

# AN EXAMINATION OF DARWIN'S "ORIGIN OF SPECIES" IN THE LIGHT OF RECENT OBSERVATIONS AND EXPERIMENTS

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ABOUT three years ago, some members of a local club, to which the writer belongs, having heard that Darwinism was on its death-bed, a report on the origin of species was ordered. The present paper is made up from notes prepared for that occasion.

In a letter to Hooker, March 9, 1885, Professor Huxley says:

I have been reading . . . the book [Origin of Species] for the nth time. . . . It is one of the hardest books to understand thoroughly that I know of, and I suppose that is the reason even people like Romanes get so hopelessly wrong. ("Life and Letters," II, 204.)

If Huxley, who helped to fight Darwin's battles when "The Origin of Species" was young, who talked and argued with its author, can make such a statement concerning the book, it is little wonder that people come to different conclusions after reading it now.

My examination of Darwin's great work in the light of present-day beliefs has resulted in the finding of numerous passages which support the following theses:

1. Darwin's main thesis is the doctrine of descent as against the theory of the immutability of species.
2. A secondary thesis accounts for the origin of species by the theory of descent with modification through variation and natural selection.
3. Two kinds of variations are recognized: (a) Fluctuating variations as now understood, but including also variations of such a degree as would make steps in development as great as those which separate existing varieties. (b) Sudden changes, or sports.

It is to be observed that this classification of varieties

is not quite in agreement with the present-day distinction between fluctuating variations and mutations. Indeed, there are many who think that the distinction between the ampler fluctuations, on the one hand, and the lesser mutations, on the other, is not entirely established.

Darwin nowhere claims that natural selection is of the nature of a creative force.

I shall now cite a few passages in support of the above findings. References are made to the sixth edition. All italics are mine.

I. The main thesis is the origin of species by descent as opposed to the theory of the immutability of species or the independent creation of species.

While Darwin believed that varieties are incipient species he also believed that this identity had not yet been demonstrated. In speaking of the resemblance of varieties to species he says:

Independently of the question of fertility and sterility, in all other respects there seems to be a general and close similarity in the offspring of crossed species and of crossed varieties. If we look at species as having been specially created, and at varieties as having been produced by secondary laws this similarity would be an astonishing fact. But it harmonizes perfectly with the view that there is no essential difference between species and varieties (pp. 261-2).

Again:

It has been asserted over and over again by writers who believe in the immutability of species that geology yields no linking forms (p. 208).

And on page 290:

Let us now see whether the several facts and laws relating to the geological succession of organic beings accord best with the common view of the immutability of species, or with that of their slow and gradual modification through variation and natural selection.

Also:

This grand fact of the grouping of all organic beings under what is called the natural system is utterly inexplicable on the theory of creation (p. 413).

A few pages farther on he says:

If species be only well-marked and permanent varieties, we can at

once see why their crossed offspring should follow the same complex laws in their degrees and kinds of resemblance to their parents, . . . as do the crossed offspring of acknowledged varieties. This similarity would be a strange fact if species had been independently created and varieties had been produced through secondary laws (p. 417).

On the following pages, 418–419, he summarizes facts such as the close resemblance between existing and extinct forms on the several continents, the inhabitants of oceanic islands, on islands near continents, and closes with this sentence:

Such cases as the presence of peculiar species of bats on oceanic islands and the absence of all other terrestrial mammals, are facts utterly inexplicable on the theory of independent acts of creation.

I make but one more quotation in this connection. Near the end of the book, in a sentence which the careless reader might understand to refer to something like the modern mutation theory, he says:

Under a scientific point of view, and as leading to further investigation, but little advantage is gained by believing that new forms are suddenly developed in an inexplicable manner from *old and widely different forms*, over the old belief in the creation of species from the dust of the earth (p. 424).

Such quotations could be multiplied many times, for over and over again throughout the book he speaks of his theory as standing for the mutability of species as against the independent creation of species. Indeed, so convincing to the world was Darwin's argument in support of his main thesis that the word Darwinism to the popular mind stands for the theory of descent, as it is perfectly right that it should do.

II. A secondary thesis is an attempt to account for the origin of species by the theory of descent with modification through variation and natural selection.

I shall now attempt to show by quotations:

1. Darwin's view of the part played by fluctuating variations.

2. The rôle of sudden variations.

3. The part taken by natural selection.

1. The following quotations would prove a narrow and

restricted meaning for the theory of descent with modification through variation if it were clear that Darwin always meant fluctuating variation when he used the word variation.

On page 156 he says:

Why should not nature take a sudden leap from structure to structure? On the theory of natural selection we can clearly understand why she should not; for natural selection selects only by taking advantage of slight successive variations; she can never take a great and sudden leap, but must advance by *short and sure, though slow steps*.

In attempting to explain the puzzling phenomenon of the so-called neuter, really undeveloped female animals, he says:

As natural selection acts only by the accumulation of slight modification of structure or instinct, each profitable to the individual under its conditions of life, it may reasonably be asked, how a long and gradual succession of modified architectural instincts, all tending towards the present perfect plan of construction, could have profited the progenitors of the hive-bee?

The answer to this query, by the way, begins with a sentence which has a very modern sound:

This difficulty, though appearing insuperable, is lessened, or, as I believe, disappears, when it is remembered that *selection may be applied to the family, as well as to the individual, and may thus gain the desired end* (pp. 229-230).

The following utterance should be read with Darwin's main thesis in mind:

If numerous species belonging to the same genera or families have really started into life at once the fact would be fatal to the theory of evolution through natural selection (p. 280).

Inferences have been drawn from the foregoing sentence as though Darwin had written: If numerous species, etc., have really started into life by variations greater than fluctuating variations, as that term will be understood at the beginning of the twentieth century, the fact would be fatal to the theory of evolution through natural selection.

Although, in his concluding chapter he makes use of such expression as:

. . . Complex organs . . . have been perfected . . . by the accumulation of innumerable slight variations.

He also says:

It is, no doubt, extremely difficult to conjecture by what *gradations* many structures have been perfected . . . (p. 404).

Again, on pp. 413-414:

As natural selection acts solely by accumulating slight successive, favorable variations, it can produce no great or sudden modifications; *it can act only by short and slow steps.*

I think that it is evident from Darwin's discussion of varieties of oaks that he would not have regarded such work as that of DeVries on the evening primrose as making a revision of the foregoing sentence necessary. Even if DeVries's mutants are what he thinks them to be, that is, elementary species, still evolution of species by that means must be by "short, slow steps."

Even if it should be shown that species originate only by mutation, the following sentence might be permitted to stand:

New species have come on the stage slowly and at successive intervals, and the amount of change after equal intervals of time, is widely different in different groups (p. 417).

2. By the following quotations I shall attempt to show the rôle which that kind of variation, now called mutation, plays in the evolution of species according to Darwin's view.

When it is noted that DeVries makes use of facts recorded by Darwin in support of his views, it will be seen that there is some reason for suspecting that some of the facts which in Darwin's day were thought to be of the grade of fluctuating variations were really of the kind now believed by many to be something quite different.

On page 22 is this statement:

Some varieties useful to him (man) have probably *arisen suddenly, or by a step.*

Examples are cited, *e. g.*, the fuller's teasel, the turnspit dog, etc. DeCandolle's memoir on the oaks of the

world is alluded to. This gives the rank of species to the forms which differ by characters never varying on the same tree and never found connected by intermediate states. Out of 300 species at least two thirds are provisional species. Thus *Quercus robur* has twenty-eight varieties, all of which, excepting six, are clustered round three subspecies.

Commenting on this condition of things, that is, where there is no clear line of demarcation between species and subspecies, and between subspecies and varieties, or between lesser varieties and individual differences, he thus concludes :

Hence I look at individual differences, though of small interest to the systematist, as of the highest importance to us, as being the first steps towards such slight varieties as are barely thought worth recording in works on natural history, and I look on varieties which are in any degree more distinct and permanent, as steps towards more strongly-marked and permanent varieties; and at the latter as leading to subspecies, and then to species (pp. 41-2).

A well marked variety may therefore be called an incipient species; but whether this belief is justifiable must be judged by the weight of the various facts and considerations to be given throughout this work (p. 42).

Darwin noticed that wide-ranging, much-diffused and common species vary most; also that species of the larger genera in each country vary more frequently than the species of the smaller genera; further, that many of the species included within the larger genera resemble varieties in being very closely, but unequally related to each other, and in having restricted range (pp. 42-45).

The following sentence is interesting in this connection :

Every one who believes in slow and gradual evolution, will of course admit, that *specific characters may have been as abrupt and as great as any single variation which we meet with under nature or even under domestication.*

The above-quoted sentence follows a notice of Mivart's belief that new species manifest themselves with suddenness and by modifications beginning at once, of which Darwin says :

This view, which implies great breaks or discontinuity in the series, appears to me to be improbable in the highest degree (p. 201).

Such statements appear to be contradictory, until it is remembered that the kind of new species meant by Mivart would involve such violently sudden changes as the three-toed Hipparion giving rise immediately to the one-toed horse; or the wing of a bird suddenly appearing in place of the fore-limb of some dinosaur.

Indeed, it seems to be to be demonstrable that the statement of Darwin's views respecting variation requires but little change to bring them into harmony, or, at least, make them include, the origin of varieties by mutation.

By abrupt variations which are yet not greater than a single variety may show, he means such cases as the six-fingered Kelleia family, or the ancon ram. It is of this kind he is speaking when he says:

Excluding such cases of abrupt variations, the few which remain would at best constitute, if found in a state of nature, doubtful species, closely related to their parental types.

On the other hand, it is clear that he included under ordinary variations some, at least, which may now be called mutations. Thus:

Although very many *species* have almost certainly been produced by steps not greater than those separating fine varieties; yet it may be maintained that some have been developed in a different and abrupt manner. Such admission, however, ought not to be made without strong evidence being assigned (p. 203).

This is probably as good a place as any to call attention to the fact that in the title of the book the theory is not stated to be the origin of species by the natural selection of favored *individuals*, but by the natural selection of favored *rac*es. Morgan's term *the survival of species* does not appear to me to be any improvement on this. To my mind a still better statement is that which stands at the head of a syllabus of lectures by Professor James D. Dana, "On the Theory of the Origin of Species through Natural Causes."

Resuming the citations, the following explicit statement is illuminating:

By the theory of natural selection all living species have been connected with the parent species of each genus, *by differences not greater than we see between the natural and domestic varieties* of the same species at the present day; and those parent species now generally extinct, have in their turn been similarly connected with more ancient forms; and so on backwards always converging to the common ancestor of each great class (p. 266).

Here is a sentence which anticipates some recent speculations respecting a so-called plastic period in the life of a species:

It is a more important consideration, leading to the same result, as lately insisted on by Dr. Falconer, namely, that the period *during which each species underwent modification*, though long as measured by years, was probably short in comparison with that *during which it remained without undergoing change* (p. 279).

To the same purport is the following:

This gradual increase in number of the species of a group is strictly conformable with the theory, for the species of the same genus and the genera of the same family, can increase only slowly and progressively . . . *one species first giving rise to two or three varieties*, these being slowly converted into species, which in turn produce by equally slow *steps* other varieties and species . . . (p. 293).

Concerning the origin of varieties he has this to say:

The complex and little known laws governing the production of varieties are the same, so far as we can judge, with the laws which have governed the production of distinct species (p. 415).

In the following passage provision appears to be made for the origin of varieties by mutation:

I have now recapitulated the facts and considerations which have thoroughly convinced me that species have been modified, during a long course of descent. This has been effected chiefly through natural selection of numerous successive, slight favorable variations; aided in an important manner by the inherited effects of the use and disuse of parts, and in an important manner, that is in relation to adaptive structure, whether past or present, by the direct action of external conditions, *and by variations which seem to us in our ignorance to arise spontaneously*. It appears that I formerly underrated the frequency and value of these latter forms of variation, as leading to permanent modifications of structure independently of natural selection, . . .

He adds, in answer to certain recent criticisms that he placed at the end of the introduction to his first edition, the following words:



I am convinced that natural selection has been the main but not the exclusive means of modification (p. 421).

3. The following explicit statement makes it very clear that Darwin did not regard natural selection in the light of an originating cause:

Some have imagined that natural selection induces variability, whereas it implies only the preservation of such variations as arise and are beneficial to the being under its conditions of life (p. 63).

It would appear that Huxley, in 1860, thought that natural selection was being urged as an originating cause. He says:

It is not absolutely proven that a group of animals having all the characters exhibited by a species in Nature has ever been originated by natural selection, whether artificial or natural.

He also thought that Darwin embarrassed himself by the use of the aphorism, *natura non facit saltum*; that nature does make a jump now and then, and that a recognition of the fact is of no small importance in disposing of many minor objections to the doctrine of transmutation. In 1861, in a letter to Hooker, he says:

The great desideratum for the species question at present seems to me to be the determination of the law of variation. . . . Why does not somebody go to work experimentally, and get at the law of variation for some one species of plant?

In 1885 he was reading the "Origin of Species" and finding it one of the hardest books to understand that he knew. In 1888 he says in a letter to Hooker:

Darwin has left the causes of variation and the question whether it is limited or directed by external conditions perfectly open.

Writing to Bateson, February 20, 1894 (?), he says:

I see you are inclined to advocate the possibility of considerable "saltus" on the part of Dame Nature in her variations. I always took the same view, much to Mr. Darwin's disgust, and we used often to debate it.

In the light afforded by these comments of Huxley, and after a careful rereading of the "Origin of Species," I am inclined to the belief that in the brilliant work of Hugo DeVries we may have a key to a real understanding of the difficulties in question.

Huxley, with his tendency to reach conclusions quickly, which, he confesses, sometimes led him into mistakes, saw intuitively, let us say, that the beginning of varietal differences might be by a sudden leap. While Darwin, who reached conclusions only after careful examination of all possible contributing data, although realizing that the origin of species from variations, by natural selection had not been proved, thought that they furnished the most favorable material for natural selection to work upon. At the same time, I think that I have shown by means of numerous quotations from the "Origin of Species" that the very slight changes which DeVries has shown to mark the beginning of some varieties, while recognized by Darwin, were thought of by him as of the same order as ordinary (now called fluctuating) variations. This view is justified, I think, by his frequent use of the word *step*. Possibly this explains why Huxley found the book such a hard one to understand thoroughly. It also throws some light on the unsatisfactory condition in which Darwin is supposed to have left the question of the origin of varieties. To my mind, instead of this being a blemish on Darwin's work, as it seems to be held by some recent writers, it is, when the state of biological knowledge in his day is taken into account, in harmony with his known caution and sagacity. To blame him for not making a sharp distinction between fluctuating varieties and mutations would be like finding fault with Copernicus for not knowing what Kepler and Newton discovered, or criticizing Newton harshly because his theory of light left much for subsequent workers before the electro-magnetic theory was possible.