CONTINENTAL ANTHROPOLOGISTS' INITIAL OPPOSITION TO DARWINISM AND THE PROSPECT OF HUMAN EVOLUTION[2]

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The initial reaction of anthropologists on the continent of Europe to Darwin's theory of evolution was one of widespread opposition. To be sure, there were some in France (e.g., Eugène Dally) and more in German-speaking Europe (Carl Vogt, Ernst Haeckel, Hermann Schaaffhausen) who quickly espoused the concept of human evolution. But, as T. Dale Stewart (1959:22) puts it, "[T]he vocal opponents outweighed the vocal proponents, both in numbers and in influence." Specifically, the leaders of anthropology in France (Paul Broca, Armand de Quatrefages) and Germany (Rudolf Virchow, Adolf Bastian) were at first quite skeptical. However, opposition was not adamant, though frequently it was long lasting. Furthermore, contrary to Darwin's charge of "*prejudices* against my views" which according to Steward (1959:12, emphasis mine) "were *surprisingly* widespread," intelligent opposition to Darwinism was well-founded in the context of the ethos of mid-19th-century science. Given the state of the field at the time, reasoned opposition to Darwinism and the prospect of human evolution quickly developed amongst anthropologists on the Continent.

The concept of evolution had a strong impact on anthropology during the first decades after it was enunciated in 1858. First in England and a few years later in France and Germany anthropological societies were engaged in lengthy discussions on the questions of fossil man and human evolution.

Though anthropologists were interested in the idea of evolution, the concept was not to structure actual anthropological research appreciably until about the turn of the century. The initial controversy over Darwinism may have delayed anthropological studies, but those studies were quickly resumed with little if any alteration in direction. The concept of biological evolution was simply not applicable to most anthropological concerns of the last century. "A theory can sustain avid interest and be discussed only so long. Moreover, the theory of evolution, envisioning as it does very slow changes over a long period of time, could not be taken into consideration in the majority of studies that physical anthropologists were pursuing" (Stewart 1959:23).

The concept of evolution, however, did find notable application in structuring discussions of human paleontology. The Neandertal skullcap from Germany (1856) and the Naulette mandible from Belgium (1866) which together were used to represent the taxon *Homo sapiens neanderthalensis* (Quatrefages 1873:1313-1317), were very much discussed in the context of the question of human evolution. Believers in human evolution generally accepted the Neandertal remains as typical of ancient man. Non-believers, at first, generally dismissed them as exceptional.

Though the idea of human evolution did structure, in part, many early discussions on the Neandertal and Naulette remains, those specimens were generally considered to provide no decisive evidence in favor of human evolution. No one claimed that Neandertal or Naulette in any sense 'proved' human evolution. The proponents of evolution, however, were in fact accused of covertly claiming Neandertal or Naulette as such proof. J. Barnard Davis, for example, charged that the opinion had been suggested that the man of Neandertal was a link in the chain which reunited the other races of man to the apes.

> Although that opinion was not clearly enunciated, it is evident that some of the authors who have written on the famous skull were disposed to interpret it thusly, and have considered the man from Neandertal rather as an anticipated phenomenon, aiding, lacking other proofs, certain hypotheses in which they believe [Davis 1864:714].

However that may be, I have come across no claim in the early literature on Neandertal to the effect that the remains were conceived as decisive evidence for human evolution. One reason that Neandertal was not claimed as good evidence for human evolution is that it was almost universally considered in the context of human races. Only William King of Galway advocated (1864a&b) specific status for Neandertal.

Armand de Quatrefages (1810-1892) was Professor of Anatomy and Ethnology at Musée national d'Histoire naturelle. One of the founders of the Société de Anthropologie de Paris, he was a leading figure in French science, whose understudies included Hamy, Verneau and Delisle. Quatrefages said of the Neandertal remains:

> Some anatomists wished . . . to consider this specimen as a special *species*, and even a fresh *genus*. It was especially considered as intermediate between

> man and apes, and here and there traces may be still found of these opinions (1879:307).

Quatrefages characterized such efforts on behalf of Darwinism in the following manner:

> The only cause of these exaggerations is a feature, striking it is true, which is presented by this cranial vault. In the Neanderthal man the frontal sinuses have an exceptional development, and the superciliar ridges, almost lost in the middle of the glabella, form a most strange protuberance above the orbit. This conformation has not failed to be compared to the *bony ridges* which the anthropomorphous apes possess in the same place. Then, starting from this fact, it has been thought necessary to find in the rest of the cranium characters in harmony with this *simian feature*. Stress has been laid upon its slight elevation, the lengthened form, the projection of the occipital region, etc. [Quatrefages 1879: 302-303].

But the efforts of the Darwinists were in vain, according to Quatrefages. After more careful research, he said, the Neandertal skull was revealed as merely that of an individual belonging to an ancient race of the human species.

> With a little partiality, and by only comparing it with modern skulls, which are considered as normal, a separate species of being has been made of the Neanderthal man. By degrees, however, other crania equally fossil have been connected with this type. Indeed, in several parts of Europe those characters which were too hastily declared to be unique have been observed in dolmens in less ancient burial places, in historical persons, and even in individuals living at the present time. There was, then, no alternative but to conclude that the Neanderthal man belonged to a formation which was unquestionably human, to a *race*, certain features of which were merely exaggerated in his case [Quatrefages 1879:303].

To a critic of evolution such as Quatrefages, the demonstration of racial rather than specific status for the man from Neandertal deprived proponents of Darwinism of a second human species and, therefore, of any argument for human evolution which that fact, once established, might have provided.

To be sure, the presence in ancient times of a primitive race of men was a fact altogether consistent with and predicted by the idea of human evolution. But it was also a fact altogether consistent with and predicted by assumptions generally held in the 19th century by evolutionists and critics of evolution alike concerning the correspondence of primitive physical characteristics with primitive social and cultural systems. Loren Eiseley says:

> *Long before the clear recognition of fossil forms of man there existed in the minds of western Europeans a notion of racial gradation, and a conception of that gradation as leading downward toward the ape.* Moreover, the less culturally advanced members of the human stock are increasingly seen as affording "a glimmer of the ape beneath the human envelope." These people are regarded as living fossils both culturally and physically; in fact, there is evident a lack of clear distinction between the two categories (Eiseley 1961: 264).

Thus the presence of a brutish race of men in Europe before the rise of civilization was a fact providing no argumentative advantage to proponents of human evolution.

DARWINISM AND THE TRANSMUTATION OF SPECIES

The question of the transmutability of species was the central issue that divided evolutionists and critics of evolution. Evolutionists argued that races were simply incipient species—a view still widely held. Critics of evolutionism, however, adhered to the belief, traditional to nineteenth century biology, that races and species were fundamentally different entities. Quatrefages argued the classical position most clearly. Stating that races interbreed to form mongrels while species interbreed to form hybrids, he argued (1879:70) that "the race and the species display very distinct and characteristic phenomena. We shall now see this opposition as strongly marked in the product of . . . unions in *mongrels* and *hybrids*." A "mongrel race" is characterized by "universal, free and indefinite fertility" (Quatrefages 1879:71). Hybrids are not so characterized. Quatrefages tells us (1879:79) that "the characters of hybrids are infertility, as a general rule, and, in the exceptions, a very limited fertility." Species cannot be successfully mixed in nature, and not even under artificial circumstances for any great number of generations, according to Quatrefages. "The infertility, or, if you will, the restricted and rapidly limited fertility between species, and the impossibility of natural forces, when left to themselves, producing series of intermediary beings between two given specific types, is one of those general facts which we call a *law*" (Quatrefages 1879:80). The term *species* refers to a natural category. "Species is then a reality" (Quatrefages 1879:84).

Darwinism is not scientifically founded, according to Quatrefages (1879:92). "Darwin has formed a complete and systematic theory, the whole, and often the details, of which it is impossible not to admire. . . . I should doubtless have yielded as so many others have done, if I had not long understood that all questions of this kind depend especially upon physiology." Specifically, Darwin had failed to recognize the fact that *race* and *species* are essentially different natural categories; "Darwin had formed no clear conception of the sense which he attributed to the word *species*" (Quatrefages 1879:95-96). There is in Darwin's conception no proper appreciation of the physiological differences between races and species; "a species is only a kind of conventional group similar

to those which are used in classification. As for races, they are only species undergoing transmutation . . . ; to what confusions such a vague kind of theory must lead" (Quatrefages 1879:96). If races are completely interfertile and species are mutually infertile, or at best capable of a most restricted infertility, and if races become species, then one might ask at what point and how does a race switch over into a species? "Now, as we have seen, the fertility among races of the same species remains constant. . . . Darwin, then, himself and his most enthusiastic adherents must admit that at some given moment these *races* become suddenly [sic!] incapable of crossing with their predecessors. Whence then arises the *sterility* which separates *species*" (Quatrefages 1879:100)? The use of the term *suddenly* suggests that Quatrefages either did not grasp or else chose not to accept Darwin's notion of transmutation occurring through the accretion of small variations through long periods of time.

No one had ever seen a race change into a species. Many different species are known, and not one of them ever was observed to transmute into another. "[I]n order to admit the physiological transmutation of race into species, a fact which is contrary to all positive facts, Darwin and his followers reject the secular results of experience and observation, and substitute in their place a *possible accident*, and the *unknown*" (Quatrefages 1879: 100). Such a procedure is unscientific, according to Quatrefages. "Now, in a *truly liberal spirit*, I ask every *unprejudiced* man, however little he may be conversant with science, the question, is it upon such foundations that a general theory in physics or chemistry would be founded? . . . In every page of Darwinian writings . . . *possibility, chance,* and *personal conviction* are invariably adduced as convincing reasons. Is modern science established upon such foundations" (Quatrefages 1879:101)? Increasingly, in the 20th century the answer to Quatrefages' rhetorical question has become "yes"!

It should be emphasized that Quatrefages' argument against the idea that races are incipient species was based on his conception of science as an enterprise that is properly restricted to the known and knowable. As a scientist he repeatedly emphasized his duty to refrain "in the name of science" (Quatrefages 1879:127-128) from speculations concerning ultimate beginnings. Some had not done so. But, according to Quatrefages:

> Others have resisted the impulse of the time; they have remained faithful to method, the mother of modern science; they have carefully preserved their inheritance of solid and precise knowledge, acquired from past centuries. They cannot on that account be accused of acting from routine or be considered as retrograding. As warmly as the most ardent partisans of the so-called advanced theories, they have applauded all the progress, and have received with equal favor new ideas, on the condition of exposing them to experiment and observation. But when they meet with questions the solution of which is at present impossible, and will perhaps always be so, they have not hesitated to answer:—WE DO NOT KNOW;—and when they find purely metaphysical theories are being imposed upon them, they have protested in the name of experiment and observation [Quatrefages 1879:127-128].

So far as science is concerned, until a race can be observed to become a species, i.e., until one species is seen to transmute into another, there is no justification in believing it ever happened, according to Quatrefages.

Quatrefages' insistence on actually observing the phenomenon of transmutation predicted by Darwin's theory must be considered in historical context. It is after all only an extension of the principle of uniformitarianism, whereby only extant forces should be used to explain the past. If one can assume that in the past events took place that are not observed in the present, is not the door opened to theories, e.g., catastrophism, that many scientists during Quatrefages' lifetime labored to reject? To Quatrefages the essential physiological difference between races and species was a universal law derived from countless observations, and no observations contradicted the general validity of that apparent law. Indeed, transmutation of species was not actually observed until the 20th century.[3]

Quatrefages maintained his empirical and uniformitarian approach to the question of human origins until the end of his life. In his last years he wrote:

> I recall two rules which I have constantly followed in the solution of questions sometimes so ardently contested, which are raised in the history of Man. The first rule is, to put aside absolutely every consideration borrowed from dogma or philosophy, and to invoke only science, that is experience and observation. The second rule is not to isolate man from other organized beings, but to recognize that he is subject (in all that is not exclusively human) to all the general laws which govern animals and plants [Quatrefages 1893:513].

A hard science attitude precluded unskeptical acceptance of the application of Darwinism to man, lacking even one single demonstration of transmutation in the animal and plant kingdoms.

Rudolf Virchow (1821-1902) was Professor of Pathological Anatomy at the University of Berlin and co-founder of the Gesellschaft für Anthropologie, Ethnologie and Urgeschichte. He was an enormously authoritative figure in nineteenth century Germany. His pupils included Ranke, Kollmann, His, Haeckel, Bastian and Boas. Virchow was, like Quatrefages, an advocate of a no-nonsense, scientific approach to the Darwinian hypothesis.

Virchow was *not* opposed to Darwinism and the concept of human evolution *as hypothesis.* Indeed, in 1887 he wrote:

> Although facts are still lacking to prove generic variation experimentally or by direct observation, the experiences of embryology, zoology, and pathology are in excellent accord with the hypothesis of descent. It is evident even that all these disciplines have made important progress in the knowledge of actual processes under the rule of the descent hypothesis. Darwinism has proved to be a most fertile idea, and will act as an energetic ferment for a long time [in Ackerknecht 1953:200].

Nevertheless, as Ackerknecht notes (1953:199), Virchow tended "to become more and more over simplified and misrepresented" as taking a "stubborn, reactionary, absolute position. . . ." Specifically, with regard to the question of human evolution, at the turn of the century when German scholars generally had come to accept evolution, Virchow's interpretations of Neandertal man were characterized as "dictated in not small part by his repugnance against Darwinism. . . . He showed that he like so many other potentates had learned nothing and forgotten nothing, that he still was bewitched by preconceived opinions" (Leche 1911: 318-319). However, Virchow was in fact by no means repulsed by Darwinism or the idea of human evolution.

> I have spoken as *a friend*, not an *adversary* of transformism, and at all times I have approached the immortal Darwin in a friendly, not a hostile way. But I have always differentiated between friend and partisan. I can salute and even support a scientific hypothesis, before it is proven by facts. But I *cannot become its partisan* as long as sufficient proof is lacking [in Ackerknecht 1953:200].

Specifically, in 1895 Virchow wrote of the *Pithecanthropus* remains from Java that "he is . . . a new link in the series of forms which make the whole realm of vertebrates *appear* to us as one that belongs together in an evolutionary sense" (in Ackerknecht 1953:203, emphasis mine). Appearances, however, do not constitute proofs.

Virchow had been receptive to the hypothesis of transmutation of species before publication of the *Origin* in 1859. To be sure, in 1858 he wrote, *"To the extent that . . . movement continues under our eyes,* it displays itself as something specifically differentiated and broken up into a great number of fixed lines among which no direct connection exists. . . . [A]nimals reproduce themselves only within their species" (in Rather 1958:117, emphasis mine). This view was in perfect accordance with the principle of uniformitarianism as understood in the mid-nineteenth century. However, Virchow by no means rejected in 1858 the possibility of the transmutation of species. "[O]ur *experiences* do not . . . justify us in regarding the invariability of species, which *currently appears* so certain, as a rule *established for all time*" (in Rather 1958:118, emphasis mine). But, again, current appearances are not proofs. Hence, even before Darwin's *Origin*, Virchow argued that "scientific necessity" required the "possibility" of transformism, even though "the *experience of our time* argues against it" (in Rather 1958:118, emphasis mine). Virchow is emphasizing empirical evidence as a requirement for the establishment of fact as opposed to hypothesis.

Virchow was not opposed to Darwinism, but rather he was opposed to uncritical acceptance of the hypothesis as though it were an established fact. He wrote in 1877 of "the inclination, inherent in mankind, to overhasty generalizations . . ." (in Rather 1958:147).

> May I recall in this connection that I belong to those who did not require this new stimulus in order to conceive of the variability of species as a necessary presupposition of the mechanistic theory of life? In a lecture . . . one year before the appearance of the first edition of the *Origin of Species* I expressed this view in the most clear-cut manner. In fact, as early as 1849 I had emphasized as a logical necessity the mechanical origin of all life out of general movement. Thus I have always been ready and willing to accept in a friendly manner and to treasure as a valuable acquisition every fact which illustrates the variability of the species and the primal creation. But I cannot avoid voicing a forceful warning, based on my own experience, against taking hypothesis for facts and forgetting the necessity for factual proof of particular cases because of the ease of general explanation [in Rather 1958:146].

It is clear that Virchow's self-admitted "conservatism" was based on the failure to observe actual transmutation of species: "I am a Darwinist at heart . . ." (in Rather 1958:148).

Virchow throughout his career had espoused a mechanistic view of physiological process in opposition to the vitalism inherent in early German Romantic *Naturphilosophie.* But in rejecting the life force, he did not deny transmutation; indeed, a mechanistic interpretation of process, according to Virchow, logically led ultimately to transmutation of species, though transmutation had never been observed in fact. Virchow's quarrel was not with Darwin, whom he treated with admiration, but with relapse away from scientific induction back to the Romantic deductive spirit of *Naturphilosophie* in the facile acceptance of Darwin's hypothesis.

> [N]othing has had a more devasting effect than the crude schematization of the Darwinists. It was certainly somewhat surprising, for those of us who were still acquainted with the old nature-philosophy, to see how the genius of a single man restored to its rightful place an idea already given official status as an *a priori* necessity by the nature-philosophers, not only reactivating it, after its long and alas not entirely unjustified banishment, but making it the basis of a general conception of the history of the organic world. But to make an article of faith out of a problem, a principle of synthesis out of a ground for inves-

> tigation, thereby drugging oneself with assumptions instead of seeking further, was almost worse than the *a priori* approach of the nature-philosophers. For all the valid facts which had been brought out in the meantime were also forced into the new system, and in this context they ran a very definite risk of losing their true meaning under a cloak of hypothesis [in Rather 1958:146].

In 1877 as in 1858 Virchow was hostile not to transformism but rather to any relapse to the vices of Romantic biology. Empiricism and induction were essential to his logical positive, hard science approach to the Darwinian hypothesis.

Virchow became more inflexible with age. Like Quatrefages, Virchow persisted in his demands for direct evidence for transmutation, especially in the case of man. He wrote (1893b:2), "Darwin and his followers have, as regards man, got no further than the formation of a mere hypothesis." Indeed, with regard to the human fossil record, his demands for proof appear to have become quite stringent when he refers to "data respecting strange individual cases, by the aid of which it is impossible to form a continuous line or constitute a genealogical tree, but which should be kept in the scientific lumber-room till the time when we can find the intermediate links that may unite them into a series" (Virchow 1893a:376-377). By such demanding standards, even today there is not hard data enough in the "scientific lumber-room" to build a lasting edifice.

Virchow was by no means the only authoritative German skeptic with regard to Darwinism. Adolf Bastian (1826-1905), co-founder with Virchow of the Berlin *Gesellschaft*, was even more given to "puritanical empiricalism" and insisted even more on the collection of facts, according to Lowie (1937-31), who refers to "his determined opposition to Darwinism." "Like Virchow, Bastian regarded transformism as untenable so long as no one had ever seen one species changing into another" (Lowie 1937:31).

The transmutability of species, an hypothesis on which evolution is based, required for proof an actual observation of one species transmuting into another, according to Quatrefages, Virchow and Bastian, and many other scholars of their day. It followed from that fact that even an extensive series of extinct forms leading from living men to the apes would provide no final proof for human evolution.

Paul Broca (1824-1880) was Professor of the Faculty of Medicine of the University of Paris. He was the principal founder and General Secretary until his death of the Société de Anthropologie de Paris. Broca first commented on Darwin's theory in 1862. "England has been reading with stubborn animosity for years, an old but charming and very remarkable work . . . which is entitled 'On the Origin of Species by Natural Selection' " (in Steward 1959:18). After outlining Darwin's argument and commenting, "Each of us will be able to demonstrate his genealogy back to the trilobites (in Steward 1959:18)," Broca took the following stand:

> Now, is Mr. Darwin right or wrong? I do not know and I do not wish to know. I find in the things accessible to science sufficient nourishment for my curiosity, without losing myself in the night of origins. When Mr. Darwin speaks of my trilobite ancestors I do not feel humiliated, but I say to him: What do you know about it? You were not there. And those who refute him know no more about it than he does.

Here Broca adumbrates Quatrefages' refusal in the name of science to become involved in metaphysical discussions of ultimate beginnings.

In 1886 while discussing the mandible of La Naulette, Broca argued that even a series intermediate between two species or genera would not prove evolution.

> The opinion of Darwin on the transformation and evolution of the species is an ingenious hypothesis which lacks, in my opinion, only one essential thing: the demonstration. . . . [T]he first condition to be fulfilled before an affiliation can be established between two species or two groups of species is to verify the existence of intermediate types arranged in a continuous series between the two groups. When this intermediate series is once established, it in no way results that the Darwinian hypothesis is demonstrated, nor even that it is probably, but it results at least that it is no longer impossible [in Steward 1959:18-19].

Was there in 1866 any known link in that required chain from men to the apes which, when completely recovered, would provide necessary, if insufficient evidence to prove the reality of human evolution?

> Now, up to this point, the known anatomical gulf between the lowest human type and that of the higher apes constituted an immense hiatus. The Darwinists were not unaware of this and not finding in existing humanity the transition types, they announced that at least these types ought to be found in the fossil remains of primitive humanity. . . . I do not hesitate . . . to say that the mandible of the Trou de la Naulette is the first fact which furnished an anatomical argument to the Darwinists [in Steward 1959:19].

The Neandertal skullcap, though somewhat simian in appearance, was not demonstrably ancient, and, therefore, not evidence.

In 1867 Broca, after describing the peculiarities of the Naulette jaw, said:

> These facts correspond to the views of partisans of the so-called Darwinian hypothesis of transformism. . . . However, they prove only a single thing, a thing, it is true, vital to that hypothesis. Namely, the serial disposition and the gradual development of organic characteristics, long ascertained in the rest of the animal gradation, is observed also in the higher grades. In other words the chain of beings, everywhere else

> more-or-less continuous, is not abruptly broken at this level. The paleontological facts have already diminished the vast interval which would appear to exist between the characteristics of man and those of apes. We can believe that that interval will be narrowed still more when we become acquainted with other human races of the Quaternary epoque and especially when we discover . . . the remains of Tertiary man [Broca 1868: 401-402].

But the inclusion of man in the Chain of Being did not prove the idea of human evolution. Man had always been considered part of the Great Chain of Being.

> The continuity of the series does not account at all in my eyes for the idea of the transformation of species. . . . That [bold] hypothesis is all the more strongly attractive intellectually as there is no other that has been opposed to it. But, those who look at it coldly, with the rigor of the scientific method, must recognize that till now it does not rest on any direct proof [Broca 1868:401-402].

Darwinism predicted and required the existence in the past of primitive human forms linking man to the apes. The concept of the Chain of Being did not predict or require extinct human forms linking man to the rest of the animal world. The discovery of such primitive forms in the Quaternary, however, did not at all contradict the old idea of species, living and dead, as links in the Chain of Being. Direct evidence for the transmutation of one species into another was required to ultimately prove the Darwinian hypothesis.

The ancient and primitive jaw from La Naulette provided no proof for the hypothesis of human evolution—whether it had originally belonged to an extinct race or an extinct species of *Homo*. It was only one of many newly found extinct links in the Chain of Being. But if the Naulette jaw and the many other extinct animal forms recently recovered from the earth did not prove evolution to be a logical necessity, perhaps collectively they were beginning to have a psychological impact on Broca. In 1870 he summed up his views as follows:

> The struggle for life is a law. The selection which results from it is a fact. The production of individual variations is another fact. The eventual transmission of these variations . . . is one of the possible consequences of the law of heredity . . . but what is neither a fact nor a law, what is no more than an hypothesis is the infinite divergence which natural selection imposes on anatomical and morphological characteristics [Broca 1870:188].

Later in 1870, during his last known statement on the subject of Darwinism, Broca appears to have reversed his former views on the probability of the transmutability of species.

> "The permanence of species seems nearly impossible; it is in opposition to the manner of succession and distribution of species in the series of beings present and past. It is therefore very probable that the species are variable and subject to evolution" [in Stewart 1959:20].

Despite Broca's "now grudging admission that evolution might apply to man" (Stewart 1959:19), he denied the power of any of the proposed mechanisms including selection to explain it. "The causes, the agents of this evolution are still unknown. All the theories which have been advanced until now are insufficient. The great synthesis of nature is not yet realized" (in Stewart 1959:20). We cannot be sure that Broca by 1870 had waived the requirement for direct evidence for the transmutability of species and become an evolutionist. It would seem, however, that the expanding fossil record, including the Naulette discovery, was pressing some scholars toward that end.

DARWINISM AND THE FOSSIL RECORD

The theory of evolution was not erected on the fossil record. The power of Darwin's theory lay in the fact that it explained a number of diverse phenomena (Lyell 1863:413-415). Phenomena related to the fossil record were just among a number of phenomena that the theory of evolution explained. As the fossil record expanded, it supported, in turn, the theory of evolution.

There were phenomena pertaining to the fossil record, most notably the many gaps in it and the magnitude of those gaps which, indeed, the theory of the separate creation of each species did in fact explain more handily. Darwin was forced to explain away the gaps in the fossil record on the grounds of the unlikeliness of preservation and the accidents of discovery. Charles Lyell (1863:424-425) tells us:

> The most obvious and popular of the objections urged against the theory of transmutation may be thus expressed: If the extinct species of plants and animals of the later geological periods were the progenitors of the living species, and gave origin to them by variation and natural selection, where are all the intermediate forms, fossil and living, through which the lost types must have passed during their conversion into the living ones? And why do we not find almost everywhere passages between the nearest allied species and genera, instead of such strong lines of demarcation, and often wide intervening gaps?

The fossil record of the day was far from a support, indeed, it was one of the major obstacles in the way of acceptance of Darwin's theory.

Opponents of human evolution especially cited the gap between man and the primates. Again, proponents argued the inadequacy of the fossil record in support of their case.

> The opponents of the theory of transmutation sometimes argue that, if there had been a passage by variation from the lower Primates to Man, the geologist ought ere this to have detached some fossil remains of the intermediate links of the chain. But . . . , we have not yet searched those pages of the great book of nature, in which alone we have any right to expect to find records of the missing links alluded to. The countries of the anthropomorphous are the tropical

> regions of Africa, and the islands of Borneo and Sumatra, lands which may be said to be quite unknown in reference to their pliocene and post-pliocene mammalia [Lyell 1863:498].

Lyell went on to predict that intermediate fossil forms would be found. "[I]n more equatorial regions . . . there will be the greatest chance of discovering hereafter some species more highly organized than the gorilla and chimpanzee" (Lyell 1863:500).

Not only were there gaps between species in the fossil record, rendering fossil species discreet entities, but in addition the record provided examples of species persisting for long periods of time and showing no discernible change. For example, according to the paleontologist, Hugh Falconer:

> Between the Pliocene . . . and the new Quaternary formations an enormous lapse of time had intervened amounting to many hundreds of thousands, if not millions, of years—during which a great portion of the Continents of Europe, Asia, and America had been chilled down. . . . How faired it with the large Mammalia during this mighty change? . . . In this case the argument of the imperfection of the geological record, which has been so powerfully handled by Darwin, could not be urged; the materials were abundant, and the deposits which marked the successive change of dry land, submergencee, and re-emergence were amply represented. . . . [H]ere was a case where quadrupeds which were either contemporaries [sic] of man or close upon his period, could be traced back into remote time, and thus *furnish a test of the mutability or persistence of specific characters*, of much higher value than that yielded by observation upon living animals, necessarily limited to a brief lapse of time . . . [Falconer 1868:586, emphasis mine].

Transmutation of species was not notable in the fossil record.

Darwinists could and did argue against the claim that the fossil record supported the permanence of species by countering that change took a longer time than the record provided for any single species. Nevertheless the recorded fact that species do not change over long periods of time in addition to the fact that the many gaps in the fossil record were not at all predicted by Darwin's theory remained and gave the appearance of refuting Darwin. On the other hand, these phenomena were consistent with and, indeed, demanded by the idea of separate creation and permanence of species.

Despite its inadequacies the fossil record was getting better. Lyell (1868:482) singled out the work of Albert Gaudry, an early French evolutionist, at Pikermi in Greece as showing there were, indeed, transitional forms.

> [I]n . . . osteology, the evidence already obtained since the time of Cuvier, in favour of transmutation, is certainly very striking. By no naturalist has its bearing been more clearly pointed out than by M. Gaudry, who, under the influence of the great teachers who preceded him, entered on the enquiry with a theoretical bias directly opposed to the conclusions which he now so ably advocates. . . . [H]e has pointed out the transition through many intermediate forms of Upper Miocene species to others of Pliocene and Post-Pliocene date, showing how each successive discovery has enabled us to bridge over many gaps which existed only 20 or 30 years ago.

Even the primate material was of help to the theory of evolution. "Only 14 species of the ape and monkey tribe have as yet been detected in a fossil state, and each of these has usually furnished but a few bones of its skeleton to the osteologist. Yet they have not failed to throw much light on the transmutation hypothesis" (Lyell 1868:483).

DOES DARWINISM APPLY TO MAN?

The inadequacies of the fossil record were generally an obstacle in the way of acceptance of Darwinism. To be sure, some of the gaps were filled fairly quickly in the mammalian record and certain lines of descent could be discerned, especially in the case of horses. However, this was not true for man. Fossil hominids did not provide any significant evidence for evolution until long after good sequences were established for a number of other kinds of mammals. Scholars, then, in so far as they were influenced by the fossil record, either did or did not believe in evolution on the basis of evidence provided by organisms other than man.

There were scholars who could accept evolution as applicable to the animal world but not to man. The lack of significant fossil links between man and the animal world encouraged that viewpoint. Haeckel in 1879 explained:

> For many years [before 1871] it was even asserted that Darwin had no intention of applying his theory to Man, but that he shared the prevalent opinion, that an entirely peculiar place in creation must be assigned to Man. Not only men unversed in science, . . . but even educated naturalists, asserted with the greatest ingenuousness, that the Darwinian Theory in itself was not to be combated, and was entirely correct, for it afforded an excellent means of explaining the origin of various species of animals and plants; but that the theory was in no way applicable to Man [in Stewart 1959:11].

No less a geological authority than Charles Lyell showed reluctance to apply the principle of evolution to man. In 1863 Lyell wrote, "I can only say that I have spoken out to the full extent of my present convictions and even beyond my state of *feeling* as to man's unbroken descent from the brutes . . ." (in Haber 1959:282). It would appear, however, that Lyell later came to feel more kindly toward the prospect of human evolution. He wrote in 1868:

> It is clearly seen that there is such a close affinity, such as identity in all essential points, in our corporeal structure and in many of our instincts and passions, with those of the lower animals—that man is so

> completely subjected to the same general laws of reproduction, increase, growth, disease, and death,—that if progressive development, spontaneous variation, and natural selection have for millions of years directed the changes of the rest of the organic world, we cannot expect to find that the human race has been exempted from the same continuous process of evolution [Lyell 1868:493].

EARLY ANTHROPOLOGISTS ON DARWINSIM AND HUMAN EVOLUTION

Belief in *human* evolution during the first few decades after the publication of *Origin* was based more on one's general belief in evolutionary theory and its applicability to man than on the basis of fossil materials. Darwin writing in 1871 in *The Descent of Man*, in which he elaborated his belief in human evolution, spoke of a "great break in the organic chain between man and his nearest allies, which cannot be bridged over by any extinct or living species," and of "the absence of fossil remains, serving to connect man with his ape-like progenitors" (1871:520-521). For the most part, acceptance or rejection of the idea of human evolution was not based on paleoanthropological research.

Anthropologists *per* anthropologists had little to contribute to the debate over evolution in terms of their own reserach. Most anthropological problems of the day had little applicability to evolutionary questions. Human paleontology was potentially applicable, but the known human fossils failed to have any significant impact on general evolutionary questions.

Anthropologists of the third quarter of the nineteenth century were not, of course, strictly anthropologists (or physical anthropologists as they would be called today in the English-speaking world). They were medical doctors, zoologists, anatomists, paleontologists, geologists or anyone else with an abiding interest in anthropological problems, which were then primarily biologically construed. Since their orientation was primarily biological, it would be expected that societies of anthropology would engage themselves in extended debate on the general subject of evolution. They did so, and anthropologists offered many opinions on the subject. Still, as anthropologists pursuing anthropological problems, they had little in the way of research to bring to bear on the general question of evolution.

The initial opposition of anthropologists to Darwinism and the prospect of human evolution in Europe was not based on research, not even on paleontological research. It was based rather on a view of the scientific process as properly empirical and inductive. Darwinism *as hypothesis* was well received on the Continent. *As established fact* it was a threat to the ethos of scientific method as then conceived and, therefore, quickly and widely opposed.

NOTES

[1]This article appears posthumously. Stephen Holtzman died at the age of 38 in December, 1975. He had taught anthropology at Brandeis University and was Assistant Professor of Anthropology at Northern Illinois State University. His obituary was published in *The American Journal of Physical Anthropology* 45:349.

[2]Acknowledgement goes to Cecil Brown, Peggy Salovesh and especially T. Dale Stewart for critical comment on this paper. All responsibility is, of course, my own.

[3]In 1927 a true-breeding hybrid between a radish and a cabbage was reported by the Russian geneticist G. D. Karpechenko. Since some of the seeds produced were highly fertile when crossed within their type but infertile when crossed with either of the parental types, technically this was a case of transmutation of species. (Garrett Hardin: Biology/ Its Human Implications, 1954:555. San Francisco: W.H. Freeman and Company.)

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