

Hesperopithecus, the Anthropoid Primate of Western Nebraska.

By Prof. HENRY FAIRFIELD OSBORN, American Museum of Natural History, New York.

EVERY discovery directly or indirectly relating to the pre-history of man attracts world-wide attention and is apt to be received either with too great optimism or with too great incredulity. One of my friends, Prof. G. Elliot Smith, has perhaps shown too great optimism in his most interesting newspaper and magazine articles on *Hesperopithecus*, while another of my friends, Dr. A. Smith Woodward, has shown too great incredulity in his article in *NATURE* of June 10. It is in reply to both these extremes that I have especially prepared for *NATURE* additional information regarding the fauna and habitat of this new Primate, and additional figures to show the comparison between

Book of Job (xii. 8), "Speak to the earth and it shall teach thee." In brief, I advised Mr. Bryan to drop all his books, as well as his attempts to grasp the meaning of the diversity of opinion among scientific writers, and to inquire of the earth only what it had to teach him. I added that he would not necessarily lose his religion, but that he would certainly become an evolutionist.

I presume it is widely known that Mr. Bryan is a native and prominent citizen of the State of Nebraska, and it is certainly a humorous coincidence that on March 14, only nine days after my advice was given, I received from the western part of the State of Nebraska the tooth from which has been named the

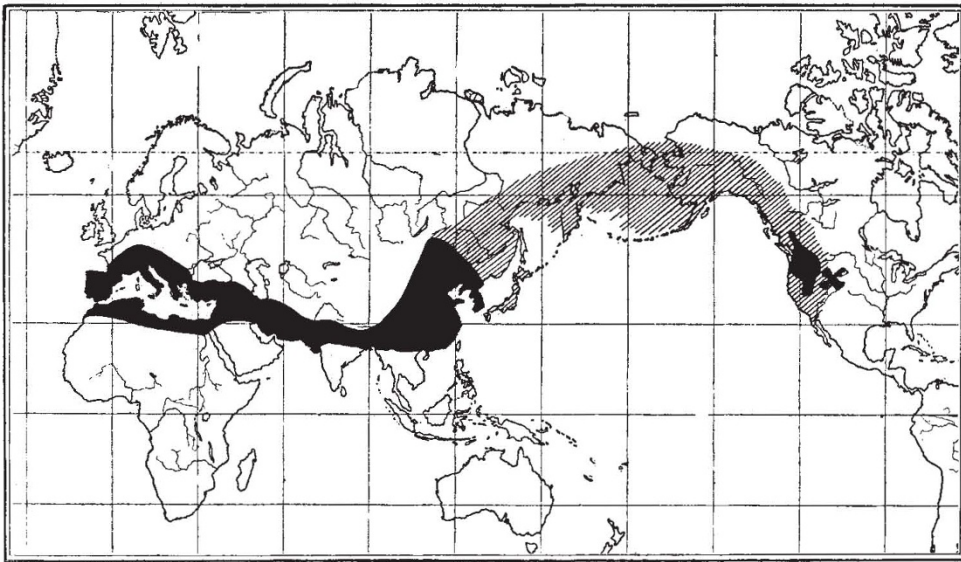


FIG. 1.—Upper Miocene and Pliocene distribution of the Strepsicerine and Hippotragine Antelopes. Known distribution in black, hypothetical migration area in oblique lines.
X, Region of western Nebraska, Snake Creek beds, site of the discovery of the *Hesperopithecus* tooth.

the small, water-worn, type tooth of the genus (Fig. 2, 1-4) and the teeth which most nearly resemble it.

First, a word regarding the time and circumstances of the discovery of this Primate which happen to have a humorous side. Fresh and very violent attacks on the Darwinian theory have been made during the last two or three years all over the United States, especially under the leadership of William Jennings Bryan, a man of ingenious and fertile mind and persuasive powers of oratory, gifted as a politician and as a religious advocate. As an opponent to Darwinism, Mr. Bryan's attack culminated in his very carefully prepared article in the *New York Times* of Sunday, February 26, 1922, in which he ably fortified his position by long quotations from Prof. W. Bateson's Toronto address recently published in *NATURE* (April 29, p. 553), and by other critics of Darwinism. The following Sunday, March 5, I replied to Mr. Bryan, and realising that quotations from the highest scientific authorities in the world would not have the slightest influence upon him or his followers I referred him to the writings of St. Augustine, also to the Holy Scriptures, and especially to a passage in the

Ape of the Western World (*Hesperopithecus*). This is the very first evidence, after seventy-five years of continuous search in all parts of our great western territory, of a Primate of any kind above the ranks of the numerous Lemur-like and *Tarsius*-like lower Primates which have long been known in our Eocene beds.

While we have all eagerly looked forward to such a discovery, and I have always regarded it as possible, I have never regarded it as probable, for the reason that the higher Primates, seeking the protection of forests, never venture out for long distances on the plains; moreover, accustomed to a forest fruit supply, they would have been exposed to great dangers in migrating from Asia to western North America except by the aid of a continuous forest belt or of a rather dense forest and savanna belt bordering a plains belt. In 1910 I published in my "Age of Mammals" (page 336, Fig. 156) a map, which I now send to *NATURE* for reproduction (Fig. 1), with indications of such a life belt for animals of the plains—antelopes and horses; adding an X to show where *Hesperopithecus* was found.

Since 1910 additional discoveries have been made which tend to indicate the existence also of a continuous forest and savanna belt between eastern Asia and western North America (black area and oblique lines), for we have found animals related to the strepsicerine and hippotragine antelopes, to the plains ungulates remotely related to the kudu, to the sable antelope, and to the eland (*Taurotragus*). We have also traced the migration of two kinds of forest- and savanna-living mastodons over this entire region, namely: (1) of proboscideans closely related to the *M. arvernensis* of southern Europe, to the *M. sivalensis* of India, and to the *M. mirificus* of western Nebraska, specimens of which have now been found in the very Snake Creek

three kinds of antelopes and of the two kinds of mastodons above mentioned. Finally, of the utmost rarity are the remains of the Primates, because during the eight seasons of continuous and expert search we have only discovered two teeth, namely, the tooth now regarded as a third superior molar of an old individual of *Hesperopithecus* found by Dr. W. D. Matthew in 1908, and the type tooth of *Hesperopithecus haroldcookii* found by the geologist Harold J. Cook in 1921. We are this season renewing the search with great vigour and expect to run every shovelful of loose river sand which composes this deposit through a sieve of mesh fine enough to arrest such small objects as these teeth. Even by this most laborious and painstaking method

the probability of finding more material is not very great, for the reason that the anthropoid Primates have always been very clever and resourceful animals, climbing into trees in times of flood, avoiding the low sandy levels and water-courses where ungulates are trapped.

Before re-examining the new figures (Fig. 2) of the *Hesperopithecus* tooth, may I quote verbally, with some unessential omissions, my own original characterisation of the tooth, for which I alone am responsible.

This second upper molar tooth is very distant from the gorilla type, from the gibbon type, from the orang type; among existing anthropoid apes it is nearest to m^2 of the chimpanzee, but the resemblance is still very remote. . . . Thus the proportions of the molar crown of the *Hesperopithecus* type are about the same as those in the *Homo sapiens mongoloideus* type. There is also a distant human resemblance in the molar pattern of *Hesperopithecus* . . . to the low, basin-shaped, channelled crown in certain examples of *Homo sapiens*. But the *Hesperopithecus* molar cannot be said to resemble any known type of human molar very closely. The author agrees with Mr. Cook, with Dr. Hellman, and with Dr. Gregory, that it resembles the human type more closely than it does any known anthropoid ape type;

consequently, it would be misleading to speak of this *Hesperopithecus* at present as an anthropoid ape; it is a new and independent type of Primate and we must seek more material before we can determine its relationships. It is certainly not closely related to *Pithecanthropus erectus* in the structure of the crown, for *Pithecanthropus* has a single, contracted crown in which the superior grinding surface has a limited crenulated basin, whereas *Hesperopithecus* has a widely open crown with broadly channelled or furrowed margins, and a postero-internal crest suggesting the hypocone of a higher Primate form. . . .

The type description, as published in the American Museum *Novitates*, April 25, 1922, requires little or no modification as a result of two months of intensive research which has been devoted to this tooth, detailed results of which will shortly be published by my colleague, Prof. Gregory. The accompanying new illustrations (Fig. 2), prepared especially

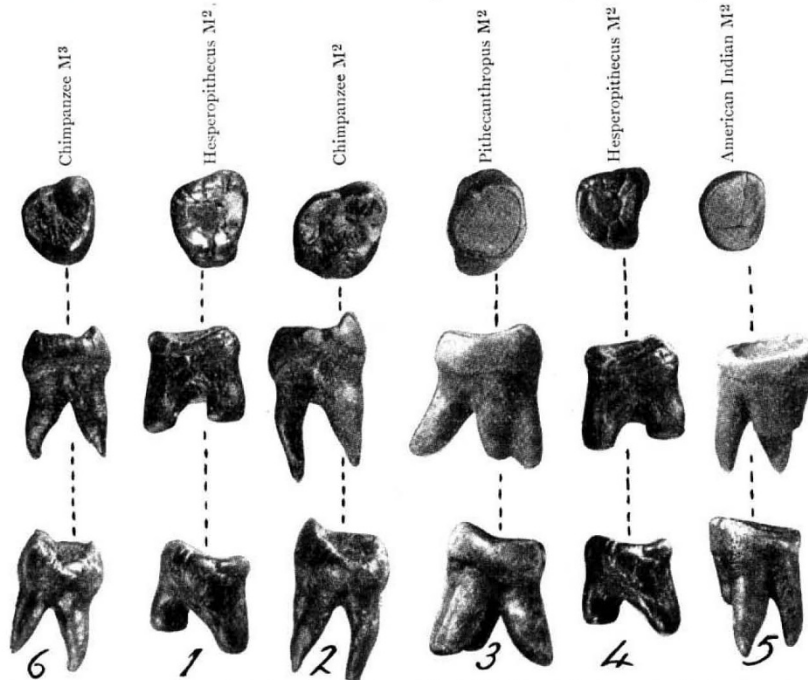


FIG. 2.—Comparison of the Second Superior Molars of the Right Side of the Upper Jaw in the Primates.

- Upper row: crown views of the superior molars.
 Middle row: anterior views of the same teeth.
 Lower row: posterior views of the same teeth.
 (1) *Hesperopithecus*, the new Nebraska Primate, middle-aged.
 (2) Anthropopithecus, a young chimpanzee.
 (3) *Pithecanthropus*, adult Trinil Ape-man.
 (4) *Hesperopithecus* (photographed in a different light).
 (5) *Homo sapiens mongoloideus*, aged North American Indian.
 (6) Third superior molar of Anthropopithecus, a young chimpanzee
 All photographed to the same scale and natural size.

beds in which *Hesperopithecus* was discovered; also (2) of the true forest-living proboscideans of the genus Mastodon recently recognised in the Snake Creek beds. A true elephant (*E. hayi*), which resembles the *Elephas planifrons* of the Upper Siwaliks of India, has been found in more recent deposits.

From these relatively new and most significant discoveries we may characterise the Snake Creek region of western Nebraska, in Middle Pliocene time, as in the belt of the south Asiatic forest, savanna, and plains fauna, which extends two-thirds of the way around the entire globe, from the region of Britain to the central-west region of the United States, and probably right across to the Atlantic coast. The plains element in this fauna is extremely abundant, especially the Hipparion; somewhat more rare are the true horses (*Pliohippus*), and still more rare are the remains of the

for NATURE, are photographs of a most convincing character, in which the *Hesperopithecus* molar (Fig. 2, 1-4), in three aspects, is placed directly between corresponding molars of a chimpanzee (right and left) which most nearly resemble it. It will be seen at once (1) that the *Hesperopithecus* molar, although greatly water-worn, has entirely different proportions from the chimpanzee molar: it is much broader transversely; it is much narrower in the fore-and-aft dimensions. This affords positive evidence that *Hesperopithecus* had a shorter facial region than the chimpanzee. In this respect it approaches the mongoloid human type (Fig. 2, 5) more closely than it does any of the anthropoid ape types; (2) the roots of the *Hesperopithecus* molar are much more robust and more human in proportion than those of any of the frugivorous apes; (3) the upper molar of *Hesperopithecus*, while resembling the upper molars of certain American Indians of mongoloid type in several absolute measurements, differs widely in the more asymmetrical form of the crown, which is broader in front and narrower behind, whereas in the mongoloid human molars the crown is more symmetrical; (4) the type upper molar of *Hesperopithecus* differs from the corresponding molar in the Trinil Ape-man (*Pithecanthropus*) (Fig. 2, 3) in nearly all its absolute measurements; but it resembles the *Pithecanthropus* molar in the great size of the internal (lingual) fang, also in the wide separation of the internal (lingual) and external (anterobuccal) fangs. It also resembles *Pithecanthropus* in the evenly concave depression of the grinding surface, which is quite unlike the ridged form of the grinding surface observed in a chimpanzee molar (Fig. 2, 2-6); (5) as for the comparison suggested by Dr. Smith Woodward with the third lower molar of the Pliocene bear (*Hyænarctos*), the differences are so fundamental that it is difficult to find any single point of agreement; the molar of *Hesperopithecus* very clearly conforms to the flattened tritubercular to quadritubercular type which characterises all the upper molars of anthropoid apes and of man.

Thus, after making due allowance for the characters resulting from the prolonged natural usage of the *Hesperopithecus* molar, also for characters due to long exposure to erosion and stream action, and to percussion by the sharp sand of the river bed, there nevertheless remain five outstanding characters, as well as many

highly significant details of character, which tend to show that this tooth belongs to one of the higher Primates, and that this genus ultimately may be included either within the Simiidae (anthropoid apes), or near certain ancestors of the Hominiidae (human stock).

I desire to summarise with emphasis my original statements about this tooth, namely, that among existing anthropoid apes it is nearest to m^2 of the chimpanzee, but the resemblance is still very remote . . . that the proportions of the molar crown of *Hesperopithecus* are about the same as in *Homo sapiens mongoloideus* (American Indian) type . . . that there is also a distant human resemblance in the molar pattern of *Hesperopithecus* to the low, basin-shaped, channelled crown in certain examples of *Homo sapiens* . . . that the *Hesperopithecus* molar cannot be said to resemble any known type of human molar very closely. It is certainly not closely related to *Pithecanthropus erectus* in the structure of the molar crown . . . it is therefore a *new and independent type of Primate, and we must seek more material before we can determine its relationships.*

My original characterisation and description have been fully confirmed by the intensive research of the past two months. I have not stated that *Hesperopithecus* was either an Ape-man or in the direct line of human ancestry, because I consider it quite possible that we may discover anthropoid apes (Simiidae) with teeth closely imitating those of man (Hominiidae), just as we have discovered in the true Piltdown man (*Eoanthropus*) teeth closely imitating those of the chimpanzee. There are so many crisscross adaptations of this kind among the mammals that we can never be sure about the family relationships of an animal until we secure not only the teeth but considerable parts of the skeleton as well. No anatomist in the possession of *Pithecanthropus* molars only would have discovered the human resemblance which is indubitably established by the roof of the cranium, by the shape of the brain, and by the shape of the thigh bone. For similar skeletal parts of *Hesperopithecus* we are making most determined and prolonged search in the type locality; it is not at all probable that the desired evidence will be easy to secure. Until we secure more of the dentition, or parts of the skull or of the skeleton, we cannot be certain whether *Hesperopithecus* is a member of the Simiidae or of the Hominiidae.

Science in Egypt.

By Col. H. G. LYONS, F.R.S.

THE important part which modern science can play in the economical development of natural resources is generally recognised to-day, but nowhere may this be seen more clearly than in Egypt, with its subtropical climate, its controlled water-supply, and its immunity from the vagaries of the weather which affect more northern latitudes. Here a population which in 1882 was under seven millions has now grown to more than twelve millions, and inhabits a cultivable area which does not exceed seven million acres all intensively cultivated; for much of the area, which was formerly flooded annually and then furnished a single crop after the river had fallen, is now under perennial cultivation with a supply of water at all

seasons, and consequently up to five crops in two years are taken from it. Under these conditions the most economical use of the material resources that science can devise, and all the improvements that it can suggest, are of the utmost importance to the country.

During Egypt's period of financial difficulty the provision for scientific work was very meagre, but with the reorganisation of the irrigation and the introduction of reforms, an improving revenue enabled gradually increasing grants to be made to state departments, and many of them have, during the past thirty years, established services in which scientific work of value and importance has been carried on.

Some scientific work had been initiated at a much