuli as have been described, and when, as a preliminary to this focusing or act of discriminative adjustment, there arises in the nerve-centre a comparative turmoil of stimuli coursing in more or less unaccustomed directions, and therefore giving rise to a comparative delay in the occurrence of the eventual response."[1] This principle, which is also enunciated in "Animal Intelligence,"[2] is clearly destructive of the assumption that primary instincts have been originated by natural selection acting upon chance variations, and that they, at the same time, contain a mental element, which entitles them to be described as "consciously adaptive actions." Mr. Romanes is therefore reduced to the log-

[1] Mental Evolution in Animals, p. 75. [2] p. 17.

ical necessity of surrendering his theory of derivation, or of accepting the conclusion that such wonderfully plastic instincts as those of worker bees (classed as primary) are, and always have been, utterly devoid of consciousness of any kind.

But without dwelling longer on the inconsistencies of this theory, let us proceed to examine briefly the fundamental assumption that "useless and capricious actions" have been the starting point or the initial stage of the most wonderful instincts. First, has this hypothesis any advantage over that of intelligent origin in point of conceivableness? The contrary seems to me to be the fact. Is it not a far less violent supposition to hold that products which so closely resemble secondary instincts have come into being through a similar or at least analogous process? Yet, as the limits of the conceivable are probably not the same for any two individuals, and must necessarily be widely different for those who approach a problem from different directions, there is nothing conclusive either way in this consideration. It is very easy in the discussion of this class of questions to dispose of an opponent's views by saying they are "unthinkable" or inconceivable. But the weapon is just as serviceable on the one side as on the other, and to settle a question solely on this issue would be much like putting it to vote.

I would therefore, in the second place, take the position that the hypothesis of chance origin is *scientifically* untenable. I do not mean simply in the sense in which Professor Huxley[1] condemns it, but in any sense. There may be, as Professor Huxley says, no harm in saying in "popular language" that the waves which break upon the seashore are indefinite, fortuitous, and break in all directions. But there is harm in saying in any language, popular or scientific, that the variations which give rise to instincts or species are fortuitous. For when the origin of such important and dignified products as these has once been un-

[1] Critiques and Addresses, p. 298.

der discussion, the application of language in a popular sense is out of the question, especially when the accurate meaning of the popularly used word would settle the point under discussion. As a matter of fact this word *fortuitous*, as employed by Mr. Romanes, is made to carry its fullest and most absolute meaning in describing the relation which exists between a newly formed instinct and the uses which it subserves. He describes incipient instincts as "purposeless habits which *chance* to be profitable."[1] Now, it is this use of the word, or rather, I should say, it is the idea which this use of the word represents, that gives the greatest force to the unanswered objections against evolution as stated, or supposed to be stated, by Mr. Darwin.

I do not refer to the objections which come from the side of theology, and are urged by those who, as Mr. Huxley says, "beat the drum ecclesiastic." But to the purely scientific objections which, until they are satisfactorily answered, forbid the acceptance of *this part* of the hypothesis. The criticism in the *North British Review*, 1864, which obtained such respectful recognition from Mr. Darwin, made its strongest point against this particular assumption. It was most conclusively shown that any merely accidental variation in any individual, even if beneficial to the race, would have no chance of being perpetuated in the struggle for existence; but would be inevitably obliterated in the course of hereditary transmission by the dissipating influence of the great mass of the race into which it must be received. To overcome this difficulty it must be assumed that the same variation occurs in a sufficiently large number of individuals to counteract the levelling influence of the remainder that does not develop it. But as soon as we postulate this, it becomes necessary to abandon the idea of chance origin, and to recognize a more or less direct causal or teleological relationship between the new variation, or incipient instinct, and

[1] Mental Evolution, etc., p. 267.

the external circumstances which it is calculated to meet.

This may be or it may not be Darwinism. It is certainly a most important consideration, and one which must obtain a more positive recognition in future statements of evolution than it has hitherto received. In his later editions, at least, Mr. Darwin almost uniformly uses the word "spontaneous" to characterize variations,—a word conveying a very different meaning from fortuitous—and in itself considered, unobjectionable: for it simply affirms that the variation, in one aspect, owes its origin to that which is inherent in the organism. Dr. Asa Gray, in his interpretation of Mr. Darwin's position on this point, claims that he held both terms of the following antithesis, —"that variations are in some way excited by change of external conditions; also that they are determined by something within rather than something without the organism. Although he does not expressly say so, his whole exposition of the subject, in his later as well as his early writings, appears to regard the changes and actions of the organism as a response to the influences of the environment."

This rendering of Mr. Darwin seems very much in the line of that already quoted from Professor Huxley as regards the importance which it assigns to the constructive agency of the organism, as contrasted with that of natural selection. But Dr. Gray admits that Mr. Darwin is correctly represented as believing that "the variations are perhaps fortuitous so far as their usefulness to the organism goes": and this certainly seems to be taking "a direct anti-teleological position," which Dr. Gray says he always declined to assume. Yet, since it is Dr. Gray who has said this, I must try to conceive how the two parts of the paradox may be harmonized; that is, how Mr. Darwin, while believing that "variations are perhaps fortuitous so far as their usefulness to the organism goes," can at the same time hold that variations are related "to the needs and even the future of the organism"; I must therefore con-

ceive of it on this wise. The organism, being stimulated to movement and variation by the pressure of surrounding circumstances, turns, like a restless sleeper, now this way, now that, in the aimless, unconscious endeavor to meet some undefined want of its being. The movements made are in "response to the influences of the environment," "they have relation to the needs, and even the future of the organism"; but it is perhaps a matter of chance whether they are ever made in a direction which will prove to be the right one. If among a great number of movements thus made certain ones hit the mark by chancing upon favorable variations, the organism attains a more perfect adjustment of itself to its environment, and its chances of survival in the conflict of existence are increased.

But here we are confronted with the difficulty above adverted to,—the necessary limitation and short continuance of favorable variations so reached. Unless we postulate some directing power within the organism, and assume that natural selection, as Mr. W. K. Brooks expresses it, "is in some way provided with variation in those parts where change is needed,"[1] we cannot rationally hold that any number of individuals would hit upon the same, necessarily complex, response to environment or that the favorable variations would be perpetuated.

May we not, without any disrespect to the great name of Mr. Darwin, clearly recognize the insufficiency of his representation of the causes of evolution? The quarter of a century which has elapsed since the publication of the Origin of Species has certainly brought much that confirms his general theory, much also that corroborates his view that natural selection has been a most potent factor in the process: but has it not also steadily forced upon the minds of the great body of scientific men the conviction that the process has not been of that uniformly gradual nature which Mr. Darwin postulated? And, further, is it not clear that the exigencies of natural selection itself

[1] Heredity, p. 284.

absolutely exclude the idea of the chance origin of variations? And are we not therefore forced to assume the positive position that the movements of the organism in response to environment are, in some way, *directed* to a successful issue?

The interpretations of Mr. Darwin given by Professor Huxley and Dr. Gray, are valuable to us as guides to the study of a great scientific leader. They will often enable us to read between the lines, and see much that is implied but not actually stated. But it is probable that Mr. Darwin's position will be a matter of unending controversy, and that authority for widely divergent opinions will continue to be discovered in his works. These interpretations therefore have an independent and much greater value as statements of what, in the opinion of these eminent authorities, the theory of evolution *ought to be*. Their value, in this aspect, is enhanced by the fact, that they are the antithesis of what has been generally and popularly conceived to be the most approved and scientific statement of the doctrine; and further because this generally received view in its most extreme form is still put forward by one class of evolutionists, as if it were the *only* one entitled to respect.

It is probably true, as Mr. Brooks has observed, that the objections against Mr. Darwin's theory have received less attention than they have deserved on the part of scientific men, because the authors who originally pointed them out "at the same time attacked the general theory in a hostile spirit, without proposing any thing to take its place." But now that the dust of the struggle for existence has in some measure cleared away, the army of the evolutionists is distinctly forming itself into opposing camps: on the one hand, are those whom we may call *progressive*, who, believing in a *universal law of evolution*, at the same time incline to the opinion of Dr. Joseph Le Conte, that its "most fundamental factors are still unknown"; and, on the other hand, those who, as extreme

Darwinians, or rather, as Hyper-Darwinians, hold natural selection to be the sole cause of organic progress, and are never tired of affirming a necessary and irreconcilable conflict between the ideas of evolution and design. To these latter the doctrine of natural selection is the sacred centre of a system. It cannot be subordinated, neither can it be modified.

I will give one illustration of this phase of what seems to be arrested development. Mr. J. J. Murphy makes the following continuous statement of an evolutionary creed:

"I agree with Darwin in the belief that all species have been derived by descent with modification, probably from one, certainly from a few original germs; and I further agree with him in attaching great importance to 'natural selection among spontaneous variations' as part of the agency by which the modifications have been effected. But I altogether differ from him, in that I believe the wondrous facts of organic adaptation cannot have been produced by natural selection, or by any unintelligent agency whatever."[1]

His critic, Mr. Grant Allen, who holds evolution and design to be mutually exclusive ideas, while admitting that Mr. Murphy has used with great force the objections which lie in the way of accepting natural selection as a *sole* cause of organic progress, complains that he uses these, "not as a mere friendly suggestion, but as a weapon of hostile import." But the question is why should we not use them as a weapon of hostile import, so long as the hostility is not directed against persons, but against natural selection as a sole or predominant cause of evolution?

Professor Huxley, in his address on the Coming of Age of the Origin of Species, after alluding to the fact that a host of young and ardent investigators seek for and find inspiration and guidance in Mr. Darwin's great work; and that the general doctrine of evolution, "*to one side of which it gives expression*," obtains in the phenomena of biology a firm basis of operations whence it may conduct its conquest of the whole realm of nature,—adds this significant prophecy: "History warns us, however, that it is the customary fate of new truths to begin as heresies and to end

[1] Habit and Intelligence, p. 3.

as superstitions; and as matters now stand it is hardly rash to anticipate that in another twenty years, the new generation, educated under the influences of the present day, will be in danger of accepting the main doctrines of the Origin of Species, with as little reflection, and it may be with as little justification, as so many of our contemporaries twenty years ago rejected them."[1] Does it not seem as if the reign of superstition had already begun in the case of those who, in the face of all the light that criticism and research have brought to bear on the question, still persist in identifying the principle of natural selection with the larger problem of evolution?

That this form of evolution will be any thing more than a side issue we may well doubt; for there is abundant reason for believing that the great body of working scientific men, fully recognizing the incompleteness of that which has been achieved, have their faces set toward the future. We may therefore leave superstition in evolution to fight it out with superstition in other departments. A living theology that is not afraid of facing scientific necessities, and that recognizes the principle of evolution in its own history, gladly joins with a progressive evolution that sets itself seriously to the task of discovering what may be discovered as to the nature of that power within the organism that works for ends.

One word more with regard to instinct, to relieve the unsatisfactoriness of a purely negative discussion, will not perhaps be out of place. I will only try to indicate the lines of inquiry from which, as it seems to me, the best results may be hoped for. The view of Mr. G. H. Lewes, who traces all instincts to intelligence, has already been alluded to, and also that of Mr. Herbert Spencer, who identifies instinct with compound reflex action. These two views are treated by Mr. Romanes as mutually exclusive. But I cannot thus regard them. Both have a sound scientific basis, though both may have been developed in

[1] Science and Culture, p. 319.

such a way as to lead to false conclusions. Reflex action is probably the physical basis of all mental operations, and may therefore, in one aspect, be regarded as the cause of instinct. The simplest idea of instinctive action we can conceive is the response of a single nerve cell to stimulation. But, on the other hand, as we rise in the scale of being, that element which we clearly recognize as conscious intelligence emerges. How far down on the scale it exists we have no means of knowing except by the results produced.

But we know this, that intelligence in the higher animals is a true originating cause of instinct. By means of consciously exerted mind power, modifications of the organism are effected which become the physical basis of instinct. This consciously exerted mind power is a more or less voluntary response of the organism to its environment. As we descend in the scale of being, the conscious and voluntary element seems to grow less and less; but we may always say that *effort* is implied in the response of the lowest creature to the pressure for a more complete adjustment of itself to its surroundings; and we may also hold that this effort proceeds from the psychical or neutral part of each organization. Therefore, while any word which has been used to express mental operation on the part of man expresses too much when we wish to speak of the activities of an amœba, I think we may rationally entertain the hypothesis that all instincts have their origin in an effort of the organism which is analogous to, though not identical with, that which we call intelligence in man.