Evolution: Possibilities and Difficulties

Evolution

T. H. MORGAN, in *What is Darwinism?* (Yale Review, April, 1928):

It has not been shown that the diagnostic differences used to separate species are differences having a survival value in the surroundings peculiar to each, or to different conditions in the same environment. Here, in fact, is the crux of the argument in so far as it applies to the species question. Its significance was insufficiently realized at first, but the difficulty has become more and more magnified until today we find that a re-examination of the evidence is imperative.

As has been stated, natural selection, if it works, is clearly a theory to explain the manifold adaptations not only of the organism to the outer world but even of the internal parts to each other—for only a system whose parts work well together could persist. Admitting the general argument that adaptations might be accounted for in this way, leaving the origin of species out of the question for the moment, it would still remain to be shown that the differences that distinguish individuals from each other within the species suffice to produce something new. Here, too, we have found by an appeal to fact that there are serious difficulties that were not appreciated by Darwin, because he did not have the necessary evidence to support his assumption.

A few examples will suffice to illustrate some of the questions that must be answered with regard to the survival value of the differences that distinguish related species before the premises of the argument can be admitted.

If any particular character, such as size or color, is measured in a large number of individuals of a race or species, it is found to vary. Some of the individuals will be smaller or fainter in color; others, larger or darker; but the great majority will be average or middle class. If the smaller individuals are destroyed and the larger ones become the parents of the next generation, the resulting population will again show a wide range of variability, but the middle class will be a little taller than was that class in the parental population. Suppose again in the next generation, the smaller individuals are destroyed and only the larger ones left to breed. The same result follows, and the average may again be somewhat larger. Experience has shown, in fact, that the average population may in most cases be changed by eliminating consistently certain kinds of individuals through a few generations. But then the process slows down rather quickly and soon comes to an end. Further selection fails to produce further change. The upshot has been not to produce a new race in which all the individuals are taller than the tallest of the original race, but only a race in which the average individual has become taller. The tallest may be no taller than before. This fact was not known to Darwin, or at least, if vaguely known, it was not given due weight.

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There are other difficulties for the mutation theory that are still under discussion and are not to be prejudged without further work. For example, most of the new types are less vigorous than the wild types from which they come; many of them are defective and could not possibly survive in open competition; others differ so far from the original types in one or another character as to upset the nice adjustment of the parts that is so essential to the life of the individual. Such mutants often give the impression of downward rather than upward evolution. These are difficulties that the mutation theory must meet, but it would be rash to reject the evidence because of these considerations.

We must remember, in the first place, that animals and plants are already so adjusted to the manifold conditions of their existence that almost any haphazard change will be deleterious. If this be generalized, it might be used equally as an argument against all theories of change—that is, against any theory of evolution. There is, however, a way out of this apparent *impasse*. The external conditions may change and the organism will then be maladjusted, and unless it can make a new adjustment it will perish. Again, at the boundaries of its usual range, new variants may be able to adjust themselves to the different conditions that there exist. Furthermore, there may occur at times physiological changes that are an improvement, such as an increase in fertility, or in hardihood, or in time of reaching maturity, and so on. These changes would be difficult to detect, and as yet the mutationists have paid too little attention to them. There is, however, every reason to conclude from what we know even now concerning the scattering of the mutation process that such changes may occur.

In a word, the arguments just reviewed by no means close the door of hope to the modern student of evolution by mutation. The important matter is not that he has a new talking point but that he has new material which he can hope to put to a real test, abiding by the outcome. We must also remember that the majority of mutants that we find are not new, but have probably been rejected many times by natural selection, for some of the same mutants appear over and over again in our cultures. New ones, too, are continually appearing—new in the sense that we have never seen them before. These, too, have no doubt occurred elsewhere. Perhaps the best argument in favor of the view that mutant changes have furnished the material for evolution is the discovery that whenever single hereditary differences are found between wild types, they follow the same laws of heredity as do the newly discovered mutant types.

Quite aside from these technical problems, a wider issue is sometimes raised when evolution is interpreted as the outcome of mechanistic principles, and natural selection as dependent on *chance* variations. To those who are not biologists, and even to some biologists, it seems inconceivable that such a complex machine—even admitting for the moment that the organism works like a machine—could have been brought into existence without relation to the purpose that it fulfils. This seems to them as inconceivable as it would be to suppose that a watch could have come into existence by the chance meeting of pieces of metal, and since everyone knows that watches were not made in this way but that the parts were assembled with the end in view, that is, with a purpose, it is argued that the infinitely more complex organism could not have come about by chance. It is (*Continued on page* 202)

The Porcupine

Zoology

JAMES J. MONTAGUE, in the New York *Herald-Tribune:*

The porcupine can see no good
In other creatures of the wood.

When sniff or call or foot he hears,
He makes himself a ball of spears

With which to jab them if they seek
In common friendliness to speak.

No pals has he among the brutes
Which follow various pursuits

To make an honest livelihood
Along the trails that thread the wood.

No other creatures care to know
A varmint which distrusts them so;

He will not pass the time of day
Or greet them in a kindly way,

But nurses sinister designs
To stick their noses with his spines.

Yet rabbits, which are friendly folk
And wear no rough and spiny cloak,

Are often on the bill of fare
In many a wolf's and fox's lair.

And squirrels, whose hearts are full
of cheer,
But briefly tarry on this sphere.

Though he is full of hate and spite,
Perhaps the porcupine is right!

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Evolution—*Continued*

implied that, even if the materials existed independently of each other, no imagined series of happy accidents could have brought them together. Hence, not chance variation, but design, must have ruled the evolutionary process, just as purpose has brought about the construction of the watch. It is Paley's old argument scarcely disguised.

Today we are a little more careful in the use of the word *chance,* and somewhat skeptical about the other word, *purpose,* when transferred from its human meaning to events outside of man's activities. If *chance* has any status in science, it means that we do not know what special set of conditions causes a particular event to be realized. A game of chance is one in which a complex series of changes is involved in each new deal—all possible deals might be computed but no particular one could be predicted without a knowledge of a complex set of physical events. On the other hand, the word *purpose,* as we commonly use it, means, in general, that we bring about a particular series of events with the end in view. In a word, we control the happening so that a watch or a locomotive emerges. We can do this because we are familiar both with the desired result and with the combination of parts that will give that result. But is it not hazardous to insist because we make watches in this way, that this is the only way in which contrivances can come about? It may be conceded that when Paley wrote, it may have been difficult at best to suggest how organisms might have evolved by natural process, but at the present time we can at least suggest how this might happen without invoking ultra-scientific agencies. It suffices to show such a possibility to meet his argument on its own grounds, but while this may relieve the biologist of the burden of proof, he will not be satisfied to leave the matter there but will continue to press forward in his endeavor to obtain experimental evidence that evolution may be explained without going beyond the facts furnished by living animals.

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Although only three to five per cent. of the cotton boll weevils live through the winter's cold, there are enough hardy survivors in the spring to keep cotton growers perpetually worried.