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TWO VIEWS OF THE ORIGIN OF MAN[1]

To speak about phobias in a society that includes so many distinguished psychiatrists may seem like carrying coals to Newcastle. Nevertheless I beg your indulgence for describing a new kind of phobia which is now widely prevalent among the American public. It may be named pithecophobia, or the dread of apes—especially the dread of apes as relatives or ancestors. During the past few years this phobia has become almost pandemic; perhaps we have not yet passed the peak of its incidence, especially in rural communities.

Dr. Osborn and I are now trying out rival prophylactic and therapeutic measures upon our patients. My method, in a word, is to inoculate the patient with the Darwinian theory of the origin of man. Professor Osborn's method is to remove the cause—by abolishing the apes, or rather by disproving their claims to close physical and mental kinship with us. In this way sensitive souls may be able to hear the word "gorilla" without shuddering.

Professor Osborn and myself, sighting the same vastly distant and obscure event, the emergence of man, from somewhat different viewpoints, naturally report somewhat different aspects of it. With unwearied patience and unsurpassed industry Professor Osborn has traced the rise and decline of many long-lived lines of fossil mammals through the long ages of the Eocene, Oligocene, Miocene, Pliocene, Pleistocene and recent epochs, covering, according to the estimates of Barrell, a period not less than sixty millions in years' duration.

Of the generalizations which Professor Osborn has drawn from his paleontological studies the following bear especially on the problem of the evening:

(1) Every great order of mammals is polyphylectic, that is, it includes a large number of genera which may be traced backward along independent lines through amazingly long periods of geologic time. So many are these phyla, as they are called, and so severe the ravages of time upon the fossil record, that one rarely finds the remote common ancestral stocks that gave rise to the many slowly diverging phyla. This has been proved by Professor Osborn and other paleontologists to be the case among the families of horses, tapirs, rhinoceroses, titanotheres, camels, antelopes, deer, pigs, cats, dogs and many other groups of mammals.

[1] Address before the Medical Society of the County of Kings, May 17, 1927.

(2) Each of these phyla is distinguished by a definable assemblage of dental and skeletal characters apparently adapted in each case to some special mode of life. After a phylum begins to specialize in a given direction, that is, toward certain habits, it goes on becoming more and more specialized in the same direction until it becomes overspecialized, or unable to adapt itself to changed environmental conditions, after which it may become extinct. So many examples of this kind could be cited that this has come to be looked upon as the normal course of evolution among mammals.

Professor Osborn has been a leader in expanding our views of the antiquity of man and has already shown you the evidence for the existence of intelligent tool-making men far back in the Pliocene epoch, possibly three or four million years ago. Even at that vastly distant date the ancestors of the horses, asses and zebras were but little different from their modern descendants. So far as known the Pliocene men also were essentially like the men of to-day except in minor points; especially is this true apparently in the essentially human characters of the brain and mind. In view of all this and very much more is it any wonder that Professor Osborn has applied the same principles to the history of man and has come to the following striking conclusions:

(1) The human family, like other families, includes a great number of independently evolving phyla which for untold ages evolved independently of each other in different parts of the world.

(2) As in other mammals, we shall very rarely find the true stem forms at the bottom of the phyletic lines.

(3) The older of these human phyletic lines may well run back as far as many other lines of mammals do, that is, at least to the Lower Oligocene or Eocene. Hence even in those inconceivably remote ages we may expect to find Dawn men—erect-walking, plains-living, large-brained, speaking men, totally dissociated from the family of the apes, especially in their evolutionary trend which was toward life in the open, while that of the apes was toward more and more specialized life in the trees.

(4) Hence the idea of man's ape ancestry is a myth and a bogie, due to our previous ignorance of the real course of human evolution. For millions of years man has been a ground-living, erect-walking being and if at some still earlier period he may have passed through an arboreal stage such a stage could not have been long or have left a very deep imprint upon his skeleton and nervous system.

It must not be supposed that these conclusions of Professor Osborn will be regarded as improbable by many paleontologists. On the contrary, many who have the most intimate knowledge of the history of mammalian phyla are already of much the same opinion. It is a matter of sincere regret to me that I can not follow my honored leader into this new and spacious field of thought. I deem it rather my duty to defend the old and always unpopular view of Darwin, Huxley, Haeckel and others of previous generations. To come to the point at once then, I must attack his whole argument, in so far as it is based upon his studies of mammals other than primates, as a series of analogies, unsupported by direct evidence and outweighed by many definite facts of record.

The slowly evolving phyletic series of hoofed mammals become differentiated from each other at almost imperceptibly low rates, so that it has taken possibly sixty millions of years to produce the structural differences between modern horses and modern tapirs. But it is a mere begging of the question at issue if we assume, as many paleontologists are inclined to do, that it took an equally long period to produce the present differences between man and the chimpanzee. For there is definite evidence that both the human and the anthropoid stocks are far more plastic, less fixed in hereditary grooves, than are the wild species of the horse and tapir families. If we look over a large series of upper molar teeth of wild species of horses, asses and zebras we shall easily see how trivial are the differences in their complex molar patterns. If, on the other hand, we compare an equal number of upper molar teeth of various human races, we shall find a far wider range of variability among them, while in even a small collection of orang or chimpanzee teeth the range of variability will be astonishingly wide. During late Pliocene and early Pleistocene times the variability in lower molar patterns of man was apparently high, since the Piltdown lower molars are almost indistinguishable from those of the anthropoid *Dryopithecus,* while the Heidelberg molars are distinctly human in pattern. So too the variability in molar patterns of the fossil apes of the distant Miocene and Pliocene epochs seems remarkably high in proportion to the small number of specimens known, since hardly any two specimens are closely similar and it is difficult to determine from the fragmentary materials what are the limits of the species. Similar high variability is also characteristic of the lower premolars of recent and fossil anthropoids, some approaching the primitive compressed condition seen in certain jaws of *Dryopithecus,* others being widened and almost approaching the bicuspid form of human lower premolars.

If man and the anthropoids had begun to drift apart as early as did the horse and tapir it is difficult to see why, especially in view of their higher plasticity, they should have remained so much alike

in the structure of their molar teeth that even as late as in Pleistocene times there were still structural transitional stages (Piltdown, Ehringsdorf) between them. Nor is it easy to understand, if man and chimpanzee began to drift apart as long ago as did tapir and horse, namely in the Lower Eocene, why man and chimpanzee should be so much more alike in structure than are tapir and horse and why man and ape should still retain so many physiologic reactions in common in spite of their radical differences in environment, diet and modes of locomotion.

During the twenty-five millions of years of Eocene time the fossil record already known reveals the existence of many genera of tree-shrews, lemuroids (Notharctids) and tarsioids (Anaptomorphids), but none rise anywhere near the human grade of organization; during the sixteen millions of Oligocene time only three genera of fossil primates are known, all in the lower Oligocene of Egypt; of these, one (*Parapithecus*) appears to be a highly progressive protoanthropoid, the other (*Propliopithecus*) has a very primitive molar pattern potentially ancestral to all the anthropoids and man. During the twelve million years of Miocene time and the first three millions of Pliocene time the record reveals a widely ranging anthropoid group, some pointing to modern anthropoids and all having the basic molar pattern and dental formula of man and the anthropoids. Hence, although fragmentary, the paleontologic record as it stands indicates the emergence of strictly human characters in the Pliocene *after* the *Dryopithecus* type of dentition had been the dominant one in Miocene times.

But, say the paleontologists, *Dryopithecus* or some allied genus may well be the ancestor of man, provided its foot, when discovered, shall show distinctly human specializations. Otherwise it is an ape and therefore excluded from ancestry to man. This raises again the crucial question, did man ever pass through an arboreal stage and what were its characters? Man belongs to an order, all the known members of which were completely adapted to arboreal life as far back as the Lower Eocene. With surprisingly few exceptions highly varied tree-shrews, lemuroids, cheiromyoids, tarsioids, New World monkeys, Old World monkeys, gibbons and great apes are thoroughly arboreal even at the present day, and only a few, such as the baboons and certain other monkeys, have more or less given up arboreal life for life on the plains. Hence, unless man can be shown to belong to an entirely distinct zoological order, the presumptive evidence is all in favor of the hypothesis that he too must be traced back eventually to an arboreal stock.

Long-continued life on the ground invariably results, so far as our experience extends, in specializations of the locomotor apparatus which the human skeleton has fortunately escaped. The retention of unimpaired pentadactyl extremities, of a claviculate shoulder girdle, of undiminished powers of supination of the hand and of a full complement of muscles of the limbs, all testify explicitly to the fact that man's ground-living adaptations are his latest acquisitions and that they have not continued long enough to wipe out many of the former arboreal characters which he still shares with his nearest relatives, the chimpanzee and the gorilla.

But there is even more direct evidence from many sources that underneath the bipedal habitus, acquired in several millions of years of adaptation to life on the plains, man still carries the plainest traces of an earlier arboreal mode of life. In a large number of characters of the brain, sense organs and viscera, man still agrees with the chimpanzee, gorilla, orang and gibbon, all fundamentally arboreal, brachiating bipeds. Moreover, the human fetus of the ninth week shows a widely divergent great toe, the under surface of the foot being provided with the interdigital and thenar pads of primitive aboreal primates. The thumb at this early stage has retained certain distinctly ape-like characters. In support of these statements I refer to the detailed descriptions of the early foetal hand and foot of man by Professor Schultz, of the Johns Hopkins University. And even the adult hand is remarkably similar in its anatomy.

The superficial unlikeness of the human foot to that of the chimpanzee and gorilla has been one of the principal difficulties for those who can not see the case for the arboreal origin of man. But the human foot itself is a veritable museum of relics of a former arboreal condition. The earliest known fossil primates of the exceedingly remote lower Eocene time already had a large and sharply divergent metatarsal of the great toe of the hind foot. The distal end of the hallux evidently bore a large flattened nail, while from the proximal end of the metatarsal sprang a large process upon which was evidently fastened the thick tendon of the peroneus longus muscle, a muscle of the utmost service in leaping and climbing. All known recent and fossil primates, including man, exhibit the same fundamental characters of the great toe, the principal difference being that in man this digit is brought around parallel to the other digits instead of being sharply divergent from them as it is in the foetus of the ninth week. It is also twisted around its own axis so that it faces downward toward the ground, whereas in the foetus of the ninth week its volar surface is turned partly inward toward the other digits, as in the tree-climbing anthropoids. The transversus and adductor hallucis muscles of the human foot, although differing in detail from those

of anthropoids, now assist in maintaining the transverse arch of the foot while in the anthropoids they served chiefly in the grasping action of the foot. The very dominance of the great toe in man was, as I interpret the evidence, the natural result of its derivation from an anthropoid stage in which the great toe was already enlarged and in which the main axis of weight of body passed on the inner side of the foot. Even the transverse ligament of the foot, which in the adult ties the great toe firmly to the others, in the foetus of the ninth week was evidently stretched so as to permit a wide cleft between the great toe and the other toes as in the anthropoid apes. These are only a few of the features in which the adult human foot differs in the proportional development of its parts as well as in its functions from the foot of the chimpanzee and the gorilla. In view of all this and of corroborative testimony from many other sources, can we any longer doubt that the human foot has been derived from an arboreal pro-anthropoid type by a change of function and by remodelling during its final stage of use on the ground?

Paleontologists have been dealing largely with races of mammals each of which from the Lower Eocene to the present time exhibits a progressive intensifying of a given function in a single direction. Comparative anatomy, on the other hand, affords numerous clear-cut cases of a change of function, involving sharp change in the direction of specializations. In the case of the flippers of seals and whales, for example, the comparative anatomist is fully convinced that in both cases the flippers have been produced by easily traceable modifications of enlarged hands of animals that were formerly terrestrial. And he may well stand by this inference, even though no fossil remains showing intermediate conditions between hands and flippers may have been discovered. So, too, comparative anatomists have long been satisfied that the human foot has been derived by a profound change of function from the arboreal grasping foot of primitive anthropoids. But the paleontologist, not so much impressed by experience with examples of the change of function, takes the stand that nothing of the kind can be proved except by fossils.

The astragalus is a bone which paleontologists find to be of high significance in classification. The order and even the family of most recent and fossil mammals may be determined by an attentive study of the astragalus. Here again the form of the human astragalus clearly suggests the place of man in the Primate order, not far removed from the chimpanzee and the gorilla. In this connection it is important to note that the astragalus of the Neanderthal race is slightly but distinctly more pithecoid in character than that of a modern man. And according to Dr. D. J. Morton's study of casts of several calcanea of Neanderthal man, this bone too contains some highly significant anthropoid features that are lost in later races of man.

The whole forearm of man affords the most cogent testimony to his relatively close relationships with the chimpanzee and greatly strengthens the evidence that man is derived from an arboreal brachiating ancestor. Here, however, a word of caution is necessary. All the existing species of apes are now over-specialized for arboreal life. Their hands are degenerating into hooks and their hind limbs are adopting more and more the suspension grasp which finally, as in the orang, makes them unfit to support the body in the upright position adopted by the gibbon and by the remote ancestors of man. These over-specialized arboreal characters have been advanced by many authors as an objection to the derivation of man from the anthropoid stem. But there is no need to impute them to the common man-anthropoid stock.

In conclusion then, during the past twenty years I have published a series of investigations on the classification and evolution of the vertebrates, dealing since 1916 especially with the origin of man, and during this period I have been unable to discover a single valid objection to the direct evidence afforded by comparative anatomy and in harmony with the paleontological record of the entire Primate order, so far as known, namely, that man's relatively close kinship with the chimpanzee and the gorilla is an unassailable fact; that he is a member of a group that, so far as known, first appears in the Oligocene epoch and is characterized originally by the erect position (as in the gibbons), by primitive brachiating arms, and by feet with divergent great toes; that of this group the existing anthropoids, remaining in the ancestral forests, became over-specialized in the direction of extreme brachiation, while the ancestors of man, left perhaps in a region of dwindling forests some seventeen million years ago, early in the Miocene epoch, spent more and more time on the ground and initiated an extensive series of changes in function, the results of which have partly masked the still more ancient and deeply impressed arboreal stamp upon the brain and sense organs and locomotor skeleton.

Paleontologists to date have brought forward no substantial evidence against this view. They cite the essentially human character of the Neanderthal and other fossil human races at a time perhaps ten million years and some 800,000 generations later than the real transitional period between apes and man. Disregarding the fact that of the many genera of Eocene tarsioids and lemuroids already known, none

rises even to the anthropoid grade of evolution, many paleontologists prefer to invent hypothetical unknown Oligocene and Eocene ancestors of man rather than to accept the highly varied Mid-Tertiary anthropoid stock as the common human-anthropoid source so precisely indicated by comparative anatomy and allied fields.

Refusing to accept even the paleontologic record so far as it is known, disregarding the cogent and direct evidence of comparative anatomy, many paleontologists do not hesitate to extend to man supposed laws of evolution deduced from the study of orders of mammals which in their entire organization and history stand in wide contrast to the primates. From such analogies has been conjured the Eocene Dawn Man—a colossal anachronism some forty million years ahead of his time in the world's history.

WILLIAM K. GREGORY

AMERICAN MUSEUM OF NATURAL HISTORY

SUTHERLAND SIMPSON[1]

WHEN I commenced work as a student of physiology in Edinburgh in 1899, Dr. Sutherland Simpson, having graduated in medicine that same year, had just been appointed an assistant in the department. Thus he was one of my first teachers in physiology. I already knew him well, for as natives of the same little county of Scotland and residing in the same university city we had frequently foregathered. It was a great feather in my cap to have made his acquaintance while I was a schoolboy there. Every Orcadian youth who came to study in Edinburgh knew at least something of his remarkable career, how from laboratory boy he had worked his way forward to a degree in science and had now set himself to qualify in medicine. In those days Simpson made a wonderful impression upon his associates. As one man put it, "When he walks into a room of people, with self-reliant step and head high, he carries an atmosphere with him. You recognize at once that there is a man." I did not know which to admire most—his abounding energy and virility or his unusual gift of sympathy and kindness.

On the remote island where he was born he had early decided on a career. That was not to become a physiologist, for he had never heard the word named. One day a Dundee whaling vessel with full spread of canvas approached and dropped anchor near his home. The sight of the captain standing solitary and with speaking-trumpet issuing peremptory orders, which, instantly obeyed, controlled every turn of the vessel, was a revelation to the youth, who had never before seen a man exercise what seemed to be boundless authority over his fellow men. Thenceforward Simpson had one ambition. That was to be master of a seagoing merchantman. To this he would bend all his energies.

The first thing was to acquire some higher education. Fortune here favored him. The school teacher, in order to escape from a contentious wife, started an evening school for the young men of the island. The main subject was navigation, but he also professed arithmetic, elementary mathematics and English composition. Simpson later discovered that he likewise knew French, but he had to extract the information, for the dominie was a poor expounder, and the evening school, as a commercial proposition that might have helped to temper the gibes of the wife, proved a complete failure. Very soon there was but one pupil left—Sutherland Simpson. This indomitable scholar stayed on month after month until he had been introduced to English literature, had read the whole of Voltaire's "Charles the Twelfth" in the original and had exhausted the store of mathematical knowledge of his instructor.

Years afterwards I chanced to meet a farmer who had known the Simpson family; as a young man he had sailed each summer on the herring-boat owned by Simpson's father. The father, a highly intelligent observer, placed his nets with such discrimination that the other fishing craft used to profit by merely watching and following the course that he took. So successful each year was the Simpson boat that there was keen competition among the young men to be numbered among the crew of that vessel. My informant, speaking of the son, who by this time had made his way in the world, said, "A most remarkable man is Sutherland Simpson, and he was that when he was a boy. When I sailed on his father's boat and we would be lying at the nets, the other fellows might be skylarking, playing the melodeon or dancing on the foredeck. But Sutherland Simpson would aye be sitting in the stern with a slate in his hand doing some calculation or other."

To carry out his cherished ambition Simpson left home at the age of sixteen and proceeded to Leith, his idea being to join a ship there. It was a time of great scarcity of work and he had to take a temporary job as a dock laborer. Sustaining an accident to his hand, he was incapacitated for some weeks. Meantime an advertisement in an evening paper announced that the department of physiology of Edinburgh University required a laboratory boy. On the strong solicitation of his landlady, a shrewd woman who had recognized his superior knowledge, he went

[1] Address delivered April 13, 1927, on the occasion of the presentation of a portrait of the late Dr. Sutherland Simpson to Cornell University.