NATURAL SELECTION INSUFFICIENT TO THE DEVELOPMENT OF MAN.

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IN a well-known passage towards the close of the "Origin of Species," Mr. Darwin supposes the question to be put to him, How far does your doctrine extend, and what amount of ground does it cover? The answer is perfectly frank and clear. Practically it covers the whole area of life. Every class, at least of animals and plants, must own a common ancestor, and probably these class-founders are themselves only brethren descended from some yet remoter stock. Of the former of these two positions he speaks confidently. "I cannot doubt," he says, "that the theory of descent, with modification, embraces all the members of the same class. I believe that animals have descended from at most only four or five progenitors, and plants from an equal or lesser number." Of the latter he speaks with more reserve. "Analogy would lead me one step further, namely, to the belief that all animals and plants have descended from some one prototype. But analogy," he adds, "may be a deceitful guide. Nevertheless he sees sufficient reason to justify him in following its guidance in this instance, and finally sums up his opinion in the following remarkable words: "Therefore I should infer from analogy that probably all the organic beings which have ever lived on this earth have descended from some one primordial form, into which life was first breathed."

The natural inference from these words would be that Mr. Darwin considered his theory of natural selection as sufficient to account for all the varieties of life on the face of the earth. But it is not a necessary inference. For he is speaking, in this passage, not precisely of the doctrine of natural selection, but of the doctrine of "descent with modification;" and the two ideas are perfectly distinct. For it is quite possible that all living beings may be descended from a single primordial form, and yet that natural selection may not be the only

agency employed in the determination of their actual variety. Other methods and other forces may have conspired with it, checked or thwarted it, in the work of educing from one common form the boundless multiformity which now meets our eyes. No doubt the whole course of Mr. Darwin's reasonings and illustrations leads us to the conviction that in his judgment the unassisted action of natural selection is sufficient to produce all the necessary modifications, but so far as express words go, he has not excluded—at any rate in the passage which I have quoted—the possibility of the co-operation or interference of some other cause; and it is important to call attention to this, because a very high authority on this subject, Mr. A. R. Wallace—the independent originator, and the most able defender of the theory which bears Mr. Darwin's name—has recently proclaimed his conviction that natural selection by itself is inadequate to the production of at least one, and that the most important, form of life. In other words it is impossible, in Mr. Wallace's opinion, that man can have been developed from the inferior animals by the process of natural selection alone. Whatever else it may have done, it is unequal to this, the great and crowning act of creative power.*

To understand his reasonings we must first get a clear idea of what the doctrine of natural selection is. It does not imply, as many will persist in assuming, any capacity in the individual to alter his own structure, and adapt himself to surrounding circumstances. The individual does not materially change. Such as he is born, such, in his physical structure, he will remain to the end of his life. Only if his physical structure does not happen to be well adapted to the circumstances in which he finds himself, his life will be a short one. His neighbour, who happens, by some small variation, to be slightly better adapted to those circumstances, will live longer. And, moreover, since the offspring inherit the parents' peculiarities, the descendants of this latter are likely to prevail to the exclusion of those of the former; and thus, in the course of some generations, the prevailing type and character of the whole family will be slightly modified. It is not the individual, but the collection of similar individuals, or the Kind—a word which may be usefully employed to avoid the technical meaning attaching to class or species—that changes. And it changes only by means of changing its units, by dropping out from time to time those that are unsuitable, and keeping in and preserving those that are suitable. In this way it adapts itself

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* See "Contributions to the Theory of Natural Selection." (Macmillan & Co.) By A. R. Wallace. This paper is little more than an expansion of part of the argument in one of these Essays.

to the perpetual changes of surrounding circumstances, and keeps itself by its own variations in constant harmony with the ever-varying world around it. As earth and seas, forest, river and meadow, climate and temperature, are never for a moment stationary, but maintain a perpetual ebb and flow of ceaseless interchange, so the general forms and types of life, which are affected by all these influences, are also in continual and corresponding flux. Both are always in a condition of instability in themselves, because both are always in perfect harmony with each other. But it follows from this that no modification can possibly be introduced into any form or type of life, unless it be beneficial to the creature modified—unless it tend, in some way or other, to bring him more into harmony with the conditions around him than he was before. If the change be merely a matter of indifference, doing neither good nor harm to the possessor, it will make no impression on the Kind. It is an individual peculiarity which may re-appear again here and there in other individuals, but which has no tendency to prevail over other similar peculiarities in others. But if the change is actually injurious, it will vanish at once. The unlucky possessor of it will be inferior to his neighbours in the struggle for existence; his life will be cut short sooner than that of others; his offspring, if they inherit his peculiarity, will inherit also his disadvantages, and will soon perish out of the Kind, leaving no trace behind them. Natural selection is like fortune; it favours only the brave; it helps those only who can help themselves; it rejects the weak, the puny, the ill-provided, and ill-adapted; and its effect is best described as the survival of the fittest.

Now let us apply these principles to the case of man. Were the changes by which the Kind passed—if it did pass—from some lower type to the human type such as would be manifestly beneficial in the first instance to the individuals who were affected by these changes? Because, if they were not, that transition could never have been effected by natural selection. If it occurred at all, some other agency must be taken into account. What, then, were these changes? We cannot, of course, tell exactly, unless we knew—as we certainly do not know—the form of life which immediately preceded the human. But let us assume for the moment that the anthropoid apes and man are the extremities of divergent lines from some remote ancestor, uniting in himself the characteristics which they have in common; how would the differentiation begin to be carried on? One of the most marked peculiarities in man is the soft, smooth skin. Alone among the mammalia, he is unprotected either by the hardness or the shagginess of his integument. He has neither the impenetrable armour of the rhinoceros, nor the

thick fur of the bear, nor the warm wool of the sheep. Was it any advantage to the first individual that came into the world with this soft, smooth skin, or with any approximation to it, beyond his fellows? Was it a peculiarity likely to help him in the struggle for life—to enable him to survive when others perished?—likely, therefore, when transmitted to his offspring, to appear in greater force in the next generation; and gradually, by its superior adaptation to surrounding circumstances, to supplant the tough or hairy skins which had preceded and accompanied it? Was it likely, in short, to become an object of natural selection? Is it not, on the contrary, quite plain that the very reverse would be the case? The accidental possessor of this smooth skin would clearly be at a great disadvantage. He would succumb beneath the attacks of enemies which his hardier fellows could successfully resist. Rain and frost and cold would work their bitter will upon him unchecked. Inclement seasons, which only produced a moderate inconvenience, or none at all, to creatures with thick or shaggy hides, would soon prove fatal to the animal we are imagining. There is no conceivable reason why such an animal should live and perpetuate his peculiarity, while others which did not possess it perished; there is, on the contrary, every reason to suppose that such an animal, born for the first time, an anomaly in a shaggy world, would speedily be eliminated and leave no trace behind him. That is to say, it is impossible to picture a condition of things in which a kind of creatures distinguished by smooth skins could have arisen by the process of natural selection. In other words, natural selection cannot account for the origin of this peculiarity in the human form.

But that is not all. The theory of natural selection not only requires that every change promoted by it should be for the benefit of the possessor; it requires also that it should be for his *direct* and *immediate* benefit; that it should be no greater than is necessary to give him some instant advantage, however slight, over his fellows. For it does not act, any more than Nature herself, *per saltum*. It rests for its motive force upon the variation which always exists between a parent and an offspring; and this variation is, for the most part, very slight. It is enough to distinguish one from the other, but never much more. It is generally so small that the unpractised eye often fails to see any difference whatever. We do not mistake our friends for their fathers, though, if we do not know them well, we are liable sometimes to get confused between brothers and sisters; but, except to the shepherd, a flock of sheep seem to be all exactly alike. The differences between individuals of the same kind are for the most part very small, and it is only

on these differences that natural selection acts. Hence it happens that the transformation of one kind into another is a very slow and gradual process, because it has to be accomplished by a series of very small steps. A long step cannot be taken unless it is more to the advantage of the individual than a short step in the same direction, because it is certain that many more individuals will be born in any given generation with the small than with the large variation; and, unless the large one has some direct advantage over the small, the mere superiority of numbers will give the victory to the latter. Let us illustrate this by an example. Suppose a flower, such as the *Angrœcum Sesquipedale* of Madagascar, with a very deep nectary, and a supply of nectar at the bottom of it. This can only be reached by a moth with a very long proboscis. Suppose also that this nectary has, from any cause, a continual tendency to lengthen in successive generations. It is evident that moths that happen to be born with probosces longer than the average will have an advantage over those that are born with them shorter. They will have at least, other things being equal, one more flower to feed on, and so have a better chance for life. Natural selection will therefore operate to produce a Kind of moths with long probosces. But it will not give any preference to a proboscis longer than is required for that special purpose. A proboscis which has an inch to spare would not be a bit more useful than one which could just drain the nectar and no more. And while many moths would be born with the slight additional length necessary for this, few or none would be born with the proboscis an inch longer. Such moths would be monstrosities, and monstrosities are always rare. And there would be no cause at all tending to perpetuate such a monstrosity and to counteract the universal tendency in all such cases to return, if unchecked, to the normal type—a tendency which is, in point of fact, simply another expression of the perpetual effort, which all life manifests, to bring itself into absolute harmony with all around it. The music of the spheres will not tolerate a discord; if a half-note too high or too low can be caught occasionally by the listening ear, it is soon swept out and lost in the full strong current of advancing sound. The office of natural selection is to maintain this concord, and it does it by favouring those slight variations which, by bringing their possessor more into harmony with the world around, give him an instant advantage over his fellows. It does not favour any larger variations; it has no forecasting eye to the possibilities of any future advantage to be derived from them.

Now let us apply this principle once more to the case of man, and in so doing let us pass from an external and super-

ficial to an internal and very forcible characteristic. The smooth skin is an obvious and striking peculiarity of man; but if anyone were asked what above all else made him what he is, he would probably reply, the brain. Let us see, then, if it seems likely that the human brain was developed by natural selection from the brute brain. The size of the human brain is, in comparison with that of all other animals, enormous. This superiority in magnitude, accompanied as it is by certain other less obvious and less indisputable marks of difference, seemed to Professor Owen sufficient to justify him in placing man in a class by himself—that of Archencephala, or chief-brained animals. The average brain of the highest anthropoid apes—the orang-utan or the gorilla—does not reach above 28 or 30 cubic inches, while the average internal capacity of the cranium in the Teutonic family of man amounts to 94 cubic inches. The difference is enormous; but if we could trace the growth of that difference step by step from one to the other, and see how at every step the owner of the larger brain would gain thereby an advantage over the smaller, there would be nothing in this difference to take it out of the ordinary action of natural selection. If the primitive flint-chippers had brains not much larger than apes, if those of the modern savages were a little bigger still, and if, as we travelled towards the civilised and intellectual periods of history, we found the brain steadily increasing, the change would be in full accordance with other illustrations of the law. But what is the case? So far as investigation has yet gone, there is no great difference in the average cranial capacity of man under any circumstances. That of the Esquimaux is 91 cubic inches, of the Negro 85, of the Australians and Tasmanians 82, while even that of the Bushman—the lowest specimen of living humanity with which we are acquainted—is 77. Nor do the few skulls of the earlier races, which have yet been discovered, tell any different tale. The celebrated Engis skull, which was probably contemporary with the mammoth and the cave bear, has been pronounced by Professor Huxley to be "a fair average skull, which might have belonged to a philosopher, or might have contained the thoughtless brains of a savage." But the brains of any ape would have lain in a corner of it, and left a large vacancy. If the ape passed into the savage, the change in the brain was made by a leap. Now is there anything to make such a leap likely? Is there anything in this enormous increase of brain which would give its possessor an advantage over smaller brains, and enable him to survive while they perished? No doubt a larger brain has an advantage over a smaller one. The brain is the organ of the greatest power that we know—the power of mind. It is the

seat of thought, intelligence, sensation, emotion, will. He who owns these mighty implements in larger measure than his fellows has no doubt a great advantage over them in the struggle for existence, *if he uses them*. But they are no good to him in this respect while they lie latent or unused. A man does not become a match for a wild beast because he has a spear laid up in his armoury at home. The spear must be in his hand, and driven by strong muscles into the heart of his foe, to be of any use to him. So it is with the mental faculties. Just so much as a man *uses* of them would become the object of natural selection, and no more. All the surplusage goes for nothing in the battle of life. The largest gorilla brain that has yet been measured contains 34½ cubic inches. Probably mental power depends on some other conditions besides the mere size of the brain, and therefore we should not be justified in saying that a creature with 35 inches of brain would certainly beat this gorilla. But we know that size is a principal factor in the problem, and we may therefore say very confidently that 40 inches of brain would answer this purpose. How, then, does it happen that the lowest savage has more than 70? Natural selection might secure him the 40, because apes with less brain would be crushed out to make room for him; but how would he get or keep the additional 30? If an individual chanced to be born, a mere monstrosity, with this huge addition to the normal quantity of his kind, what likelihood would there be of its being perpetuated? He would be simply in the condition of the moth with its proboscis an inch longer than was required for any useful purpose, and the sure result—if natural selection were the only power that acted upon it—would be the rapid reversion of his descendants to the ordinary type.

But, it may be asked, is all this brain so much surplusage in the savage? Are we justified in assuming that the greater portion of it lies dormant? Are we sure that he does not use it all, and that, in this use of it, there does not lie the secret of his superiority over the brutes around him, and the germ of that dominion over the whole creation which seems to be the goal to which he is continually tending? The only answer to this can be found in the comparison of the savage as regards the action of mind, on the one hand, with the highest of the brutes beneath, and, on the other, with the civilised man above him. If the difference in the amount of brain corresponds in these three gradations with the difference in mental development, the inference would be that the whole brain was used in each case. If this correspondence does not exist, it will follow that the brain is unused in any case in the degree in which the mental development in that case falls short of its required

proportion. Now the average proportions of the brain in the anthropoid apes, in the savage, and in civilised man respectively, may be represented by the figures 10, 26, and 32. Is this a true representation of the mental conditions of the three? Is the difference between the savage and the brute really more than twice as great as that between the savage and the educated European? Mr. Wallace bids us think of the difference in mathematical power between a senior wrangler and an average Englishman, and then descend from that to the condition of a savage who cannot count beyond three or five—of the mental wealth and vigour implied in forming abstract ideas, carrying on chains of complicated reasoning, and transacting the manifold business of law, commerce, and politics in our modern life on the one hand, and of the meagreness and poverty of savage life on the other, wholly given up to the mere necessities of providing daily food—and then say whether the intellectual development of the savage is not much more nearly akin to that of the lower animals around him than to that of the cultivated European. But if so, a large part of his enormous development of brain is simply wasted. He gets no good from it, and therefore there is no reason, on the principle of natural selection, why it should have grown so large. For natural selection can only favour the increase of any particular organ just so far as that increase confers an actual benefit in the struggle for existence. If the increase of the organ outgrows its use, that additional growth is due to some other cause; for natural selection admits no surplusage.

Nor is the size of the brain the only characteristic in man which presents this difficulty. Mr. Wallace applies the same line of argument with great ingenuity to the foot, the hand, the voice, and, above all, the higher mental faculties. All these seem to be perfected and specialised far beyond their actual needs in savage man. The upright gait of man, "god-like erect," the delicate capacities of his hand, the vocal apparatus capable from the first of the exquisite modulations which can only be appreciated by the cultivated ear, the moral sense, the perception of beauty, the abstract conceptions of number and extension—all these seem wholly out of the range of the results that can be accounted for by the preservation of useful variations. They all point in a very different direction, and lead us on to another stage in Mr. Wallace's argument.

For it is remarkable that all those peculiarities, which seem, like the large brain, to be superfluous, or, like the smooth skin, to be positively injurious, to their first possessor, are eminently qualified to lead man on to the heights of being which he has subsequently attained. The smooth skin suggests at once the necessity of clothes; the absence of claws and

talons, combined with the wonderful capacity of the hand, leads naturally to the fabrication of tools and weapons; the vast size of the brain provides a dormant reservoir of intellectual power, out of which every need, as it arises, may be met by a corresponding contrivance of supply. But all these capacities have a reference to the future, and not to the present. In the first instance, we see a creature born into the world weak, undefended, and unsupplied for the moment, but provided with faculties which eminently fit it for a far higher existence in some remote ages and under very different conditions. The capacities are given first; the use of them comes later. They do not arise out of the pressure of past necessity; they are bestowed in anticipation of future wants and for the furtherance of a future development. But that is the method of final causes, which is exactly contradictory to that of natural selection. The former looks always forwards, and the latter looks always backwards. The one is the method of prophecy, and the other of history. The one implies the action of an intelligent and forecasting agent, while the other relies wholly on a chain of causation—which may or may not have been established in the first instance by an intelligent agent, but which, once established, works on blindly and unalterably by itself. This may be illustrated by the action of man upon Nature in his own province of artificial selection. When the florist wishes to produce a particular variety of flower or leaf, he carefully selects all individuals that approximate towards it, guards them from injurious influences, secures their inter-breeding, and takes them, in short, by his protecting care out of the natural conditions into which they are born. The pigeon-fancier aiming at a special feather, the poultry-breeder desiring to secure plenty of eggs, the sheep-farmer cultivating specially, as it may happen, wool or mutton, acts in the same way. In all these cases an ideal is first proposed which is afterwards worked up to. The ordinary operations of Nature are defied or counteracted by special contrivance in order that the proposed end may be gained—that the intended type of animal may be, so to speak, created. They are all cases, within narrow limits, of final causes, in which man's intelligence is the causer, and the laws of Nature the unintelligent instruments. Natural selection has, in these cases, to bow before the higher power of human selection. The inference which Mr. Wallace draws from the line of thought which he has developed—and it seems the only possible inference—is that some such superior selection has been at work in the production of man. Some higher intelligence has exercised over the world at large the same kind of control which man displays in his farm or in his poultry-yard. This superior intelligence has forced the great life-agencies on the

earth out of their natural course for the sake of producing a choice and eminent creature, just as the florist manipulates his roses to produce a Lamarque or a Maréchal Niel, or a pigeon-fancier his birds to bring about a pouter or a fan-tail. Into the further question of what this mighty Life-fashioner may be, or by what other name he may be called, Mr. Wallace does not enter, though we may gather, from a passage in which he speaks of "the controlling action of such higher intelligences," that he does not necessarily identify him with the First Cause of all things, but rather inclines to the view that such interference with the ordinary course of nature may be due to some unknown order of intelligent existences, the existence of which may help to carry our thoughts across the immeasurable chasm which separates man from the Infinite and Unconditioned.

These are thoughts which open vistas of scientific imagination in which even Professor Tyndall might find ample room to range. If we admit them at all, it is scarcely possible to stand still on them. If this overruling and intelligent selection has been necessary to produce man, why should it be limited to that single achievement? A unique and solitary interference of this kind is far more inconsistent with any philosophical view of creation than an habitual and regular guidance. Mr. Wallace himself puts this forcibly when he admits that his theory "has the disadvantage of requiring the intervention of some distinct individual intelligence, to aid in the production of what we can hardly avoid considering as the ultimate aim and outcome of all organized existence—intellectual, ever-advancing, spiritual man." But the disadvantage vanishes if he will boldly extend his theory, and allow it to include, as he hints in the following sentence, the idea "that the controlling action of such higher intelligences is a necessary part of the great laws which govern the material universe;" or, to put it in other words, that intelligent superintendence is a perpetual factor in the development of life. Other cases, besides man, might easily be brought forward, which present similar difficulties in the way of natural selection, and seem therefore to require the introduction of this other factor. What, for instance, were the steps which led to the production of the first mammal, or of the first vertebrate? It is easy to see the superiority of the perfect animal in either case, and its consequent fitness as an aim towards which intelligence might work, but very difficult to comprehend how the first steps in either direction can have been beneficial to the individual. Some years ago a Scotch clergyman, Mr. Rorison, published a little book, which has hardly been so widely read as it deserved to be, entitled "The Three Barriers." They were the Brain, the Breast, and the Backbone—the symbols of Wisdom,

Love, and Power—which he maintained to constitute insuperable barriers in the development of species by natural selection alone. Mr. Wallace has admitted the difficulty in the case of the brain; is he prepared to deny it in the case of the other two? He maintains—so far as appears at present, unanswerably—that man cannot have been produced by the unaided power of natural selection: does not that raise a strong presumption in favour of the introduction of another agent in other cases also? He has marked out very clearly and conclusively the limits of natural selection in the origination of species; can he set any limits to the controlling and interfering Power which he has invoked to fill up the deficiency?