

Why Darwin Answered the Question As He Did

(1)

A NUMBER of eighteenth-century naturalists and speculators constitute a transition from the purely philosophical to the mixed treatment of the question about how man differs. While Buffon, Bonnet, Robinet, and Jenyns are not scientific investigators in the full sense of that term, as it is applicable to Darwin and his contemporaries, they do take account of evidences that lie outside the common experience of mankind. To the extent that they do, they represent the entrance of science into the picture; perhaps it would be more accurate to say the entrance of modern science, for Aristotle, in addition to being a philosopher, was a biological scientist—an observer and investigator whose extensive array of data on the characteristics and habits of animals established a zoological classification so detailed and, in many respects, so accurate, that it persisted to the time of Linnaeus, and then, with slight Linnaean revisions, right down to the time of Darwin.

Aristotle's double role—as an empirical philosopher and as a scientific investigator—may account for the way in which he combined a conception of nature as consisting in a hierarchy of radically distinct grades of being (plants, brute animals, and men)

with the recognition that within the domain or kingdom constituted by each of these grades of being (e.g., the plant kingdom or the animal kingdom), there was a continuous ascent by degrees from lower to higher forms of life. His recognition of these diverse continuities did not prevent him from maintaining that animals differed from plants, and men from animals, by a difference in kind, not just a difference in degree; nor was his insistence on this point inconsistent with his recognition of the continuous scale of degrees by which forms of plant or animal, or even human, life vary from lower to higher.

The eighteenth-century writers with whom we shall now be briefly concerned were so impressed by the appearance that nature gave of a continuous ascent through a scale of degrees from lower to higher forms of life that they converted Aristotle's several and separate continua into a single all-embracing continuum of nature. It might be thought that, in doing so, they had merely adopted the view held by Leibniz and Locke, that nature consists in a single continuum of forms, varying by degrees from lower to higher. But it must be recalled that Leibniz and Locke also retained a version of the Aristotelian hierarchy of grades of being which required them to assert, quite inconsistently, differences in kind as well as differences in degree. Not so Buffon, Bonnet, Robinet, and Jenyns; they—or at least the most consistent of them, Robinet—carried the principle of an unbroken continuity in nature to its inevitable conclusion. He saw that the principle allows only for differences in degree, which carries with it the equally inevitable corollary that species are nonexistent and that distinctions in kind are illusory or at best only apparent. [1]

In his *Histoire Naturelle*, published in 1749, Buffon discarded the notion of species as artificial and misleading. "In reality," he declares, "individuals alone exist in nature." Hence, if they differ, they differ in degree; or if they appear to differ in kind, that is appearance only, never the real state of affairs. [2] Buffon later repudiated this extreme position, but it was espoused by Bonnet in his *Contemplation de la Nature* in 1764–65. However, Bonnet qualified it somewhat by dividing the continuous scale of natural things, differing only in degree, into four general classes—inert bodies, plants, animals, and men. [3] He was criticized in 1768 for this qualification of the principle of continuity by J. B. Robinet who argued that the principle of continuity, correctly

understood, requires us to reject the reality of all species, kinds, or class distinctions, and to see the whole of nature as one continuous scale of differences in degree. [4]

Robinet, of course, does not hesitate to treat man as differing only in degree from higher animals; and even Bonnet, in spite of assigning men and brutes to distinct classes, minimizes the differences between man and ape. He may have been influenced in this by the views of Lord Monboddo who, in 1770, declared that man and the higher apes, especially the chimpanzee and the orangutan, are of the same species. [5]

Even earlier, in 1754, Rousseau, as had Locke before him, expressed the view that the line between man and brute was a shadowy one. (We must, for the moment, ignore the fact that both Locke and Rousseau also espoused the opposite view that the line is a sharp one—drawn by Locke in terms of man's exclusive possession of abstract ideas and by Rousseau in terms of man's exclusive possession of free will.) Locke in several places suggests that if you compare the lower degrees of humankind with the higher degrees of animal life (a feeble-minded man, for example, with a baboon or drill), you will find that they overlap. [6] Rousseau thinks that the same ideational powers belong to men and animals, especially the man-like apes, and that the apparent difference in kind between them can be explained by man's *accidental* development of language. [7]

Still another example of the same kind of thinking is to be found in Soame Jenyns; but where Locke aligns the baboon with the idiot, Jenyns aligns the chimpanzee with the Hottentot. Though some men are superior in degree to some animals, the lowest degree of humankind is about on the same plane with the highest degree of animal life. [8]

I have briefly reviewed this line of thought, not because it represents a clear handling of the problem of continuity and species, or of the question about man's difference, but because it sets the stage for Darwin—for his theory of evolution, as set forth in *The Origin of Species* (1859); and for his application of that theory to man in *The Descent of Man* (1871). I will deal, first, with the theory of evolution quite apart from man—beginning with Darwin and coming down to the present day. After that I will deal with the question about man in the context of evolutionary theory and research—as handled by Darwin without

the benefit of paleontological evidence, and as treated in our day in the light of fossil remains.

(2)

The theory of biological evolution, as formulated by Darwin, can be summarized by saying that it converts Leibniz' principle of continuity into a temporal law—a law of development. [9] All the diverse forms of life, including forms now extinct and forms now extant, are connected developmentally. In the succession of countless generations, in each of which the offspring vary slightly from their ancestors and from each other, differences multiply; but at the point in time and space at which they first occur, they are slight, almost insensible, differences in degree.

Borrowing the expression to which Leibniz first gave currency, Darwin emphatically declares: *Natura non facit saltum* ("Nature does not make jumps.") [10] If by "a jump" is meant the crossing of the gap that is made by a real difference in kind—a difference constituted by one thing's having a characteristic totally lacking in another—*then* "nature does not make jumps" means that evolutionary development (by descent with modification from ancestral forms) excludes the reality of kinds. To this extent Darwin would appear to be in agreement with those of his immediate predecessors—especially J. B. Robinet—who espoused the principle of continuity in its extreme form.

If Darwin had done only that, he might have had a theory of evolution (a temporalized, developmental version of the principle of continuity in nature), but he would not have had a theory of speciation (a theory of the origin of species). Varieties or races of one and the same species, like individual members of a species, may differ from one another in degree; but if the diverse species of a single genus are to be distinguished from the diverse varieties or races of a single species, the difference between distinct species must at least *appear* to be one of kind.

Darwin expresses many doubts about the possibility of distinguishing varieties or races from species. He often says that species are nothing but well-marked varieties. There is no problem here, of course, if the naturalist's taxonomic scheme is something he imposes upon nature for his own convenience—if the

kinds or groupings that he sets up are artificial. But if his class distinctions are supposed to represent "natural kinds"—natural groupings that differ in kind, not just in degree—then he is confronted with the problem of reconciling natural kinds with his evolutionary principle of developmental or phylogenetic continuity. For if evolution is a continuous development of living forms from living forms—without jumps, by insensible gradations or differences in degree—how is it possible for new species to come into being at any point in the developmental continuum? Or, to put the same question in a different way: Must not the taxonomist's classification of the living organisms now extant into a large number of distinct species, be artificial—something imposed on nature rather than a representation of divisions actually existing in nature itself?

It would look as if Darwin's answer to this question should have been in accord with the one given by Robinet—that species have no reality. But if he had given that answer he could not have developed a theory of the origin of species. The answer he gives agrees with Robinet and conforms to the principle of continuity in one respect—it denies that the difference between species is a *real* difference in kind, i.e., it denies that species are kinds between which intermediates are impossible. But in another respect his answer departs from Robinet. Even though species are not really different in kind, species are nevertheless naturally existing groups that *appear* to differ in kind because the intermediates that might have connected them by a continuous series of gradations in degree are *absent* or *missing*. The absent intermediates—often called the "missing links" in the chain—create the *appearance* of a difference in *kind* between species. Between the varieties or races of a single species there are no missing links or absent intermediates. That is why they are only varieties or races, not species.

The metaphor "missing links" is unfortunate because a chain does not convey the image of a continuous series. I prefer to speak of "gaps" or "breaks" in the continuum—like the interference bands or interruptions in the spectrum of light. An *apparent* difference in kind exists where intermediates, though *possible*, are *absent*, and so a gap or break occurs in the continuum of degrees. [11]

By treating species as naturally existing groups or organisms

that are only *apparently* different in kind—separated islands in an interrupted continuum—Darwin developed a theory of speciation that did not violate his evolutionary principle of developmental continuity. Species originate, according to his theory, by a process of natural selection that operates to perpetuate certain varieties and to cause the extinction of other varieties—thus giving rise to gaps or interruptions in the continuum, without which there would be no species.

Viewed *developmentally*, this means that the organisms we distinguish at a given time as different species of the same genus were represented at an earlier time by ancestors that were distinguished as races or varieties of the same species. At the earlier time there were also intermediate races or varieties; but through the process of natural selection these gradually became extinct. With the extinction of the intermediate varieties, the extreme varieties tended to separate genetically through various barriers to interbreeding; and thus they became the distinct species of a single genus, where earlier their ancestors were merely different varieties of the same species.

Viewed *taxonomically*, this means that co-existing species at any given time are distinct kinds only by virtue of the absence of intermediate forms or varieties that have become extinct. *If* the geological record of fossil forms were complete instead of imperfect, and *if* fossil remains enabled us to reconstruct all previously existing organisms, we could repair the broken or interrupted continuum by filling in the gaps; and we could thus re-establish at one time the continuity of nature, with no differences in kind at all, not even apparent, but only differences in degree. [12]

(3)

Let me now try to summarize briefly the main import of Darwin's theory before turning to post-Darwinian modifications in the theory of evolution and of speciation.

Darwin's theory of developmental continuity excludes the possibility of there being any radical differences in kind among the species of living things; for, if there were, it would be impossible

for them to be connected in a phylogenetic series constituted by slight variations in degree; nor could they have originated by the extinction of intermediate varieties through the operation of natural selection.

It is difficult to say whether Darwin's theory also excludes the possibility of superficial differences in kind. The fact that intermediates are impossible in this case as well as in the case of radically distinct kinds would seem to suggest that such differences in kind should also be excluded, since Darwin's theory requires the *possibility of absent intermediates*. On the other hand, superficial differences in kind, involving as they do an underlying continuum of degrees with a critical threshold, do not violate the evolutionary principle of phylogenetic continuity. As we shall see, post-Darwinian theories of speciation differ from Darwin's in admitting the possibility of superficial—real, not merely apparent—differences in kind.

The Origin of Species does not mention man, except in a single sentence in the concluding pages, where Darwin says: "Light will be thrown on the origin of man and his history." (In later editions, this was changed to "much light.") In those same concluding pages, however, Darwin does consider the question whether the origin of life is monophyletic or polyphyletic. He answers this question by saying: "I believe that animals are descended from at most only four or five progenitors, and plants from an equal or lesser number." He goes on to say: "Analogy would lead me one step further, namely, to the belief that all animals and plants are descended from some one prototype. But analogy may be a deceitful guide." [13] He did not have to rely on analogy; for strict adherence to his own principle of phylogenetic continuity should have led Darwin to postulate, as did J. B. Robinet, a single prototype or progenitor for all living organisms—both plants and animals.

If there were as many as two original progenitors—one for all forms of animal life and one for all forms of plant life—it would mean that the plant and animal kingdoms are separated by a real (and maybe even radical) difference in kind, not by an apparent difference in kind that masks a continuum of degrees in which gaps have occurred. A polyphyletic origin of life is incompatible with the principle of phylogenetic continuity.

(4)

The most important change in post-Darwinian theory involves a shift from natural selection and the extinction of intermediate varieties as the explanation of the gaps in the continuum that are indispensable for the origin of species. Where Darwin used the extinction of intermediate varieties by natural selection of the fittest to explain the genetic isolation of the remaining extreme varieties, the post-Darwinian theorists—with greatly improved genetics and much more paleontological evidence—use geographic barriers as the explanation of the genetic isolation responsible for the formation of new species. It is now generally accepted that most speciation is allopatric—the result of geographical separations that bar interbreeding between varieties of the same species, with the result that the gene pools of the spatially separated varieties become isolated from each other. In the exceptional cases of sympatric speciation—the origin of new species in the same locality—the explanation given is polyploidy, an explosive genetic change unknown, and probably unimaginable, to Darwin. [14]

Though post-Darwinian theory has distinguished three or four different types of speciation and has given us a different explanation of the factors productive of it, the central point remains the same: namely, that distinct species are genetically isolated populations between which interbreeding is impossible, arising (except in the case of polyploidy) from varieties between which interbreeding was not impossible, but between which it was prevented. Modern theorists, with more assurance than Darwin could manage, treat distinct species as natural kinds, not as man-made class distinctions. Ernst Mayr and Julian Huxley even go so far as to regard speciation as introducing “discontinuity” into nature. Since they subordinate this “discontinuity of species” to the basic phylogenetic continuity of the evolutionary process, it is clear that they do not mean “discontinuity” in the sense that excludes the possibility of intermediates in the underlying continuum of degrees that explains superficial differences in kind. [15]

Another important change in post-Darwinian theory is the departure, in a number of exceptional cases, from strict adherence

to the rule that nature makes no jumps. George Gaylord Simpson and Theodosius Dobzhansky speak of quantum jumps in evolution—what, in effect, is saltatory speciation. This involves something like breaks in the developmental continuity of evolution, just as ordinary speciation introduces manifest gaps in the continuum of coexisting populations. Quantum evolution—or “breaks in the evolutionary continuity”—occur, according to Dobzhansky, “when the differences between the ancestors and the descendants increase so rapidly that they are perceived as differences in kind.” [16]

What are these differences in kind that are produced by any of the diverse types of speciation recognized by modern theory? Are they all only apparent? Or may they also include some that are real differences in kind?

In the first place, it is necessary to reiterate that the post-Darwinian theory of evolution and speciation excludes radical differences in kind as emphatically as does Darwin’s theory; for such differences are plainly incompatible with developmental continuity which, even when it involves breaks or quantum jumps, cannot be equated with the basic discontinuity called for by radical differences in kind.

In the second place, leading contemporary theorists—Dobzhansky, Mayr, and Julian Huxley—agree that there would be no species at all if interbreeding were totally unrestricted and all the possible genetic combinations or genotypes were simultaneously realized in co-existing or extant phenotypes. Such genetic swamping would result in an array of individual differences. [17]

Dobzhansky asks us to consider “an imaginary situation, a living world in which all possible gene combinations are represented by equal numbers of individuals. Under such conditions no discrete groups of forms . . . could occur. . . . The variability would become a perfect continuum.” He goes on to say of the actual world: “. . . if the representatives of different groups interbred at random, all the gene combinations that are now rare or absent, would be produced, given a sufficient number of individuals, within a few generations from the start of random breeding. That would mean a breakdown of the separation of groups, and an emergence of continuous variation over a part of the field. If all the organisms were to interbreed freely, a perfect continuum postulated above would result.” [18]

Does this lead to the conclusion that the manifest differences in kind that exist in the actual world, the world in which we know that completely random interbreeding between groups does not occur, are only *apparent*, not real, differences in kind; and that, in reality, the situation is as Robinet and Darwin supposed it to be; namely, one in which, except for the accident of absent intermediates or missing links, there would only be differences in degree? I do not think so. Genetic swamping would, of course, result in an abolition of species or group differences, replacing it with an array of individual differences. But it does not follow that all individual differences are necessarily differences in degree. If we bear in mind the distinction between a superficial and a radical difference in kind, we can see that there is no difficulty about there being superficial differences in kind between the individuals that have been produced by genetic swamping, for such differences do not preclude genetic continuity in the process by which they have been produced.

Without the critical insight provided by the distinction between superficial and radical differences in kind, biologists might be tempted to follow Darwin in thinking that all differences in kind must be apparent, not real. In the absence of that distinction, it would be natural—almost unavoidable—to suppose that unrestricted or random interbreeding, with consequent genetic swamping, would not only replace specific groupings by an array of individual differences, but would also make the only real differences in nature differences in degree. Dobzhansky might appear to be adopting this view when he refers to a “perfect continuum,” for a perfect continuum without any breaks whatsoever, even of the sort that are produced by manifest and merely superficial differences in kind, would exclude all differences except differences in degree. But, as we shall see in the following chapter, he, along with Ernst Mayr, Julian Huxley, and most of the other leading evolutionists who deal with the origin of man, affirm a real difference in kind between the *Hominidae* and the *Pongidae* and *Hylobatidae*, though, of course, they regard it as a superficial, not a radical, difference in kind. Their theories of saltatory speciation or quantum jumps in evolution indicate that they recognize superficial differences in kind at many other points in the phylogenetic continuum. It would be plainly inconsistent with such views on their part for them also to hold that completely

random interbreeding and genetic swamping would abolish all differences in kind, replacing manifest differences in kind that are merely apparent with differences in degree.

(5)

Let us now return to the question about man. Bringing the foregoing discussion to bear on that question, we are confronted with the following alternatives. (1) If the view of Darwin is adopted, then the human species differs from other closely related species by no more than an apparent difference in kind, a difference that is really a difference in degree, which is masked or concealed by the absence of intermediate forms—the missing links. (2) If, on the contrary, the view of most post-Darwinian evolutionists, and especially the paleoanthropologists among them, is adopted, then even within the framework of evolutionary development and without violating the principle of phylogenetic continuity, the difference between man and other animals may be a real difference in kind—superficial, of course, not radical.

We need not let the matter stand with such iffy alternatives unresolved. The immense array of data that has accumulated since Darwin's day and the significant advances in the theory of evolution that have been made since his time lead us to embrace the second answer. It is, nevertheless, useful to try to understand why Darwin gave the answer that he did. Light is thrown on this by the state of evolutionary facts and theories at the time, within the context of which he developed his views of man.

Darwin addressed himself to the question about man hesitantly, almost reluctantly; *The Descent of Man* was published in 1871, twelve years after *The Origin of Species*. In his Introduction to *The Descent of Man*, he acknowledges that other evolutionists had applied evolutionary theory to the origin and nature of man. He mentions Lamarck, who antedated him by many years—more than sixty, in fact. He also mentions among his more immediate contemporaries, the writings of Wallace, T. H. Huxley, Lyell, and Haeckel; and expresses special indebtedness to Haeckel's discussion of the genealogy of man in a book published in 1868. [19]

The relation of Darwin to three of these contemporaries deserves a brief further comment. Lyell, in the closing chapter of

The Antiquity of Man (1863), demurs "to the assumption that the hypothesis of variation and natural selection obliges us to assume that there was an absolutely insensible passage from the highest intelligence of the inferior animals to the improvable reason of man." That, says Lyell, may have been accomplished by a leap: nature "may have cleared at one bound the space which separated" the highest stage of the unprogressive intelligence of the inferior animals from the first and lowest form of improvable reason manifested by Man." [20] Referring to the foregoing statement by Lyell, Darwin remarked, "it makes me groan"—and well it might, for it denied his principle that nature makes no jumps. [21]

Wallace, first in a paper published in 1864, and more emphatically in a paper published in 1869, denied that the theory of speciation by natural selection and by the extinction of intermediate varieties could explain the origin of man. He did not think there was sufficient time for this to take place, and he was puzzled by the absence of the fossil evidences that would be needed to support Darwin's theory. This led to a serious rift between Darwin and his closest colleague in the development of the theory of evolution. [22]

On the other hand, Darwin could draw support from the views of another of his associates—T. H. Huxley, who in 1863 published a book of essays on *Man's Place in Nature*. Huxley took the position, later to be taken by Darwin, that man, in all his mental faculties, differs only in degree from the anthropoid apes and other higher mammals; though he also concedes, somewhat inconsistently, that man "alone possesses the marvellous endowment of intelligible and rational speech." [23] Huxley also devotes one of his essays to the fossil remains of early man, and discusses the Engis and Neanderthal skulls; whereas Darwin, in his handling of the subject, makes no reference at all to these fossil evidences that were available to him as well as to Huxley.

Lacking the rich and varied fossil finds of later paleoanthropology, and obviously regarding the two early human skulls discussed by Huxley as insufficient to support his thesis about man's origin from a remote ancestor common to the one living human species and the several extant species of apes, Darwin argued entirely from a comparison of the behavior of living man with the behavior of the living apes and other extant species of animals,

especially the higher mammals. His argument had to take the form of establishing the proposition that the behavioral differences between man and other animals indicate that the difference in their mental powers is only one of degree. In the light of all the comparative evidences that he is able to marshal, he thinks he is justified in concluding that "the difference in mind between man and the higher animals, great as it is, is certainly one of degree, not of kind." [24] To which he later adds the remark: "A difference in degree, however great, does not justify us in placing man in a distinct kingdom." [25]

Like Huxley, he concedes that rational speech is peculiar to man; but he qualifies this in many ways by pointing out incipient and rudimentary forms of expression and communication in other animals; [26] and, in addition, he explicitly disagrees with Max Müller that man's use of language implies the power of forming general concepts and with Müller's further view that, since no animals possess this power, there is a real and, perhaps, radical difference in kind between men and animals. He says: "With respect to animals, I have already endeavored to show that they have this power, at least in a rude and incipient degree." [27]

Though in one place he attributes man's development of articulate speech to his intellectual powers, he explains man's intellectual superiority, as manifested in his linguistic performance, by reference to the superiority of his brain in size and complexity—a difference in degree from that of other animals. [28] I mention this because, even if one were to say to Darwin that man's exclusive possession of articulate speech made his difference from all other animals a real difference in kind, we can imagine a philosophically instructed Darwin countering this by saying that, if it is real, it is at most superficial, based on a critical threshold in the continuum of degrees in brain size and complexity.

The reason why Darwin had to argue in this way should be perfectly plain. If he had conceded the possibility that man might really differ in kind, and could not show—as at his time he could not—that this was only a superficial difference in kind, he could not support his thesis that the human species originated in the same way that all other animal species have: by descent with modification from a common ancestor, accompanied by the extinction of intermediate varieties. The only view of man's difference compatible with this theory of his origin is a difference in

degree or, at most, an apparent difference in kind—where that apparent difference in kind arises solely from the absence of intermediates, the missing links responsible for a gap in the continuum of degrees. Hence Darwin argued in the light of all the comparative evidence he could cite that the mental powers of man differ only in degree from those of other animals. But, because of the absence of fossil remains, he also had to hypothesize, without sufficient evidence, the earlier existence of forms intermediate between man and the apes. The fact that these are now extinct explains the breaks or gaps in the continuum that should connect man and the apes. [29] These gaps or breaks do not alter Darwin's view that man and the apes have evolved from a common ancestral form by a continuous process of descent—without jumps or gaps. [30]

(6)

Before I turn in the next chapter to the fossil evidences of modern paleoanthropology, I would like to close this discussion of Darwin with three comments on his position and on his mode of argument.

(1) The principle of phylogenetic continuity, central to the theory of evolution and supported by a vast array of data, controls Darwin's reasoning. If comparative evidence with respect to human and animal behavior had shown that man really differed in kind from other animals, Darwin would not have concluded that the principle of continuity was false or that it did not apply to the origin of all other animal species. He would have concluded instead that man was the one or rare exception, and that the origin of the human species could not be explained in the same way as the origin of all other species. However, thinking as he did that the comparative evidence showed only differences in degree, Darwin felt justified in applying the principle of phylogenetic continuity and his theory of speciation to the origin of man.

(2) It is of the utmost importance to observe the direction of Darwin's reasoning here. It is *not* from a hypothesis about man's origin (based on fossil evidences) to a conclusion about man's nature or man's difference. On the contrary, Darwin's line of

reasoning is from a conclusion about man's nature and his difference, based on comparative evidence of human and animal behavior, to the support of, though not the indubitable proof of, a hypothesis about man's origin: namely, that his speciation is like that of all other animals.

(3) The effect of Darwin's *Descent of Man* is best summarized by the remark of William Graham in 1881: "That man is an animal," he wrote, "is the great and special discovery of natural science in our generation." [31] Read one way, this is a very strange remark, indeed. With the possible exception of Descartes, who ever denied that man was an animal? With that one exception, every philosopher—from the Greeks to Kant and Hegel—who held that man differs radically in kind from other animals also asserted that man is an animal—a *rational* animal, but an *animal* nonetheless.

What then is the meaning of William Graham's remark? It is simply that man is a *brute* animal; or that there is no radical difference in kind among animals between those that are rational and those that, being not rational, are therefore brutes. What Graham is saying, in short, is that Darwin overthrew the prevailing view that the world of living things is divided into three kingdoms—plants, brute animals, and rational animals or men. Animals share with plants the common characteristics of all living things, but we do not say, therefore, that animals are plants. Hence, the fact that men share with brutes the common characteristics of animal life should not lead us to say that men are brutes unless we mean to deny, as Graham obviously thought Darwin had, the existence of a radical difference in kind between men and other animals.