

SCIENCE

VOL. LXV

MAY 20, 1927

No. 1690

CONTENTS

<i>Recent Discoveries relating to the Origin and Antiquity of Man: DR. HENRY FAIRFIELD OSBORN.....</i>	481
<i>Nomenclatural Efficiency: DR. E. P. FELT.....</i>	489
<i>Scientific Events:</i>	
<i>Memorial Services to Charles D. Walcott; Activities of the American Museum of Natural History; Meeting of the Sigma Xi Committee and Dedication of the New Physics Laboratory at Union College; Elections of the American Academy of Arts and Sciences; The Medal Meeting of the Franklin Institute</i>	491
<i>Scientific Notes and News.....</i>	493
<i>University and Educational Notes.....</i>	498
<i>Discussion and Correspondence:</i>	
<i>Lability in Ferric Oxide Hydrosols: C. H. SORUM. "Finger Prints" of Minerals: PROFESSOR A. N. WINCHELL. Correlation of Mexican Bean Beetle Population with Original Forest Type: NEALE F. HOWARD. Confusion in Scientific Terminology: PROFESSOR R. G. HUDSON.....</i>	498
<i>Scientific Books:</i>	
<i>Dakin's Elements of General Zoology: DR. G. K. NOBLE</i>	501
<i>Scientific Apparatus and Laboratory Methods:</i>	
<i>A New Device for filing Microscope Slides: DR. J. HOWARD BROWN. A Method of handling Small Objects Previous to Sectioning: R. J. BEAN.....</i>	501
<i>Special Articles:</i>	
<i>The Chlorides of Ruthenium: PROFESSOR JAS. LEWIS HOWE. Studies in Microbial Thermogenesis: LAWRENCE H. JAMES.....</i>	503
<i>The American Association for the Advancement of Science:</i>	
<i>Spring Meeting of the Executive Committee: DR. BURTON E. LIVINGSTON.....</i>	506
<i>Science News</i>	x

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

**New York City: Grand Central Terminal.
Lancaster, Pa. Garrison, N. Y.
Annual Subscription, \$6.00. Single Copies, 15 Cts.**

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

Entered as second-class matter July 18, 1923, at the Post Office at Lancaster, Pa., under the Act of March 3, 1879.

RECENT DISCOVERIES RELATING TO THE ORIGIN AND ANTIQUITY OF MAN¹

IN the great drama of the prehistory of man converge all the many branches of science which have been cultivated and encouraged by the American Philosophical Society since its foundation two hundred years ago. In fact, we do not progress very far in this most difficult, as well as most noble, branch of biological research if we pursue pathways which are purely anthropological or purely archeological. It is such specialistic mode of attack which has led more than one generation of man into pitfalls of opinion and of theory from which there is no escape except by direct retreat. In the list of those who have been compelled to reverse engines are the names of many great anthropologists, among them the renowned Hans Virchow, the still more widely known Ernst Haeckel and, probably to your great surprise, no less a name than that of Thomas Henry Huxley. Virchow opposed the recognition of the Neanderthal skull of 1846 with pathologic and theologic preconceptions. Haeckel also eagerly espoused the Ape Ancestry hypothesis by ignoring the profound cleft between ape and man. Huxley failed disastrously in rating the Neanderthal man with recent types of man and threw Darwin completely off the track of this veritable missing link. Huxley, too, failed to visit the Foxhall quarry of Ipswich, site of the greatest discovery in modern times, namely, the fireplace and tool flint quarry of Tertiary man. Even Jupiter nods when the purely specialistic pathway is pursued.

In the triumphs of modern astronomy, four sciences converge, namely, mathematics, mechanics, physics and chemistry; but, in the triumphs of anthropology, beginning with its dawn in the mind of Blumenbach, 1796, and reaching a succession of climaxes in 1927, no less than twelve of the major and minor branches of science converge, as follows:² The astronomy of Croll (1875) and Wallace (1880); the glaciology of Geikie (1894-1914), of Penck and Brückner (1909), of Leverett (1910); the glaciology and river terraces

¹ Address before the American Philosophical Society at Philadelphia, on April 28, on the occasion of the celebration of the two hundredth anniversary of the foundation of the society.

² Osborn-Reeds: "Old and New Standards of Pleistocene Division in Relation to the Prehistory of Man in Europe," p. 413.

of Depéret (1918-1921); the paleogeography of Suess (1885), of de Lamothe (1899-1918), of Daly (1920-1926); the clay laminae of De Geer (1910-1921); the loess of Schumacher, of Merzbacher, of Obruchev, and of Soergel (1924-1927). A host of other lines of research conspire to portray the great successive phases in the environment of man.

These great stepping stones of the Age of Man, of the Quaternary, of the Glacial Period, lead to our modern and greatly extended conceptions of the antiquity of man. Whereas Charles Lyell, in his classic work, "The Antiquity of Man," postulated 400,000 years for the Quaternary Period, we have practically multiplied the Glacial Age of Agassiz by four in the demonstration that there were not one but *four* titanic glaciations during Quaternary time and have thereby reached a minimum estimate of 1,000,000 years for the Age of Man.

But to complete the human prehistoric panorama as it is now painted, we can not stop with the inorganic sciences. It is necessary to muster the whole galaxy of organic sciences—botany, including paleobotany; zoology, including paleontology; anatomy, including comparative anatomy and embryology; anthropology, including ethnology and archeology. The latest of the biological sciences to make its tribute is psychology, including comparative and physiological psychology, especially, of late (Tilney, 1926-1927), the localization of functions in the brain, and finally, the latest of the psychic cluster, known as behaviorism. It is our recent studies of behaviorism of the anthropoid apes as contrasted with the behaviorism of the progenitors of man which compel us to separate the entire ape stock very widely from the human stock.

While these twelve or more branches which bear upon anthropology have been advanced chiefly through the brilliant researches of specialists, it is our privilege and opportunity on this bicentenary occasion to gather all the reins and endeavor to present a truly philosophical series of generalizations, which may be summed up in advance under four chief captions:

(1) The antiquity of man is now to be reckoned not in thousands, but in hundreds of thousands of years, and we foresee the soon approaching period when it will be reckoned in millions of years.

(2) The Age of Man, or Pleistocene, can no longer be regarded as Act I of the prehistoric human drama, but rather as the final act, because at the very beginning of the Pleistocene we find the human race well-established and widely distributed over the earth. Act I of the Age of Man is during Tertiary time in what may be known as the "Dawn Man" stage and the "pro-human" stage.

(3) While still supported by very able anatomists

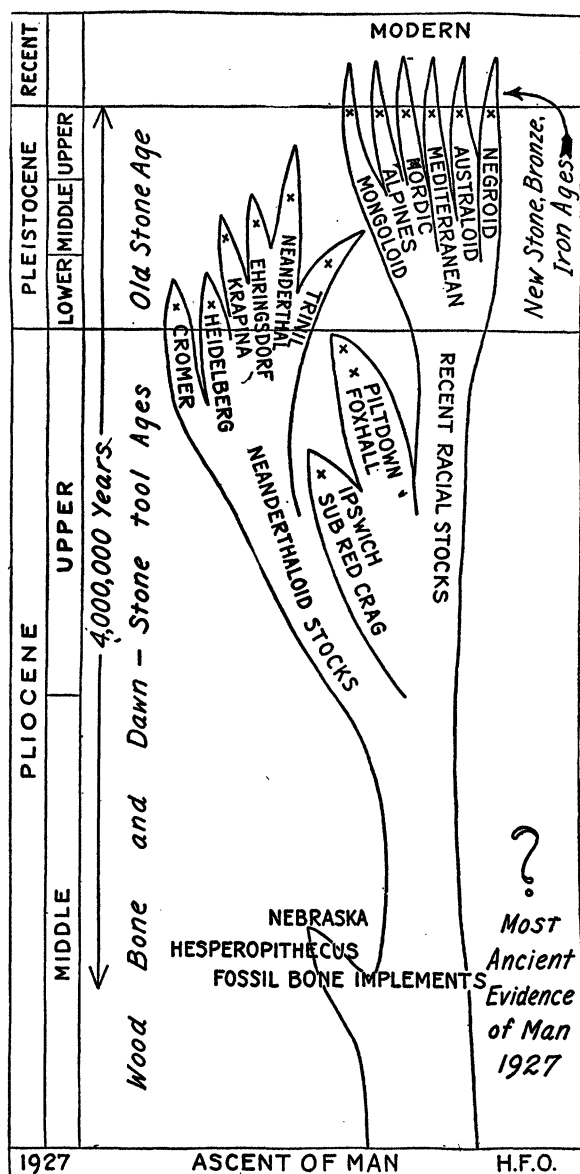


FIGURE 1. PREHISTORIC AND RECENT RACIAL STOCKS

NEANDERTHAL STOCKS (LEFT); PARTLY KNOWN PLIOCENE STOCKS (CENTER); SIX PLEISTOCENE AND RECENT RACIAL STOCKS (RIGHT). (BELOW) LEVEL OF THE SUPPOSED FOSSIL BONE IMPLEMENTS OF THE HERPEROPITHECUS QUARRIES IN NEBRASKA—POSSIBLE EVIDENCE OF MIDDLE PLIOCENE BONE-TOOL AGE IN AMERICA.

such as Gregory, the ape-human ancestry theory is, in my opinion, greatly weakened by recent evidence, and I am inclined to advocate an independent line of Dawn Man ancestors, springing from an Oligocene neutral stock, which also gave rise independently to the anthropoid apes.

(4) The Dawn Man line belongs to a distinct family, the *Hominidae*, ground-living, cursorial, alert,

capable of tool-making, and living in a relatively open country on the high plateaus and plains of Northern Asia.

(5) The Anthropoid Ape belongs to a distinct family, the *Simiidae*, tree living, brachiating, sluggish, incapable of tool making, restricted to the forests of south temperate and tropical countries.

LET US ABANDON THE APE-HUMAN THEORY

The prologue and the opening acts of the human drama occurred way back 16,000,000 years ago in the Upper Oligocene Period. At this period, or before, the family of man sprang from a stock neither human nor ape-like, but possessing certain common attributes which have been transmitted over this very long period of time to variously branching races of human beings on the one hand and to variously branching races of anthropoid apes on the other.

In this very ancient man-ape stock (*Anthropoidea*) resided the affinity which survives to-day in all blood tests, in peculiar susceptibility to or immunity from certain diseases, in resemblance of the hæmoglobin blood crystals, in the uniform division of the teeth to the number of thirty-two, in the extension of the caudal vertebrae into a tail, reversional both in man and apes, and in many psychic characteristics such as curiosity, fear, family protection and courage. It is not surprising that these and other common ape-human characteristics have survived when we see similar survivals among other animal stocks which we know parted company millions of years ago. Of all substances ever discovered, the heredity or the hereditary germ-plasm on which all these survivals depend is the most stable. The germinal stability which has preserved the earliest Cambrian organisms over a period now estimated at 500,000,000 years is also capable of preserving pro-human anatomical and physiological traits for the relatively brief 16,000,000 years which have elapsed since the close of Oligocene time.

Consequently, many of the resemblances between ape and man which have been erroneously cited as proofs of ape-man descent are due either to very remote common inheritance or to the *convergence* of the ape toward the human type. An example of such convergence to the human type is shown in the foot of the gorilla by the recent observations of Akeley, of Morton and of Gregory. I regard the ape-human theory as totally false and misleading. It should be banished from our speculations and from our literature not on sentimental grounds but on purely scientific grounds and we should now resolutely set our faces toward the discovery of our actual pro-human ancestors. In my opinion, the most likely part of the world in which to discover

these "Dawn Men," as we may now call them, is the high plateau region of Asia embraced within the great prominences of Chinese Turkestan, of Tibet and of Mongolia. The great plains area north of the high plateau should also be searched, because we have recently determined that this was probably the home of the primitive horse and, according to our theory, the home of primitive man should be looked for in the same kind of country in which the primitive horse flourished.

In abandoning the Haeckel ape theory which reached its apogee in the fantastic speculation of Klaatsch that different races of anthropoid apes gave rise directly to different races of man, we now give an entirely new frame to the human prototype to separate it sharply from the anthropoid ape type. Reconstructing our pro-human ancestors and endeavoring to assign an adequate date to the origin of the pro-human stock, we depend on the science of phylogeny, which has become in itself one of the finest products of human scientific endeavor. Phylogeny made a brave start in the sciences of comparative anatomy and embryology but it awaited paleontology to place it upon a broad and firm foundation. Most of the recent advances in anthropology have been by paleontologic means and methods.

To build up the unknown human prototype by phylogenetic means we must take advantage of the really marvelous knowledge gained from all the minor and greater steps in the ancestry of the horse, of the rhinoceros, of the tapir and of the titanotheres since these animals were first discovered in North America by the great Joseph Leidy, of Philadelphia, in 1856. Our pro-human ancestors through their behavior, their tastes, their habits, and their fondness for travel were the architects of their own destiny, as the horses and titanotheres were the unconscious architects of their destinies. Moreover, the open country best adapted to the evolution of the horse is also best adapted to the evolution of the higher races of man. We have determined that the horse did not evolve in Southern Asia or even in the southerly portions of the high plateau regions of Central Asia. To the North is a great unexplored plateau and plains region of Asia which now appears to have been the center of the origin of the family of horses and possibly may have been the center of the origin of the family of man. Certainly, the family of man could not have originated in a densely forested country rich in natural food materials. Man's nomadic wandering instinct, which even in Upper Pliocene time impelled his migrations, is not a forest characteristic but a characteristic of the open country. Almost without exception, precocious human civilizations have been found in open country partly deformed

ested either by secular desiccation or by the severity of the northern steppe climates. Practically the same environmental conditions have favored the precocious development of the finer races of horses.

Secondly, when we at last discover one of our pro-human ancestors in Miocene or even in Oligocene time, the human characteristics will be found plainly stamped on this ancestor, as the horse characteristics are plainly stamped on the *Plihippus*, on the *Protohippus*, on the *Mesohippus* and even on the *Eohippus*. It was my observation of the full-bred horse of Middle Pliocene time, known as *Plihippus leidyani*, which led me to predict to the National Academy of Sciences the discovery of a full-brained pro-man also in Pliocene time; this prediction preceded the recent demonstration that *Eoanthropus dawsoni* of Piltdown is probably of Pliocene age.

This distinctive pro-human stamp will be seen chiefly in certain outstanding characteristics of habit and of structure which were acquired millions of years ago. In contrast with the Simian and pro-Simian stamp, we may clearly present the chief characteristics in two columns:

HOMINIDÆ (Family of Man)	SIMIDÆ (Family of Apes)
<i>Pro-human characteristics</i>	<i>Pro-ape characteristics</i>
(1) Progressive intelligence, rapid development of the fore-brain	(1) Arrested intelligence and brain size
(2) Ground-living bipedal habit — cursorial, adapted to rapid travel and migration over open country	(2) Arboreal to hyper-arboreal quadrumanal habit—living chiefly in trees
(3) Bipedal habit and development of the walking and running type of foot and big toe	(3) Quadrupedal habit when on the ground
(4) Shortening arms and lengthening legs	(4) Lengthening arms and diminishing legs
(5) Development of the tool-making thumb	(5) Loss of the thumb and absence of tool-making power
(6) Walking and running power of the foot enhanced by enlargement of the big toe	(6) Grasping power of the big toe for climbing purposes, modified when walking

In the remarkable discoveries and studies of Boule, of Dubois, and of McGregor on the fossilized limb bones of man and in the complementary studies of Schultz in the embryogeny of man, the ape-arboreal-reminiscent hypothesis has not been strengthened; it has, on the contrary, been greatly weakened. The thigh-bone of the Neanderthaloid types resembles that

of a man rather than that of an ape; it reveals the erect bipedal, rather than the stooping quadrupedal position. The arms of the Neanderthals are not elongated as they should be according to the ape ancestry hypothesis; they are rather short. The legs of the Neanderthals and of the Trinils are not abbreviated as they should be for the ape ancestry hypothesis; they are decidedly long. Similarly, a superb series of embryonic hands and feet of unborn infants assembled by Schultz do not reveal reminiscences of the attenuated ancestral fingers of an ape-arboreal stage, resembling those of gibbons, chimpanzees, or even of gorillas, but they are short and blunt like modern human hands. The embryonic thumb, similarly, is well developed and reveals no symptoms of recovery from the abbreviated or useless thumb characteristic of all arboreal or branchiating types of primates. Still more, the embryonic big toe, while slightly set apart from the other toes, shows little vestige of former limb-grasping such as is seen in the foot of the anthropoid apes, which is so hand-like as to give the bearer the title *quadrumanus*, or four-handed. The human embryonic big toe is set apart like the toes of *Eocene* lemuroids such as the *Notharctus* of Leidy and Gregory.

Comparative and human psychology also weaken rather than strengthen the ape-man hypothesis. The geologic rearrangement of the Piltdown, the Trinil and the Heidelberg races which we owe to recent geologic discovery renders both the Heidelberg and the Piltdown races far more ancient than we had supposed. All the present evidence points to closing Pliocene age for the Piltdown Dawn Man, appropriately named *Eoanthropus* by Smith Woodward. This Dawn Man has a flat vertical forehead like the modern Bushman, a very thick skull, a chimpanzee-like jaw, and a surprising brain capacity of 1,070 cubic centimeters. This brain cube exceeds that of the existing Indian Veddah tribes. As analyzed by Elliot Smith and by Tilney, this Dawn Man has a well convoluted forebrain, speech areas and diversified motor areas for the coordinated motions of the fore limbs, of the hands and of the fingers.

LARGE TERTIARY BRAIN CAPACITY

The Heidelberg race, now recognized as of Lower Pleistocene, is probably a giant pro-Neanderthal, characterized by projecting eyebrows and by a brain which would probably prove to be somewhat inferior in capacity to the more recent Neanderthals. We consequently reach an entirely new estimate of the brain capacity of the human race at the close of Pliocene time and the beginning of Pleistocene time, a period estimated at between 1,250,000 to 1,000,000 years before our era.

BRAIN CUBE OF THE NEANDERTHAL AND TRINIL RACES

	Male	Female
Neanderthal Caveman of Western Europe:		
La Chapelle aux Saints	1530	.....
La Quina, France	1367	.....
Gibraltar, Spain	1250-1300	.....
Trinil Man of Java (<i>Pithecanthropus erectus</i>)	940	.....
Piltdown Man of Sussex, England.....	1070	.....
Native Indian Veddahs	1000	1040

The Trinil man of Java, *Pithecanthropus erectus* of Dubois, was formerly regarded as of Upper Pliocene, but now it is assigned by Dietrich and Osborn to a more recent geologic age, namely, Middle Pleistocene, since its fossil remains are found associated with stegodontine elephants much more recent in character than those of the Upper Pliocene, such as *Stegodon insignis ganesa*. Meanwhile, the brain of the Trinil man has been shown by Tilney to be distinctly pro-human, with a fairly well-developed forebrain or intelligence area. Consequently, we may now regard *Pithecanthropus erectus* as a very primitive type, a case of arrested development, possibly related to the Neanderthal stock, surviving in the southern subtropical forests of Asia, with a brain capacity of 940 cc.—not far inferior to that of the native Indian Veddahs with a brain capacity of 1,000 cc.

It required a very long antecedent period to develop the Dawn Man brain capacity and Dawn Man intelligence as demonstrated, in the case of the Piltdown and probably contemporaneous Foxhall races, in the manufacture of many different kinds of small flint implements and in the use of fire. In the case of the Heidelberg race, we observe the manufacture of very large and varied flint implements, such as are found at Cromer on the eastern coast of England and which are believed to be of the same geologic age as the Heidelberg jaw.

Flint tools were, however, by no means the first tools employed by man; they were almost certainly preceded by bone tools of great variety, and bone tools were in turn preceded by wooden tools. Not improbably there was a very long 'age of wood,' then a very long 'age of wood and bone,' followed by a very long 'age of flint' preceding the metal ages. During this enormously long period, which we must now reckon in millions of years, tool-designing and tool-making, the adaptation of tools to certain purposes and needs of life, the use of these tools in offense and defense, in the chase, and in the preparation of food and of clothing laid the foundations of the intelligence of mankind.

HOMINIDÆ (Family of Man)

Pro-human psychology and behavior

(1) Tool-making capacity of the hands and especially of the thumb

(2) Adaptation and design of implements of many kinds in wood, bone and stone

(3) Design and invention directed by an intelligent forebrain

(4) Use of the arms and tools in offense, defense and all the arts of life

(5) Use of the legs for walking, running, travel and escape from enemies

(6) Escape from enemies by vigilance, flight and concealment

(7) Tree-climbing by embracing the main trunk with the arms and limbs after the manner of the bear

SIMIIDÆ (Family of Apes)

Pro-ape psychology and behavior

(1) Limb-grasping capacity of the hands and loss of the thumb

(2) Adaptation of the fore and hind limbs to the art of tree climbing and brachiating

(3) Design limited to the construction of very primitive tree nests

(4) Use of the arms chiefly for tree-climbing purposes; secondarily for the prehension of food and grasping of the foe

(5) Use of legs in tree-climbing and limb-grasping

(6) Escape from enemies by retreat through branches of trees

(7) Tree-climbing always along branches, never by embracing the main limbs and trunk

The above are only a fraction of the host of psychic contrasts which might be drawn between the daily behavior of the Dawn Man and the daily behavior of the pro-anthropoid ape. As I have elsewhere summed it up, in the life and conduct of the pro-ape was the potency of the super-apes living to-day—the orang, chimpanzee, gorilla and gibbon—but in the Dawn Man was the potency of modern civilization. The most welcome gift from anthropology to humanity will be the banishment of the myth and bogie of ape-man ancestry and the substitution of a long line of ancestors of our own at the dividing point which separates the terrestrial from the arboreal lines of primates.

It is true that Darwin used the expression, "Man is derived from some member of the Simiidae," and that the term "ape-man" is deeply engraved in our consciousness, but I claim that it is misleading. The gorilla, chimpanzee and gibbon give us our conception of the ape. I hold that very few of the ape characters were possessed by man in his early stages; they are all characters belonging to an extremely ancient arboreal stage perhaps as ancient as Eocene time. Comparative anatomists find likenesses between apes and man

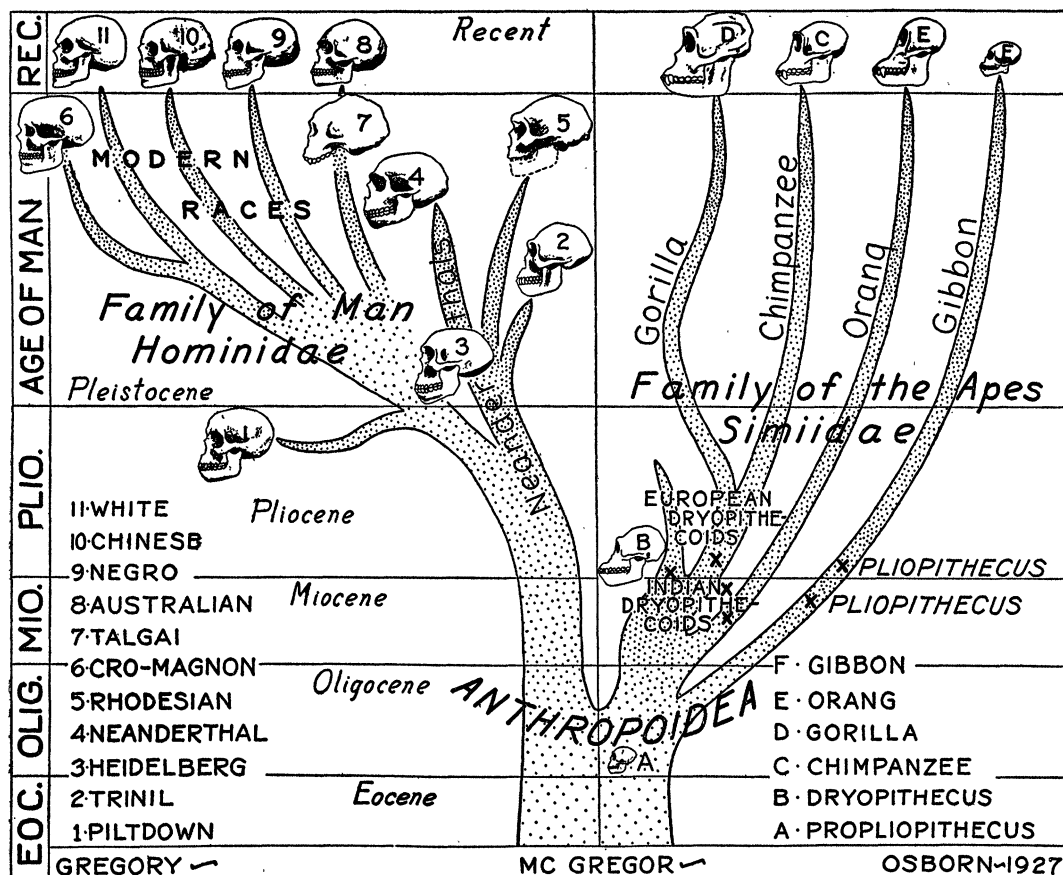


FIGURE 2. RECENT EVIDENCE AS TO THE ASCENT OR PHYLOGENY OF MAN

(LEFT) FAMILY OF MAN, *Hominidae*, DIVIDING INTO THE NEANDERTHALOID (RIGHT) AND MODERN RACIAL (LEFT) STOCKS. PRESENT GEOLOGIC LOCATION OF THE PILTDOWN, HEIDELBERG, TRINIL, NEANDERTHAL AND RHODESIAN FOSSIL RACES (LEFT). (RIGHT) FAMILY OF THE APES, *Simiidae*, INCLUDING THE PLIOCENE AND MIOCENE DRYOPITHECIDS NEAREST THE ANCESTRAL STOCK OF THE *Anthropoidea*; ALSO THE LINES LEADING TO THE GORILLA, ORANG, CHIMPANZEE AND GIBBON. *Anthropoidea*—THE COMMON OLIGOCENE ANCESTORS OF THE *Hominidae* (LEFT) AND OF THE *Simiidae* (RIGHT).

by blood tests, osteology and morphology; these characters are strikingly pro-human, and anatomists have dwelt on them to the exclusion of others not human. Between man and the ape—not only the hands and feet of the ape, but the ape as a whole, including its psychology—you will find more differences than resemblances. In brief, man has a bipedal, dexterous, wide-roaming psychology; the ape has a quadrupedal, brachiating, tree-living psychology.

The term "ape-man" has been forced into our language along a number of lines, and even the term "anthropoid" has come to lose its significance. "Ape-man" has gained prestige through early explorers and travelers who represented the anthropoid apes as walking on their hind feet. We have since discovered that no anthropoid ape walks upright; the gibbon balances himself awkwardly when he comes down from the trees, but all the other apes are practically quadrupedal in motion, except possibly in defense, when

they rear as a horse would rear. We may therefore eliminate the early descriptions in forming our notions of the anthropoids. A parallel to the misuse of the word "ape-man" would be this: the horse, ass and zebra are so closely related that unless one examines very carefully one can not tell the skeletons apart; they agree more closely than do the anthropoid apes and man. But when we study the habits of the horse, the ass and the zebra we find that each has a totally different psychology: the horse has a forest psychology, the ass has a desert psychology, the zebra has an open-plains psychology. The horse is a splendid swimmer, whereas the mule—a cross between the horse and the ass—has the ass psychology and is afraid of water. It is no more proper to speak of the common ancestor of the apes and of man as "ape-man" than it is to call the common ancestor of the horse and the ass an "ass-horse." Another instance of wide psychic difference between like animals is

that of the black and the white rhinoceros of Africa, which have a very dissimilar psychology and react differently in every emergency.

EMPIRE OF THE LOW-BROWED NEANDERTHAL RACES

We may class together as Neanderthaloid all the prehistoric races with prominently projecting supra-orbital processes; with low, retreating foreheads; with correspondingly low, broad type of brain, especially with low forebrain in contrast with the relatively high forebrain of the Piltdown and of modern races; with massive jaw and retreating chin of the Heidelberg and true Neanderthal type. The increasing brain power of these Neanderthaloids during Pleistocene time is perhaps measured by contrast between the Trinil brain of 940 cubic centimeters and the most highly developed Neanderthal brain of 1,530 cubic centimeters. The psychology of this race is further revealed by the prevailing type of flint implement, of offense and defense, of the chase and in the preparation of food. The first of these great Neanderthal flint types is found in the Cromer deposits in East Anglia—tremendous flint implements used largely in combat. Over an enormously prolonged period these implements passed through Cromerian, pre-Chellean, Chellean, Acheulean and, finally, Mousterian stages, wherein they begin to show decadence and loss of virility, together with invasion of other types of implements.

The great Neanderthaloid race, with its characteristic stone culture, apparently dominated North Africa and all of Europe and extended eastward into the heart of Asia. Its quarries and camping grounds increase in number as Pleistocene time goes on, and an eastward to southward spread may be represented in the recent discoveries of Mousterian camping sites in Ordos, China, and of a Neanderthaloid skull, which has been named the Rhodesian skull, at Broken Hill Mine, South Africa. The animal life contemporaneous with this race is well known; it included a large variety of elephants, chiefly of the southern and straight-tusked types, rhinoceroses and, in the lower lands, hippopotami. This is known as a South Temperate fauna adapted to rather fertile lands, river bottoms and abundant forests. In such an environment game was so plentiful that there was relatively little struggle for existence, hence there was little incentive to the development of a diversified flint industry. Superior intelligence was not demanded and it is therefore surprising that under these circumstances the Neanderthal brain attained the dimensions which threw even the genius of Huxley off the track as to the very primitive character of this race. Taken altogether, the widely extending range of the Neanderthaloid races is one of the most firmly established facts of

prehistory. If our geologic time scale is reliable, it extended over a period of 900,000 years, and if our present records of quarry grounds and implements are reliable, the Neanderthals had almost exclusive possession of an enormous territory.

THEORY OF THE NORTH EURASIATIC ORIGIN OF THE HIGH-BROWED RACES

It was formerly believed by certain anthropologists that the Neanderthals were the progenitors of the succeeding higher races, but in my opinion we may entirely abandon this theory and substitute a theory of the complete replacement of the Neanderthal empire by invading races that had acquired superior intelligence under entirely different conditions of life. In other words, while the Neanderthals were enjoying exclusive possession of Central Europe, Asia and a large part of Northern Africa and were spreading southward into Rhodesia, the progenitors of all the modern races were occupying another great area, under conditions of life in which the struggle for existence was much more severe and in which there were far greater demands upon the native wit of man to overcome natural difficulties by invention and resourcefulness.

This unexplored territory, the unknown homeland of the higher races of man, can not be south of the Neanderthal Eurasiatic belt, because to the south conditions of life were less rigorous, food was more easily obtained, and the milder sub-tropical climate was less stimulating to discovery and invention. In this southern, less stimulating region of Eurasia may have survived the persistent Trinil race of Java and other primitive races still undiscovered. To the south, in Africa, may also have developed Negroid stock under Central African conditions of life that must closely parallel those of Central and Southern Eurasia during the great Neanderthal period.

Consequently, it is to the northern regions of Eurasia that we must look for the unknown homeland of the higher races, to a temperate and north temperate region which extended along the northern borders of the Neanderthal empire over the high central plateau region of Asia, over the great plains region to the north of the central plateau and, finally, over the confines of eastern Europe. It may be laid down as a fixed principle in the rise of the intelligence of man that only when the struggle for existence is fairly keen does any race progress; when the struggle for existence is too severe the entire life is devoted to physical support, to the exclusion of intellectual and social progress.

The new modern races, pure and blended—Mediterranean long-heads, Alpine broad-heads, blended Cro-Magnons, Nordics—apparently moved eastward

over this northerly plateau and plains region and finally subdued the entire Central Eurasiatic empire of the Neanderthals. These new races were not only distinguished by large brains and by equal powers of observation, of reasoning, of design, of tool-making, and of social, moral and political organization, but were also endowed with higher intellectual, spiritual and creative faculties which gave them both physical and intellectual supremacy over the Neanderthals and led to their entire occupation of western Europe. First, to measure their capacity purely by the cube of their brain, let us place these nearly arrived races in order of brain power with the existing races, high and low:

	Cube of Brain Capacity		
	Male	Female	Maximum
<i>Cro-Magnon Caveman of Mentone</i>	1550	.....	1590
Average modern European.....	1450	1300	.....
Average modern Swiss.....	1200	1230	1660
<i>Upper Palaeolithic broad-head race of Ofnet</i>	1400	.....	.....
Living broad-head race of Czechoslovakia	1230	1000	1800
Native Australian race.....	1310	1154	.....
Native Indian Vedda's.....	1000	1040	1400
Papuans of New Guinea.....	1236	1125	.....

The Cro-Magnons, who have been termed the Palaeolithic Greeks, rank extremely high in their cubic brain capacity; they entered Europe side by side with the pure long-headed and broad-headed races, also of high brain power, and are now considered to represent a blend between long-heads and broad-heads. Imagine the enormously long period of time during which this very high modern brain power developed and consider through the astonishing industry and diversified art of these people that every faculty has its cerebral equivalent and ancestry for each of its several coefficients. The extreme accuracy of observation of animal form displayed by the Cro-Magnons is not the result of hundreds of years, but of hundreds of thousands of years.

It is possible that the Piltdown race of Upper Pliocene time with its 1,070 ccm. brain cube is an offshoot of the precociously large-brained stock that gave rise to the group of modern races—Australoid, Negroid, Mongoloid, Caucasian. Yet the Piltdown race has a chimpanzee or anthropoid ape type of jaw. It seems a very hazardous prediction, but I am inclined to anticipate the discovery, even in Pliocene time, of a modernized type of jaw with prominent chin. This is against all existing evidence, with the exception of the dubious Foxhall jaw with its prominent chin, for all the known Pliocene and early Pleistocene races

have a sloping chin or less remotely resemble the anthropoid ape type.

CONCLUSION

Let us therefore conclude with consideration of the ancestry of man according to the modified concept of "dawn men," not "ape-men." In the first place, over an incredibly long period of time the Dawn Men have been tool-makers, of high adaptability and wonderful technique. We have then a biped, a being with a hand capable of grasping and controlling tools, a tool-maker with as fine a sense of touch as that of any of the present-day etchers, engravers and artists. In my opinion, the pro-man psychology, leaving out the evidence of anatomy and morphology, is certainly that of a Dawn Man and not of an "ape-man." I agree with my colleagues that man passed through an arboreal stage, but I believe that this stage did not progress so far as to carry man into a stage approaching that of the anthropoid apes. Dollo has stated the law of the irreversibility of evolution. The brachiating hand of the ape was used as a hook—apes do not grasp a branch with the fingers and thumb but hook the whole hand over the branch, as trapeze workers do to-day—and the thumb was therefore a grave danger. If man had gone through a prolonged period of brachiating in the branches of trees he would have lost his thumb. I agree to putting our arboreal ancestors back to Eocene time, but I predict that even in Upper Oligocene time we shall find pro-men, and if we find Oligocene pro-man—in Mongolia, for example—that he will have pro-human limbs, not pro-anthropoid ape limbs.

Of all incomprehensible things in the universe man stands in the front rank, and of all incomprehensible things in man the supreme difficulty centers in the human brain, intelligence, memory, aspirations, and powers of discovery, research and the conquest of obstacles. The approach to this unknown field of future human advance—the seat of the human mind and the constitution of the human mind—is along the great paths of human and comparative anatomy and of human and comparative psychology and behavior. Yet this approach will yield only a tentative conclusion; the final solution of this problem of problems—the rise of man—will come only through unremitting exploration and the chance finding somewhere in the Eurasiatic continent of actual fossil remains of the Oligocene pro-man, of the Miocene and Pliocene Dawn Man and, finally, of the early Pleistocene ancestors of the large-brained modern races.

HENRY FAIRFIELD OSBORN

AMERICAN MUSEUM OF NATURAL HISTORY