

V

THE ASCENT OF MAN

§ I

NO one thinks less of Sir Isaac Newton because he was born as a very puny infant, and no one should think less of the human race because it sprang from a stock of arboreal mammals. There is no doubt as to man's apartness from the rest of creation when he is seen at his best—"a little lower than the angels, crowned with glory and honour." "What a piece of work is a man! How noble in reason! How infinite in faculty! in form and moving how express and admirable! in action how like an angel! in apprehension so like a God." Nevertheless, all the facts point to his affiliation to the stock to which monkeys and apes also belong. Not, indeed, that man is descended from any living ape or monkey; it is rather that he and they have sprung from a common ancestry—are branches of the same stem. This conclusion is so momentous that the reasons for accepting it must be carefully considered. They were expounded with masterly skill in Darwin's *Descent of Man* in 1871—a book which was but an expansion of a chapter in *The Origin of Species* (1859).

The anatomical structure of man is closely similar to that of the anthropoid apes—the gorilla, the orang, the chimpanzee, and the gibbon. Bone

Anatomical Proof of Man's Relationship with a Simian Stock.

for bone, muscle for muscle, blood-vessel for blood-vessel, nerve for nerve, man and ape agree. As the conservative anatomist, Sir Richard Owen, said, there is between them "an all-pervading similitude of structure." Differences, of course, there are, but they are not momentous except man's big brain, which may be three times as heavy as that of a gorilla. The average human brain weighs about 48 ounces; the gorilla brain does not exceed 20 ounces at its best. The capacity of the human skull is never less than 55 cubic inches; in the orang and the chimpanzee the figures are 26 and 27½ respectively. We are not suggesting that the most distinctive features of man are such as can be measured and weighed, but it is

important to notice that the main seat of his mental powers is physically far ahead of that of the highest of the anthropoid apes.

Man alone is thoroughly erect after his infancy is past; his head weighted with the heavy brain does not droop forward as the ape's does; with his erect attitude there is perhaps to be associated his more highly developed vocal organs. Compared with an anthropoid ape, man has a bigger and more upright forehead, a less protrusive face region, smaller cheek-bones and eyebrow ridges, and more uniform teeth. He is almost

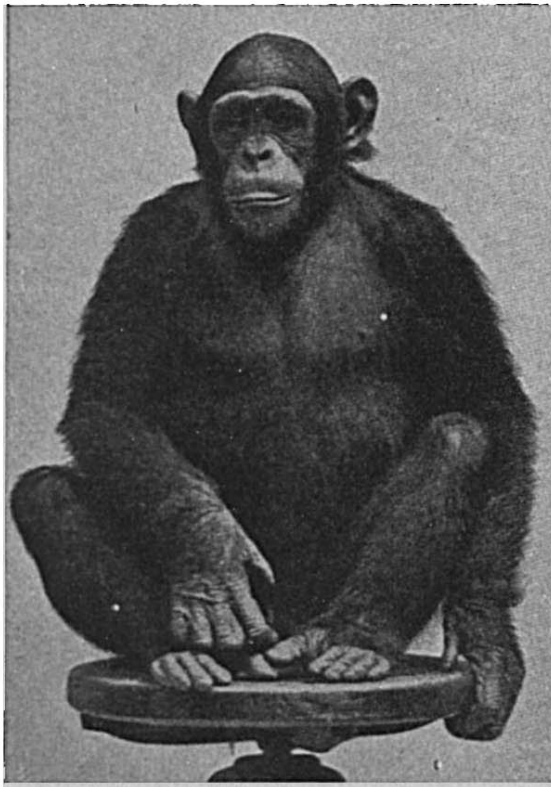


Photo: New York Zoological Park.

CHIMPANZEE, SITTING.

The head shows certain facial characteristics, e.g. the beetling eyebrow ridges, which were marked in the Neanderthal race of men. Note the shortening of the thumb and the enlargement of the big toe.

unique in having a chin. Man plants the sole of his foot flat on the ground, his big toe is usually in a line with the other toes, and he has a better heel than any monkey has. The change in the shape of the head is to be thought of in connection with the enlargement of the brain, and also in connection with the natural reduction of the muzzle region when the hand was freed from being an organ of support and became suited for grasping the food and conveying it to the mouth.

Everyone is familiar in man's clothing with traces of the past persisting in the present, though their use has long since disappeared. There are buttons on the back of the waist of the morning coat to which the tails of the coat used to be fastened up, and there are buttons, occasionally with buttonholes, at the wrist which were once useful in turning up the sleeve. The same is true of man's body, which is a veritable museum of relics. Some anatomists have made out a list of over a hundred of these *vestigial* structures, and though this number is perhaps too high, there is no doubt that the list is long. In the inner upper corner of the eye there is a minute tag—but larger in some races than in others—which is the last dwindling relic of the third eyelid, used in cleaning the front of the eye, which most mammals possess in a large and well-developed form. It can be easily seen, for instance, in ox and rabbit. In man and in monkeys it has become a useless vestige, and the dwindling must be associated with the fact that the upper eyelid is much more mobile in man and monkeys than in the other mammals. The vestigial third eyelid in man is enough of itself to prove his relationship with the mammals, but it is only one example out of many. Some of these are discussed in the article dealing with the human body, but we may mention the vestigial muscles going to the ear-trumpet, man's dwindling counterpart of the skin-twitching muscle which we see a horse use when he jerks a fly off his flanks, and the short tail which in the seven-weeks-old human embryo is actually longer than the leg. Without committing ourselves to a belief in the entire

uselessness of the vermiform appendix, which grows out as a blind alley at the junction of the small intestine with the large, we are safe in saying that it is a dwindling structure—the remains of a blind gut which must have been capacious and useful in ancestral forms. In

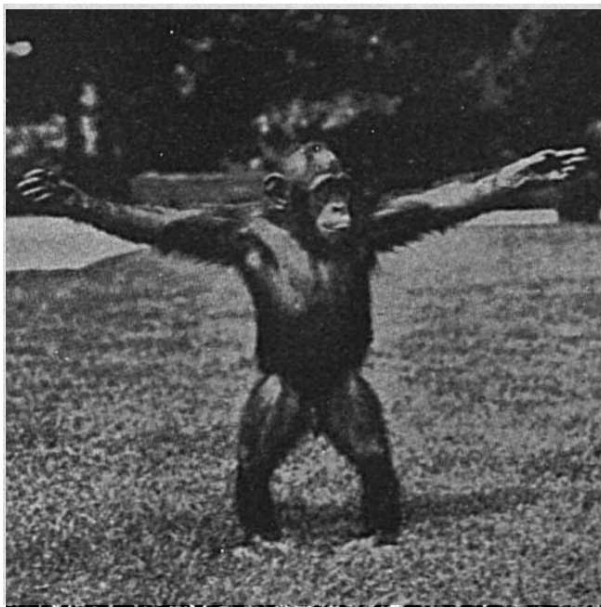


Photo: New York Zoological Park.

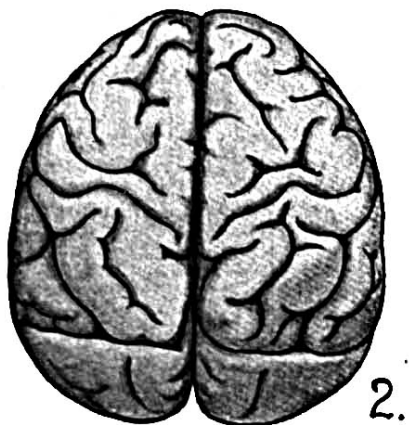
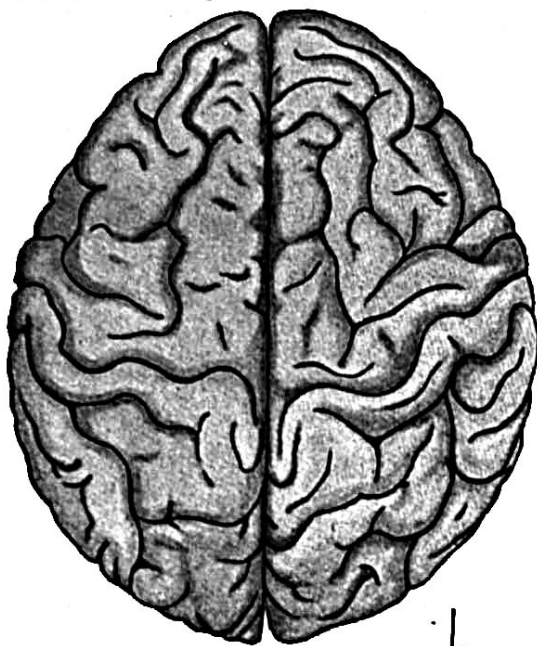
CHIMPANZEE, ILLUSTRATING WALKING POWERS.

Note the great length of the arms and the relative shortness of the legs.

some mammals, like the rabbit, the blind gut is the bulkiest structure in the body, and bears the vermiform appendix at its far end. In man the appendix alone is left, and it tells its tale. It is interesting to notice that it is usually longer in the orang than in man, and that it is very variable, as dwindling structures tend to be. One of the unpleasant expressions of this variability is the liability to go wrong: hence appendicitis. Now these vestigial structures are, as Darwin said, like the unsounded, i.e. functionless, letters in words, such as the *o* in "leopard," the *b* in "doubt," the *g* in "reign." They are of no use, but they tell us something of the history of the words. So do man's vestigial structures reveal his pedigree. They must have an historical or evolutionary significance. No other interpretation is possible.

Some men, oftener than women, show on the returned margin of the ear-trumpet or pinna, a little conical projection of great interest. It is

a vestige of the tip of the pointed ear of lower mammals, and it is well named *Darwin's point*. It was he who described it as a "surviving symbol of the stirring times and dangerous days of man's animal youth."



SURFACE-VIEW OF THE BRAINS OF MAN (1) AND CHIMPANZEE (2).

The human brain is much larger and heavier, more dome-like, and with much more numerous and complicated convolutions.

§ 2

The everyday functions of the human body are practically the same as those of the anthropoid ape, and similar disorders are common to both. Monkeys may be infected with certain microbes to which man is peculiarly

liable, such as the bacillus of tuberculosis. Darwin showed that various human gestures

Physiological Proof of Man's Relationship with a Simian Stock.

and facial expressions have their counterparts in monkeys. The sneering curl of the upper lip, which tends to expose the canine tooth, is a case in point, though it may be seen in many other mammals besides monkeys—in dogs, for instance, which are at some considerable distance from the simian branch to which man's ancestors belonged.

When human blood is transfused into a dog or even a monkey, it behaves in a hostile way to the other blood, bringing about a destruction of the red blood corpuscles. But when it is transfused into a chimpanzee there is an harmonious mingling of the two. This is a very literal demonstration of man's blood-relationship with the higher apes. But there is a finer form of the same experiment. When the blood-fluid (or serum) of a rabbit, which has had human blood injected into it, is mingled with human blood, it forms a cloudy precipitate. It forms almost as marked a precipitate when it is mingled with the blood of an anthropoid ape. But when it is mingled with the blood of an American monkey there is only a slight clouding after a considerable time and no actual precipitate. When it is added to the blood of one of the distantly related "half-monkeys" or lemurs there is no reaction or only a very weak one. With the blood of mammals off the simian line altogether there is no reaction at all. Thus, as a distinguished anthropologist, Professor Schwalbe, has said: "We have in this not only a proof of the literal blood-relationship between man and apes, but the degree of relationship with the different main groups of apes can be determined beyond possibility of mistake." We can imagine how this modern line of experiment would have delighted Darwin.

In his individual development, man does in some measure climb up his own genealogical tree. Stages in the development of the body during its nine months of ante-natal life are closely similar to stages in the development of the anthropoid embryo. Babies born in times of famine or siege are sometimes, as it were, imperfectly finished, and

Embryological Proof of Man's Relationship with a Simian Stock.

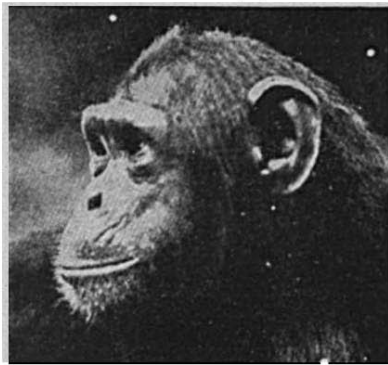
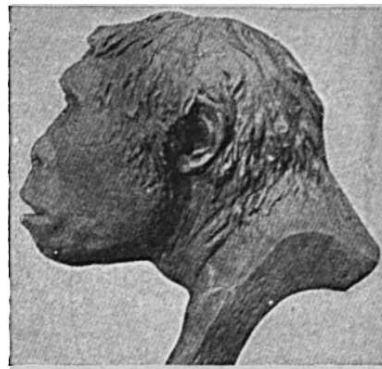


Photo: New York Zoological Park.
SIDE-VIEW OF CHIMPANZEE'S HEAD.
(Compare with opposite picture.)



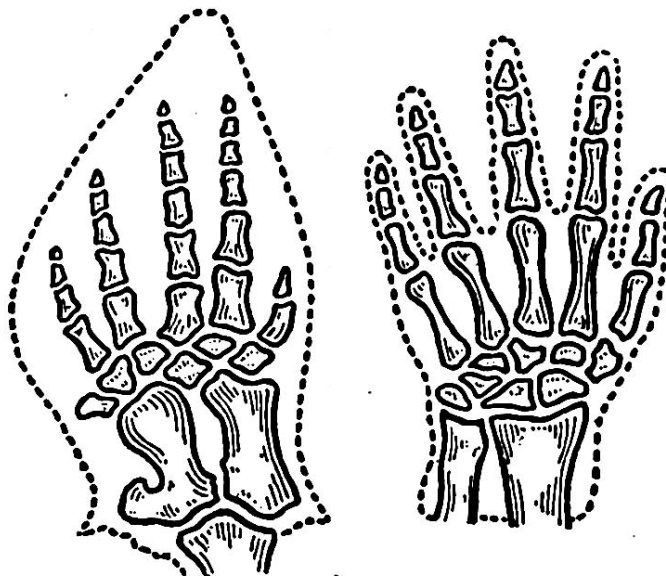
After a model by J. H. McGregor.
PROFILE VIEW OF HEAD OF PITHE-
CANTHROPUS, THE JAVA APE MAN, RE-
CONSTRUCTED FROM THE SKULL-CAP.

sometimes have what may be described as monkeyish features and ways. A visit to an institution for the care of children who show arrested, defective, or disturbed development leaves one sadly impressed with the risk of slipping down the rungs of the steep ladder of evolution; and even in adults the occurrence of serious nervous disturbance, such as "shell-shock," is sometimes marked by relapses to animal ways. It is a familiar fact that a normal baby reveals the past in its surprising power of grip, and the careful experiments of Dr. Louis Robinson showed that an infant three weeks old could support its own weight for over two minutes, holding on to a horizontal bar. "In many cases no sign of distress is evinced and no cry uttered, until the grasp begins to give way." This persistent grasp probably points back to the time when the baby had to cling to its arboreal mother. The human tail is represented in the adult by a fusion of four or five

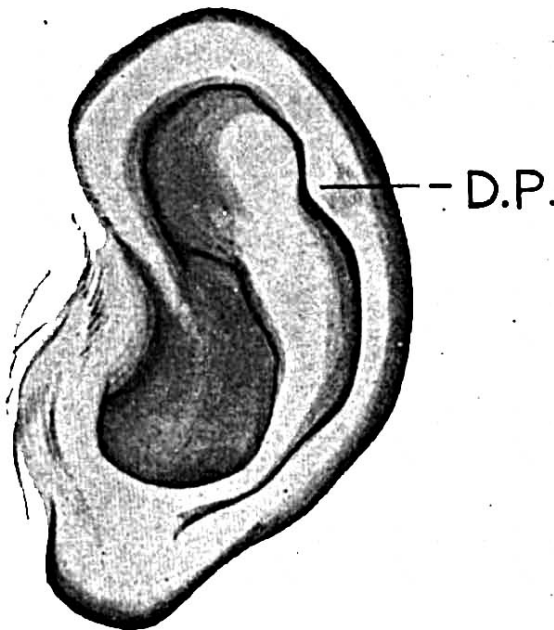
vertebræ forming the "coccyx" at the end of the backbone, and is normally concealed beneath the flesh, but in the embryo the tail projects freely and is movable. Up to the sixth month of the ante-natal sleep the body is covered, all but the palms and soles, with longish hair (the lanugo), which usually disappears before birth. This is a stage in the normal development, which is reasonably interpreted as a recapitulation of a stage in the racial evolution. We draw this inference when we find that the unborn offspring of an almost hairless whale has an abundant representation of hairs; we must draw a similar inference in

the case of man.

It must be noticed that there are two serious errors in the careless statement often made that man in his development is at one time like a little fish, at a later stage like a little reptile, at a later stage like a little primitive mammal, and eventually like a little monkey. The first error here is that the comparison should be



THE FLIPPER OF A WHALE AND THE HAND OF A MAN.
In the bones and in their arrangement there is a close resemblance in the two cases, yet the outcome is very different. The multiplication of finger joints in the whale is a striking feature.



"DARWIN'S POINT" ON HUMAN EAR (MARKED D.P.).

It corresponds to the tip (T) of the ear of an ordinary mammal, as shown in the hare's ear below. In the young orang the part corresponding to Darwin's point is still at the tip of the ear.

made with *embryo-fish*, *embryo-reptile*, *embryo-mammal*, and so on. It is in the making of the embryos that the great resemblance lies. When the human embryo shows the laying down of the essential vertebrate characters, such as brain and spinal cord, then it is closely comparable to the embryo of a lower vertebrate at a similar stage. When, at a subsequent stage, its heart, for instance, is about to become a four-chambered mammalian heart, it is closely comparable to the heart of, let us say, a turtle, which never becomes more than three-chambered. The point is that in the making of the organs of the body, say brain and kidneys, the embryo of man pursues a path closely corresponding to the path followed by the embryos of other backboned animals lower in the scale, but at successive stages it parts company with these, with the lowest first and so on in succession. A human embryo is never like a little reptile, but the developing organs pass through stages which very closely resemble the corresponding stages in lower types which are in a general way ancestral.

The second error is that every kind of animal, man included, has from the first a certain individuality, with peculiar characteristics which are all its own. This is expressed by the somewhat difficult word *specificity*, which just means that every species is itself and no other. So in the development of the human embryo, while there are close resemblances to the embryos of apes, monkeys, other mammals, and even, at earlier stages still, to the embryos of reptile and fish, it has to be admitted that we are dealing from first to last with a human embryo with peculiarities of its own.

Every human being begins his or her life as a single cell—a fertilised egg-cell, a treasure-house of all the ages. For in this living microcosm, only a small fraction ($\frac{1}{1000}$) of an inch in diameter, there is condensed—who can imagine how?—all the natural inheritance of man, all the legacy of his parentage, of his ancestry, of his long pre-human pedigree. Darwin called the pinhead brain of the ant the most marvellous atom of matter in the world, but the human ovum is more marvellous still. It has more possibilities in it than any other thing, yet without fertilisation it will die. The fertilised ovum divides and redivides; there results a ball

of cells and a sack of cells; gradually division of labour becomes the rule; there is a laying down of nervous system and food-canal, muscular system and skeleton, and so proceeds what is learnedly called differentiation. Out of the apparently simple there emerges the obviously complex. As Aristotle observed more than two thousand years ago, in the developing egg of the hen there soon appears the beating heart! There is nothing like this in the non-living world. But to return to the de-

veloping human embryo, there is formed from and above the embryonic food-canal a skeletal rod, which is called the notochord. It thrills the imagination to learn that this is the only supporting axis that the lower orders of the backboned race possess. The curious thing is that it does not become the backbone, which is certainly

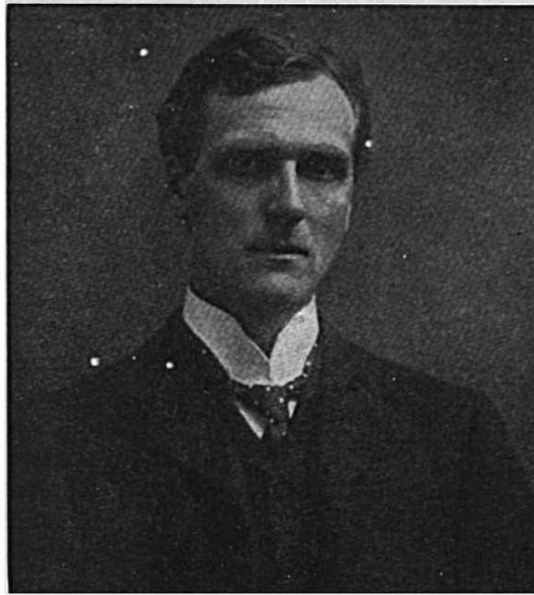


Photo: J. Russell & Sons.

PROFESSOR SIR ARTHUR KEITH, M.D., LL.D., F.R.S.

Conservator of the Museum and Hunterian Professor, Royal College of Surgeons of England. One of the foremost living anthropologists and a leading authority on the antiquity of man.

one of the essential features of the vertebrate race. The notochord is the supporting axis of the pioneer backboned animals, namely the Lancelets and the Round-mouths (Cyclostomes), such as the Lamprey. They have no backbone in the strict sense, but they have this notochord. It can easily be dissected out in the lamprey—a longgristly rod. It is surrounded by a sheath which becomes the backbone of most fishes and of all higher animals. The interesting point is that although the notochord is only a vestige

in the adults of these types, it is never absent from the embryo. It occurs even in man, a short-lived relic of the primeval supporting axis of the body. It comes and then it goes, leaving only minute traces in the adult. We cannot say that it is of any use, unless it serves as a stimulus to the development of its substitute,



After T. H. Huxley (by permission of Messrs. Macmillan).

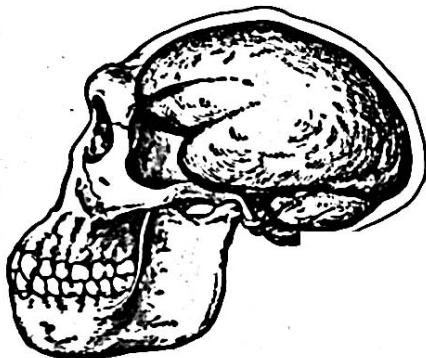
SKELETONS OF THE GIBBON, ORANG, CHIMPANZEE, GORILLA, MAN.

Photographically reduced from diagrams of the natural size (except that of the gibbon, which was twice as large as nature) drawn by Mr. Waterhouse Hawkins from specimens in the Museum of the Royal College of Surgeons.

the backbone. It is only a piece of preliminary scaffolding, but there is no more eloquent instance of the living hand of the past.

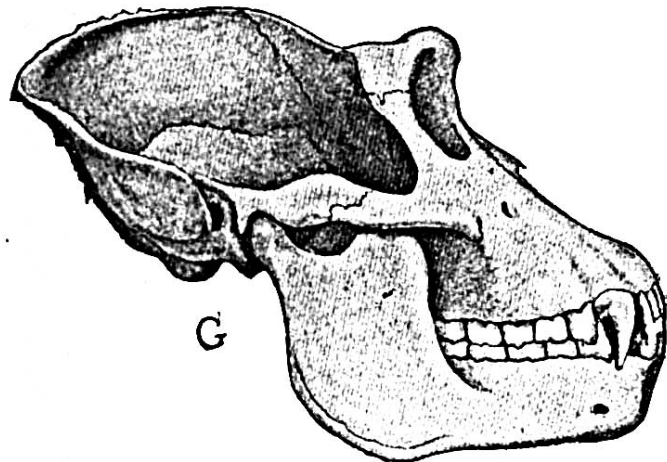
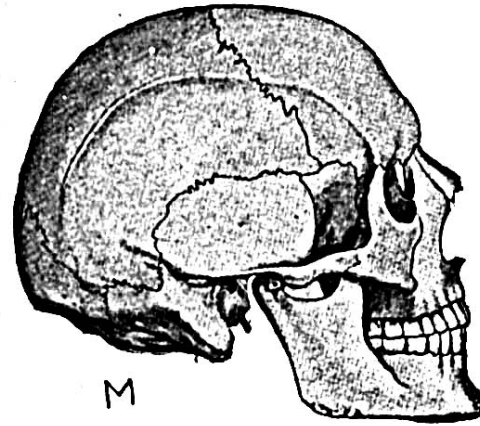
One other instance must suffice of what Professor Lull calls the wonderful changes wrought in the dark of the antenatal period, which recapitulate in rapid abbreviation the great evolutionary steps which were taken by man's ancestors "during the long night of the geological past." On the sides of the neck of the human embryo there are four pairs of slits, the "visceral clefts," openings from the beginning of the food-canal to the surface. There is no doubt as to their significance. They correspond to the gill-slits of fishes and tadpoles. Yet in reptiles, birds, and mammals they have no connection with breathing, which is their function in fishes and amphibians. Indeed, they are not of any use at all, except that the first becomes the Eustachian tube bringing the ear-passage into connection with the back of the mouth, and that the second and third have to do with the development of a curious organ called the thymus gland. Persistent, nevertheless, these gill-slits are, recalling even in man an aquatic ancestry of many millions of years ago.

When all these lines of evidence are considered, they are seen to converge in the conclusion that man is derived from a simian



THE SKULL AND BRAIN-CASE OF PITHECANTHROPUS, THE JAVA APE-MAN, AS RESTORED BY J. H. MCGREGOR FROM THE SCANTY REMAINS.

The restoration shows the low, retreating forehead and the prominent eyebrow ridges.



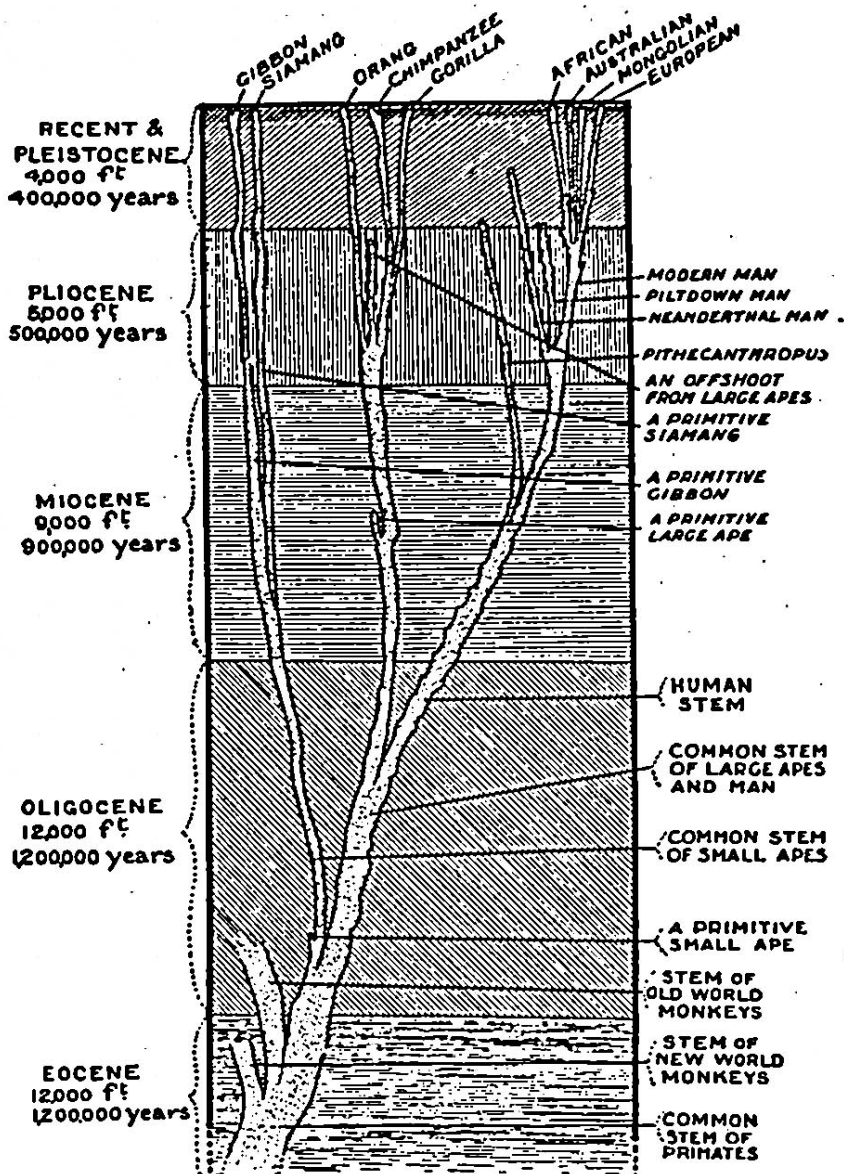
SIDE-VIEW OF SKULL OF MAN (M) AND GORILLA (G).

Notice in the gorilla's skull the protrusive face region, the big eyebrow ridges, the much less domed cranial cavity, the massive lower jaw, the big canine teeth. Notice in man's skull the well-developed forehead, the domed and spacious cranial cavity, the absence of any snout, the chin process, and many other marked differences separating the human skull from the ape's.

stock of mammals. He is solidary with the rest of creation. To quote the closing words of Darwin's *Descent of Man*: "We must, however, acknowledge, as it seems to me, that man with all his noble qualities, with sympathy which feels for the most debased, with benevolence which extends not only to other men but to the humblest living creature, with his God-like intellect, which has penetrated into the movements and constitution of the solar system—with all these exalted powers—man still bears in his bodily frame the indelible stamp of his lowly origin." We should be clear that this view does not say more than that man sprang from a stock common to him and to the higher apes. Those who are repelled by the idea of man's derivation from a simian type should remember that the theory implies rather

more than this, namely, that man is the outcome of a genealogy which has implied many millions of years of experimenting and sifting—the groaning and tra-
 vailing of a whole creation. Speaking of man's mental qualities, Sir Ray Lankester says: "They justify the view that man forms a new departure in the gradual unfolding of Nature's predestined plan." In

any case, we have to try to square our views with the facts, not the facts with our views, and while one of the facts is that man stands unique and apart, the other is that man is a scion of a progressive simian stock. Naturalists have exposed the pit whence man has been digged and the rock whence he has been hewn, but it is surely a heartening encouragement to know that it is an ascent, not a descent, that we have behind us. There is wisdom in Pascal's maxim: "It is dangerous to show man too plainly how like he is to the animals, without, at the same



SUGGESTED GENEALOGICAL TREE OF MAN AND ANTHROPOID APES.
 From Sir Arthur Keith; the lettering to the right has been slightly simplified.

time, reminding him of his greatness. It is equally unwise to impress him with his greatness and not with his lowliness. It is worse to leave him in ignorance of both. But it is very profitable to recognise the two facts."

§ 3

The facts of anatomy, physiology, and embryology, of which we have given illustrations, all point to man's affiliation with the order

of monkeys and apes. To this order is given the name Primates, and our first and second question must be when and whence the Primates began. The rock record answers the first question: the Primates emerged about the dawn of the Eocene era, when grass was beginning to cover the earth with a garment. Their ancestral home was in the north in both hemispheres, and then they migrated to Africa, India, Malay, and South America. In North America the Primates soon became extinct, and the same thing happened,

Man's Pedigree.

later on in Europe. In this case, however, there was a re-peopling from the South (in the Lower Miocene), and then a second extinction (in the Upper Pliocene) before man appeared. There is considerable evidence in support of Professor R. S. Lull's conclusion, that in Southern Asia, Africa, and South America the evolution of Primates was continuous since the first great southward migration, and there is, of course, an abundant modern representation of Primates in these regions to-day.

As to the second question: Whence the Primates sprang, the answer must be more conjectural. But it is a reasonable view that Carnivores and Primates sprang from a common Insectivore stock, the one order diverging towards flesh-eating and hunting on the ground, the other order diverging towards fruit-eating and arboreal habits. There is no doubt that the Insectivores (including shrews, tree-shrews, hedgehog, mole, and the like) were very plastic and progressive mammals.

What followed in the course of ages was the divergence of branch after branch from the main Primate stem. First there diverged the South American monkeys on a line of their own, and then the Old World monkeys, such as the macaques and baboons. Ages passed and the main stem gave off (in the Oligocene period) the branch now represented by the small anthropoid apes—the gibbon and the siamang. Distinctly later there diverged the branch of the large anthropoid apes—the gorilla, the chimpanzee, and the orang. That left a generalised humanoid stock separated off from all monkeys and apes, and including the



Photo: New York Zoological Park.

THE GIBBON IS LOWER THAN THE OTHER APES AS REGARDS ITS SKULL AND DENTITION, BUT IT IS HIGHLY SPECIALISED IN THE ADAPTATION OF ITS LIMBS TO ARBOREAL LIFE.

immediate precursors of man. When this sifting out of a generalised humanoid stock took place remains very uncertain, some authorities referring it to the Miocene, others to the early Pliocene. Some would estimate its date at half a million years ago, others at two millions! The fact is that questions of chronology do not as yet admit of scientific statement.

We are on firmer, though still uncertain, ground when we state the probability that it was in Asia that the precursors of man were separated off from monkeys and apes, and began to be terrestrial rather than

arboreal. Professor Lull points out that Asia is nearest to the oldest known human remains (in Java), and that Asia was the seat of the most ancient civilisations and the original home of many domesticated animals and cultivated plants. The probability is that the cradle of the human race was in Asia.

At this point it will be useful to consider man's arboreal apprenticeship and how he became a terrestrial journeyman. Professor Wood Jones has worked out very convincingly the thesis that man had no direct four-footed ancestry, but that the Primate stock to which he belongs was from its first divergence arboreal. He maintains that the leading peculiarities of the immediate precursors of man were wrought out during a long arboreal apprenticeship. The first great gain of arboreal life on bipedal erect lines (not after the quadrupedal fashion of tree-sloths, for instance) was the emancipation of the hand. The foot became the supporting and branch-gripping member, and the hand was set free to reach upward, to hang on by, to seize the fruit,

Man's
Arboreal
Apprenticeship.

to lift it and hold it to the mouth, and to hug the young one close to the breast. The hand thus set free has remained plastic—a generalised, not a specialised member. Much has followed from man's "handiness."

The arboreal life had many other consequences. It led to an increased freedom of movement of the thigh on the hip joint, to muscular arrangements for balancing the body on the leg, to making the backbone a supple yet stable curved pillar, to a strongly developed collar-bone which is only found well-formed when the fore-limb is used for more than support, and to a power of "opposing" the thumb and the big toe to the other digits of the hand and foot—an obvious advantage for branch-gripping. But the evolution of a free hand made it possible to dispense with protrusive lips and gripping teeth. Thus began the recession of the snout region, the associated enlargement of the brain-box, and the bringing of the eyes to the front. The overcrowding of the teeth that followed the shortening of the snout was one of the taxes on progress of which modern man is often reminded in his dental troubles.

Another acquisition associated with arboreal life was a greatly increased power of turning the head from side to side—a mobility very important in locating sounds and in exploring

with the eyes. Furthermore, there came about a flattening of the chest and of the back, and the movements of the midriff (or diaphragm) came to count for more in respiration than the movements of the ribs. The sense of touch came to be of more importance and the sense of smell of less; the part of the brain receiving tidings from hand and eye and ear came to predominate over the part for receiving olfactory messages. Finally, the need for carrying the infant about among the branches must surely have implied an intensification of family relations, and favoured the evolution of gentleness.

It may be urged that we are attaching too much importance to the arboreal apprenticeship, since many tree-loving animals remain to-day very innocent creatures. To this reasonable objection there are two answers, first that in its many acquisitions the arboreal evolution of the *humanoid* precursors of man prepared the way for the survival of a *human* type marked by a great step in brain-development; and second that the passage from the humanoid to the human was probably associated with a *return to mother earth*.

According to Professor Lull, to whose fine textbook, *Organic Evolution* (1917), we are much indebted, "climatic conditions in Asia in the Miocene or early Pliocene were such as to compel

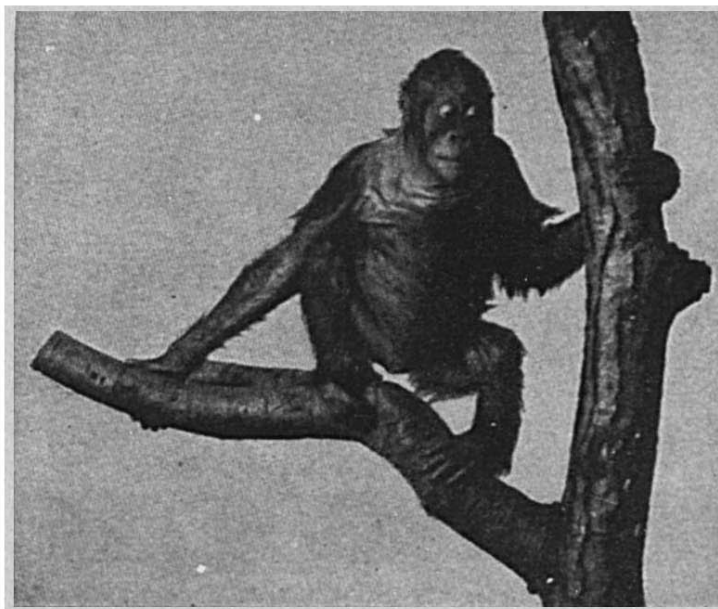


Photo: New York Zoological Park.

THE ORANG HAS A HIGH ROUNDED SKULL, AND A LONG FACE

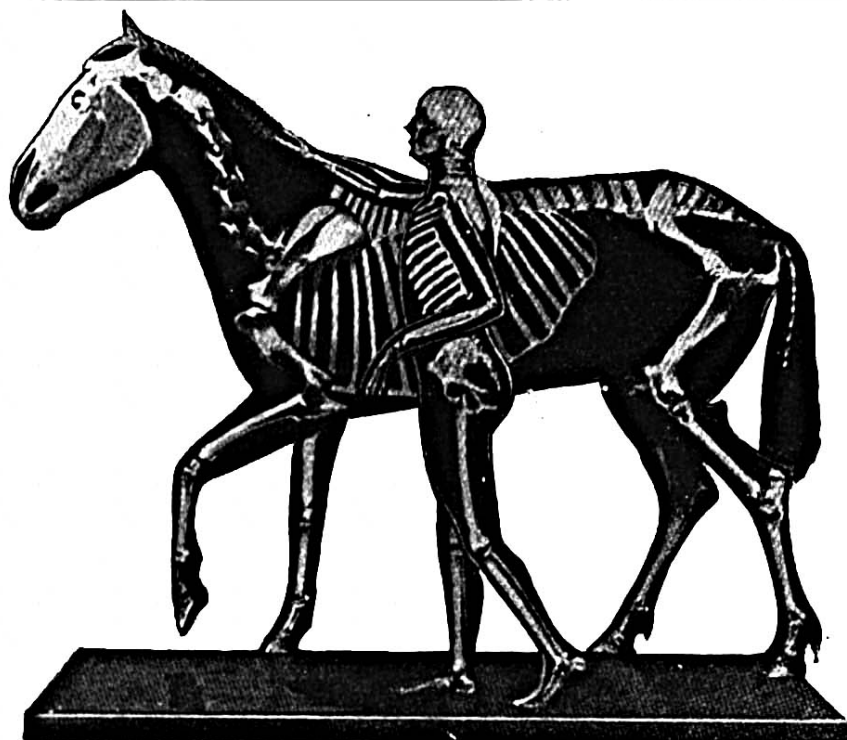


Photo: British Museum (Natural History).

COMPARISONS OF THE SKELETONS OF HORSE AND MAN.

Bone for bone, the two skeletons are like one another, though man is a biped and the horse a quadruped. The backbone in man is mainly vertical; the backbone in the horse is horizontal except in the neck and the tail. Man's skull is mainly in a line with the backbone; the horse's at an angle to it. Both man and horse have seven neck vertebrae. Man has five digits on each limb; the horse has only one digit well developed on each limb.

the descent of the prehuman ancestor from the trees, a step which was absolutely essential to further human development." Continental elevation and consequent aridity led to a dwindling of the forests, and forced the ape-man to come to earth. "And at the last arose the man."

According to Lull, the descent from the trees was associated with the assumption of a more erect posture, with increased liberation and plasticity of the hand, with becoming a hunter, with experiments towards clothing and shelter, with an exploring habit, and with the beginning of communal life.

It is a plausible view that the transition from the humanoid to the human was effected by a discontinuous variation of considerable magnitude, what is nowadays called a *mutation*, and

that it had mainly to do with the brain and the vocal organs. But given the gains of the arboreal apprenticeship, the stimulus of an enforced descent to terra firma, and an evolving brain and voice, we can recognise accessory factors which helped success to succeed. Perhaps the absence of great physical strength prompted reliance on wits; the prolongation of infancy would help to educate the parents in gentleness; the strengthening of the feeling of kinship would favour the evolution of family and social life—of which there are many anticipations at lower levels. There is much truth in the saying: "Man did not make society, society made man."

A continuation of the story will deal with the emergence of the primitive types of man and the gradual ascent of the modern species.



THE GORILLA, INHABITING THE FOREST TRACT OF THE GABOON IN AFRICA
A full-grown individual stands about 5 feet high. The gait is shuffling, the strength enormous, the diet mainly vegetarian, the temper rather ferocious.



After a model by J. H. McGregor.

PROFILE VIEW OF THE HEAD OF PITHECANTHROPUS, THE JAVA APE-MAN—
AN EARLY OFFSHOOT FROM THE MAIN LINE OF MAN'S ASCENT.

The animal remains found along with the skull-cap, thigh-bone, and two teeth of Pithecanthropus seem to indicate the lowest Pleistocene period, perhaps 500,000 years ago.

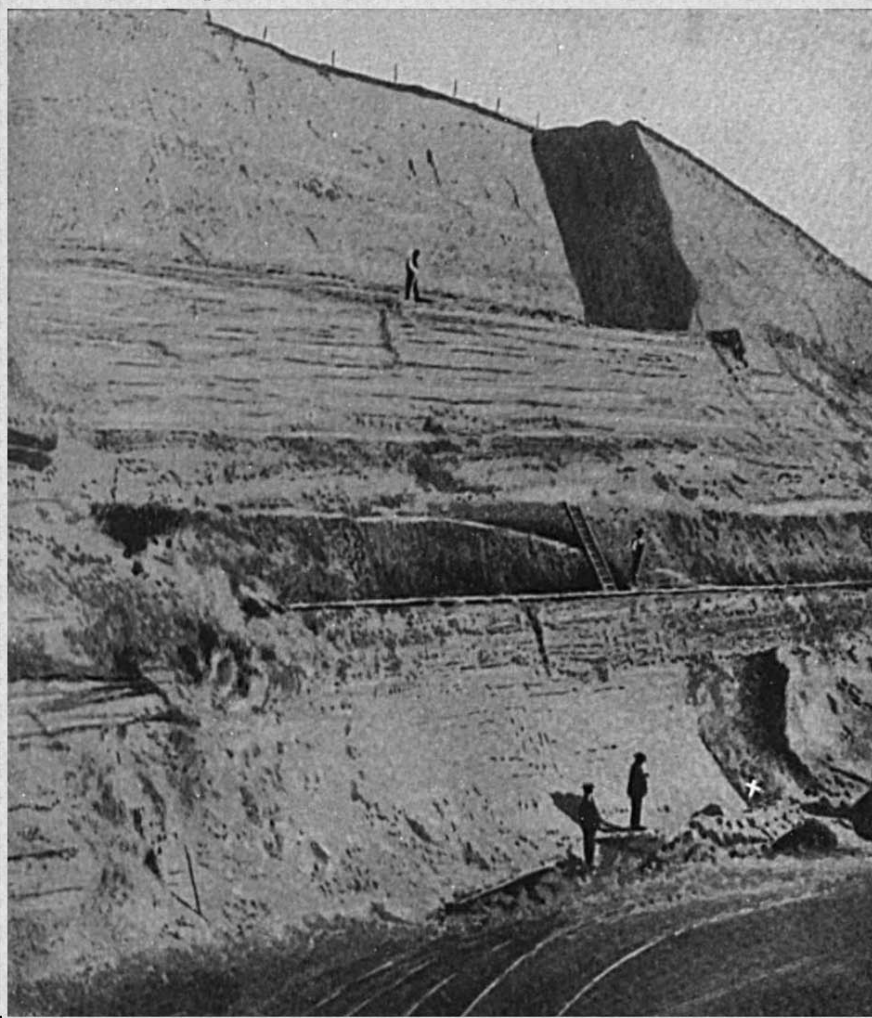
§ 4

So far the story has been that of the sifting out of a humanoid stock and of the transition to human kind, from the ancestors of apes and men to the man-ape, and from the man-ape to man. It looks as if the sifting-out process had proceeded further, for there were several human branches that did not lead on to the modern type of man.

Tentative Men. 1. The first of these is represented by the scanty fossil remains known as *Pithecanthropus erectus*, found in Java in fossiliferous beds which date from the end of the Pliocene or the beginning of the Pleistocene era. Perhaps this means half a million years ago, and the remains occurred along with those of some mammals which are now extinct. Unfortunately the remains of Pithecanthropus the Erect consisted only of a skull-cap, a thigh-bone, and two back teeth, so it is not surprising that experts should differ con-

siderably in their interpretation of what was found. Some have regarded the remains as those of a large gibbon, others as those of a pre-human ape-man, and others as those of a primitive man off the main line of ascent. According to Sir Arthur Keith, Pithecanthropus was "a being human in stature, human in gait, human in all its parts, save its brain." The thigh-bone indicates a height of about 5 feet 7 inches, one inch less than the average height of the men of to-day. The skull-cap indicates a low, flat forehead, beetling brows, and a capacity about two-thirds of the modern size. The remains were found by Dubois, in 1894, in Trinil in Central Java.

2. The next offshoot is represented by the Heidelberg man (*Homo heidelbergensis*), discovered near Heidelberg in 1907 by Dr. Schoetensack. But the remains consisted only of a lower jaw and its teeth. Along with this relic were bones



Reproduced by permission from Osborn's "Men of the Old Stone Age."

SAND-PIT AT MAUER, NEAR HEIDELBERG: DISCOVERY SITE OF THE JAW OF HEIDELBERG MAN.

- a—b. "Newer loess," either of Third Interglacial or of Postglacial times.
- b—c. "Older loess" (sandy loess), of the close of Second Interglacial times.
- c—f. The "sands of Mauer."
- d—e. An intermediate layer of clay.

The white cross (X) indicates the spot at the base of the "sands of Mauer" at which the jaw of Heidelberg was discovered.

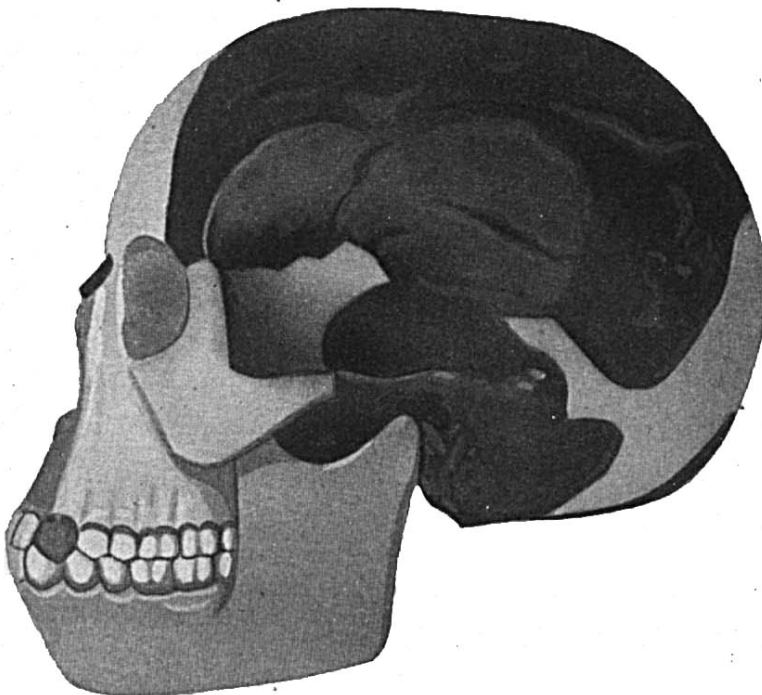
of various mammals, including some long since extinct in Europe, such as elephant, rhinoceros, bison, and lion. The circumstances indicate an age of perhaps 300,000 years ago. There were also very crude flint implements (or eoliths). But the teeth are human teeth, and the jaw seems transitional between that of an anthropoid ape and that of man. Thus there was no chin. According to most authorities the lower jaw from the Heidelberg sand-pit must be regarded as a relic of a primitive type off the main line of human ascent.

3. It was in all probability in the Pliocene that there took origin the Neanderthal species of man, *Homo neanderthalensis*, first known from remains found in 1856 in the Neanderthal ravine near Düsseldorf. According to some authorities Neanderthal man was living in Europe a quarter of a million years ago. Other specimens were afterwards found elsewhere, e.g. in Belgium ("the men of Spy"), in France, in Croatia, and at Gibraltar, so that a good deal is known of Neanderthal man. He was a loose-limbed fellow, short of stature and of slouching

gait, but a skilful artificer, fashioning beautifully worked flints with a characteristic style. He used fire; he buried his dead reverently and furnished them with an outfit for a long journey; and he had a big brain. But he had great beetling, ape-like eyebrow ridges and massive jaws, and he showed "simian characters swarming in the details of his structure." In most of the points in which he differs from modern man he approaches the anthropoid apes, and he must be regarded as a low type of man, off the main line. Huxley regarded the Neanderthal man as a low form of the modern type, but expert opinion seems to agree rather with the view maintained in 1864 by Professor William King of Galway, that the Neanderthal man represents a distinct species off the main line of ascent. He disappeared with apparent suddenness (like some aboriginal races today) about the end of the Fourth Great Ice Age; but there is evidence that before he ceased to be there had emerged a successor rather than a descendant—the modern man.

4. Another offshoot from the main line is probably represented by the Piltdown man, found in Sussex in 1912. The remains consisted of the walls of the skull, which indicate a large brain, and a high forehead without the beetling eyebrows of the Neanderthal man and Pithecanthropus. The "find" included a tooth and part of a lower jaw, but these perhaps belong to

some ape, for they are very discrepant. The Piltdown skull represents the most ancient human remains as yet found in Britain, and Dr. Smith Woodward's establishment of a separate genus *Eoanthropus* expresses his conviction that the Piltdown man was off the line of the evolution of the modern type. If the tooth and piece of lower jaw belong to the Piltdown skull, then there was a remarkable combination of ape-like and human characters. As regards the brain, *inferred* from the skull-walls, Sir Arthur Keith



From the reconstruction by J. H. McGregor.

PILTDOWN SKULL. THE DARK PARTS ONLY ARE PRESERVED, NAMELY, PORTIONS OF THE CRANIAL WALLS AND THE NASAL BONES.

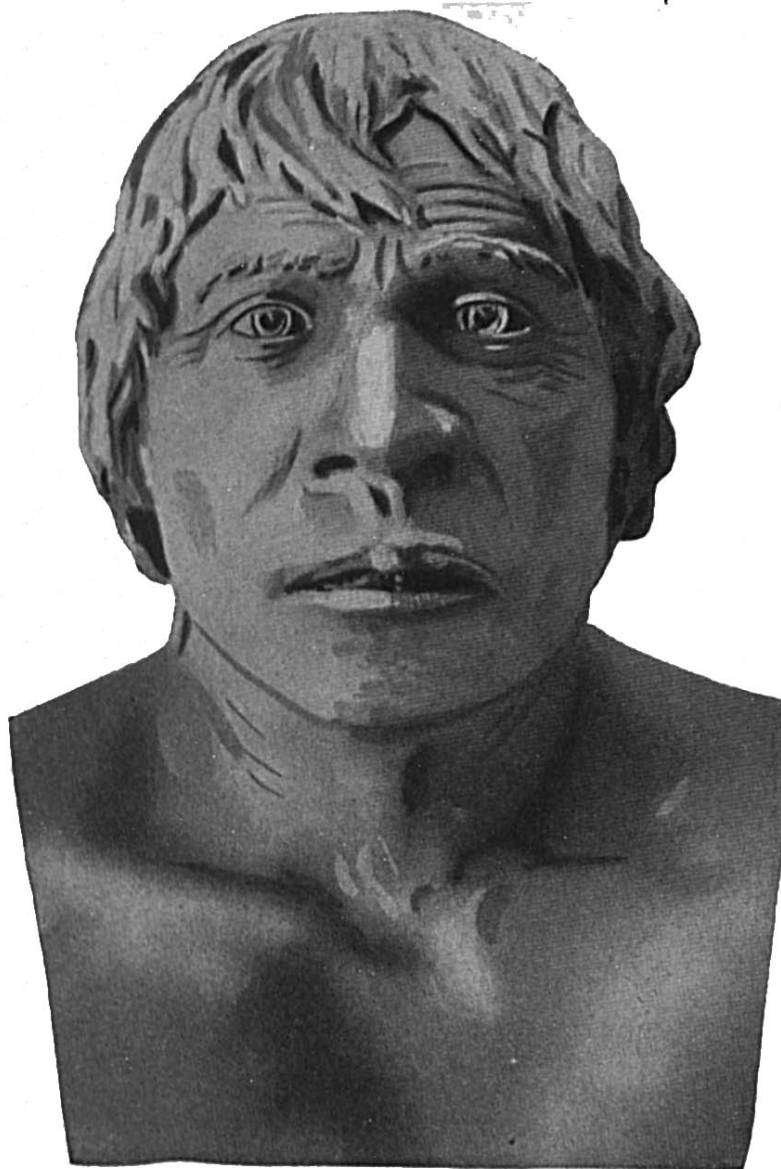
Some authorities include a canine tooth and part of the lower jaw which were found close by. The remains were found in 1912 in Thames gravels in Sussex, and are usually regarded as vastly more ancient than those of Neanderthal Man. It has been suggested that Piltdown Man lived 100,000 to 150,000 years ago, in the Third Interglacial period.

says: "All the essential features of the brain of modern man are to be seen in the brain cast. There are some which must be regarded as primitive. There can be no doubt that it is built on exactly the same lines as our modern brains. A few minor alterations would make it in all respects a modern brain." "Although our knowledge of the human brain is limited—there are

large areas to which we can assign no definite function—we may rest assured that a brain which was shaped in a mould so similar to our own was one which responded to the outside world as ours does. Piltdown man saw, heard, felt, thought, and dreamt much as we do still." And this was 150,000 years ago at a modern estimate, and some would say half a million.

There is neither agreement nor certainty as to the antiquity of man, except that the modern type was distinguishable from its collaterals hundreds of thousands of years ago. The

general impression left is very grand. In remote antiquity the Primate stem diverged from the other orders of mammals; it sent forth its tentative branches, and the result was a tangle of monkeys; ages passed and the monkeys were left behind, while the main stem, still probing its way, gave off the Anthropoid apes, both small and large. But they too were left behind, and the main line gave off other experiments—indications of which we know in Java, at Heidelberg, in the Neanderthal, and



After the restoration modelled by J. H. McGregor.

PILTOWN MAN, PRECEDING NEANDERTHAL MAN, PERHAPS 100,000 TO 150,000 YEARS AGO.

at Piltown. None of these lasted or was made perfect. They represent *tentative* men who had their day and ceased to be, our predecessors rather than our ancestors. Still, the main stem goes on evolving, and who will be bold enough to say what fruit it has yet to bear!

Ancient skeletons of men of the modern type have been found in many places, e.g. Combe Capelle in Dordogne, Galley Hill in Kent, Cro-Magnon, in Périgord, Merton on the Riviera; and they are often referred to as "Cave-men" or

Primitive Men.

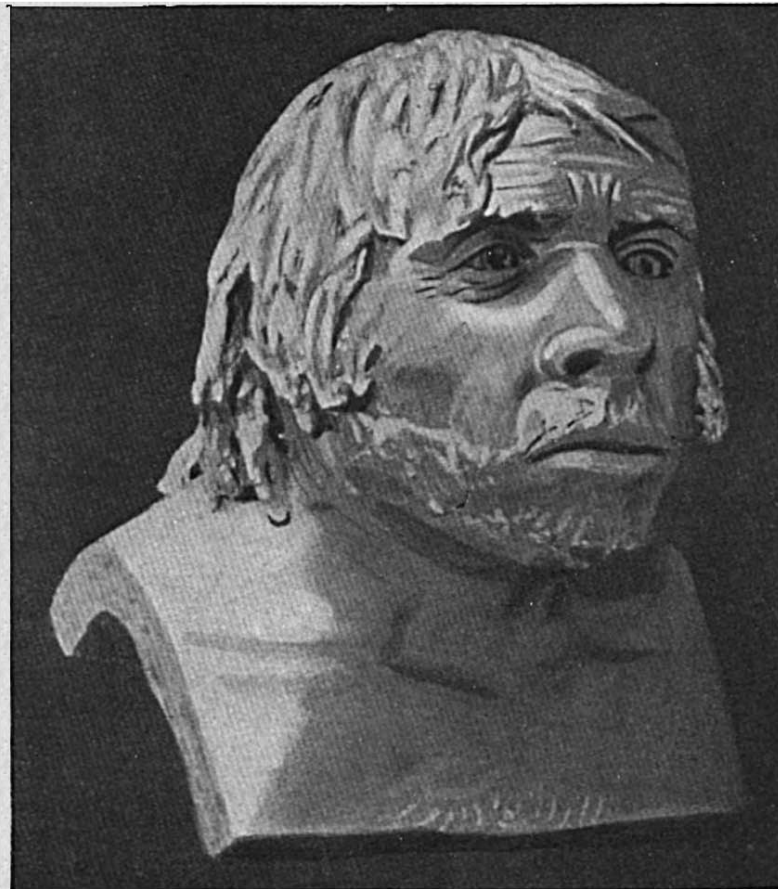
"men of the Early Stone Age." They had large skulls, high foreheads, well-marked chins, and other features such as a modern man possesses. They were true men at last—that is to say, like ourselves! The spirited pictures they made on the walls of caves in France and Spain show artistic sense and skill. Well-finished statuettes representing nude female figures are also known. The elaborate burial customs point to a belief in life after death. They made stone imple-

ments—knives, scrapers, graters, and the like, of the type known as Palæolithic, and these show interesting gradations of skill and peculiarities of style. The "Cave-men" lived between the third and fourth Ice Ages, along with cave-bear, cave-lion, cave-hyæna, mammoth, woolly rhinoceros, Irish elk, and other mammals now extinct—taking us back to 30,000–50,000 years ago, and many would say much more. Some of the big-brained skulls of these Palæolithic cave-men show not a single feature that could be called primitive. They show teeth which in size and

form are exactly the same as those of a thousand generations afterwards—and suffering from gumboil too! There seems little doubt that these vigorous Palæolithic Cave-men of Europe were living for a while contemporaneously with the men of Neanderthal, and it is possible that they directly or indirectly hastened the disappearance of their more primitive collaterals. Curiously enough, however, they had not themselves adequate lasting power in Europe, for they seem for the most part to have dwindled away, leaving perhaps stray present-day survivors in isolated districts. The probability is that after their decline Europe was re-peopled by immigrants from Asia. It cannot be said that there is any inherent biological necessity for the decline of a vigorous race—many animal races go back for millions of years—but in mankind the historical fact is that a period of great racial vigour and success is often followed by a period of decline, sometimes leading to practical disappearance as a definite race. The causes of this waning remain very obscure—sometimes environmental, sometimes constitutional, sometimes competitive. Sometimes the introduction of a new parasite, like the malaria organism, may have been to blame.

After the Ice Ages had passed, perhaps 25,000 years ago, the Palæolithic culture gave place to the Neolithic. The men who made rudely dressed but often beautiful stone implements were succeeded or replaced by men who made polished stone implements. The earliest inhabitants of Scotland were of this Neolithic culture, migrating from the Continent when the ice-fields of the Great Glaciation had disappeared. Their remains are often associated with the "Fifty-foot Beach" which, though now high and dry, was the seashore in early Neolithic days. Much is known about these men of the polished stones. They were hunters, fowlers, and fishermen; without domesticated animals or agriculture; short folk, two or three inches below the present standard; living an active strenuous life. Similarly, for the south, Sir Arthur Keith

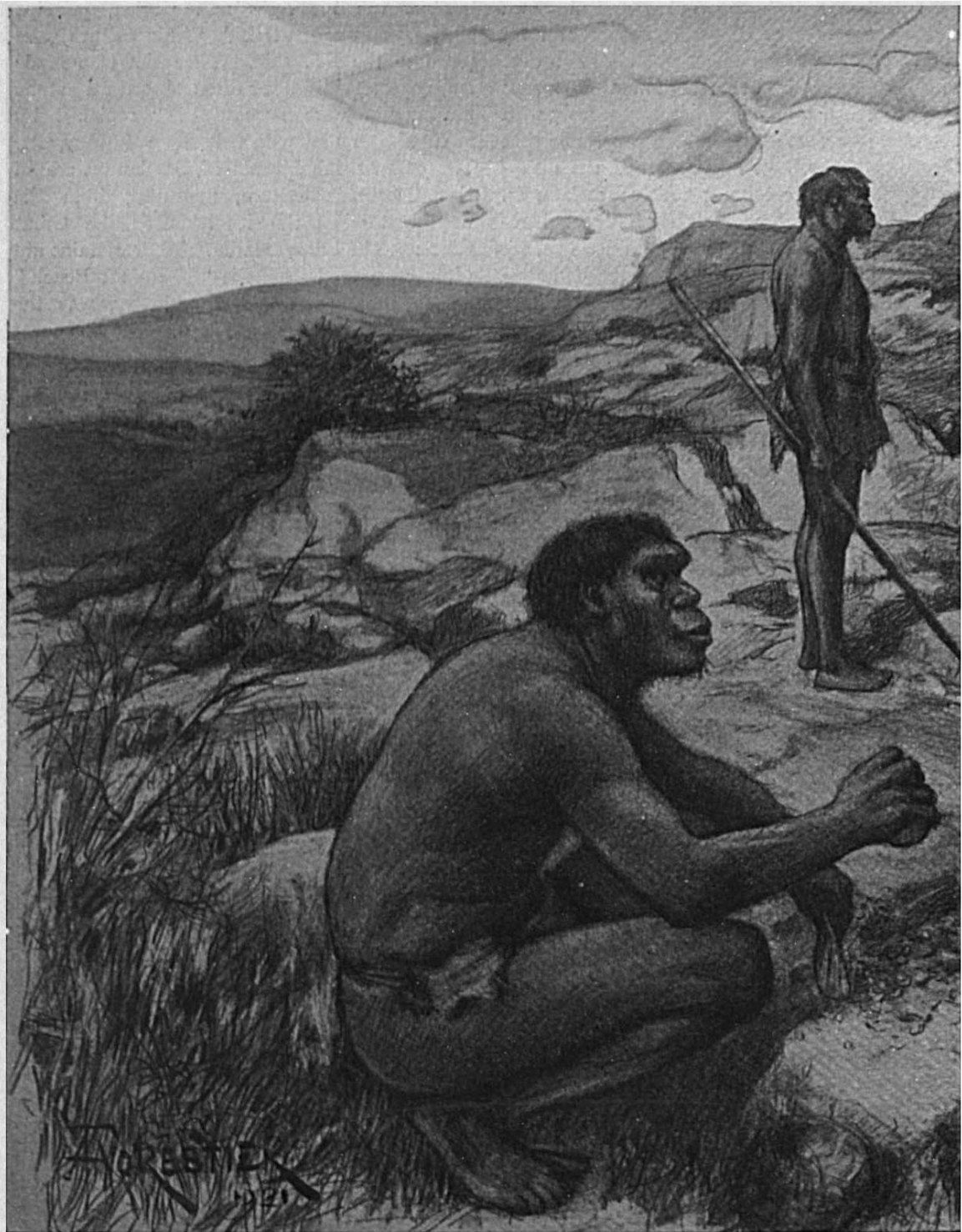
pictures for us a Neolithic community at Coldrum in Kent, dating from about 4,000 years ago—a few ticks of the geological clock. It consisted, in this case, of agricultural pioneers, men with large heads and big brains, about two inches shorter in stature than the modern British average (5 ft. 8 in.), with better teeth and broader palates than men have in these days



After the restoration modelled by J. H. McGregor.

THE NEANDERTHAL MAN OF LA CHAPELLE-AUX-SAINTS.

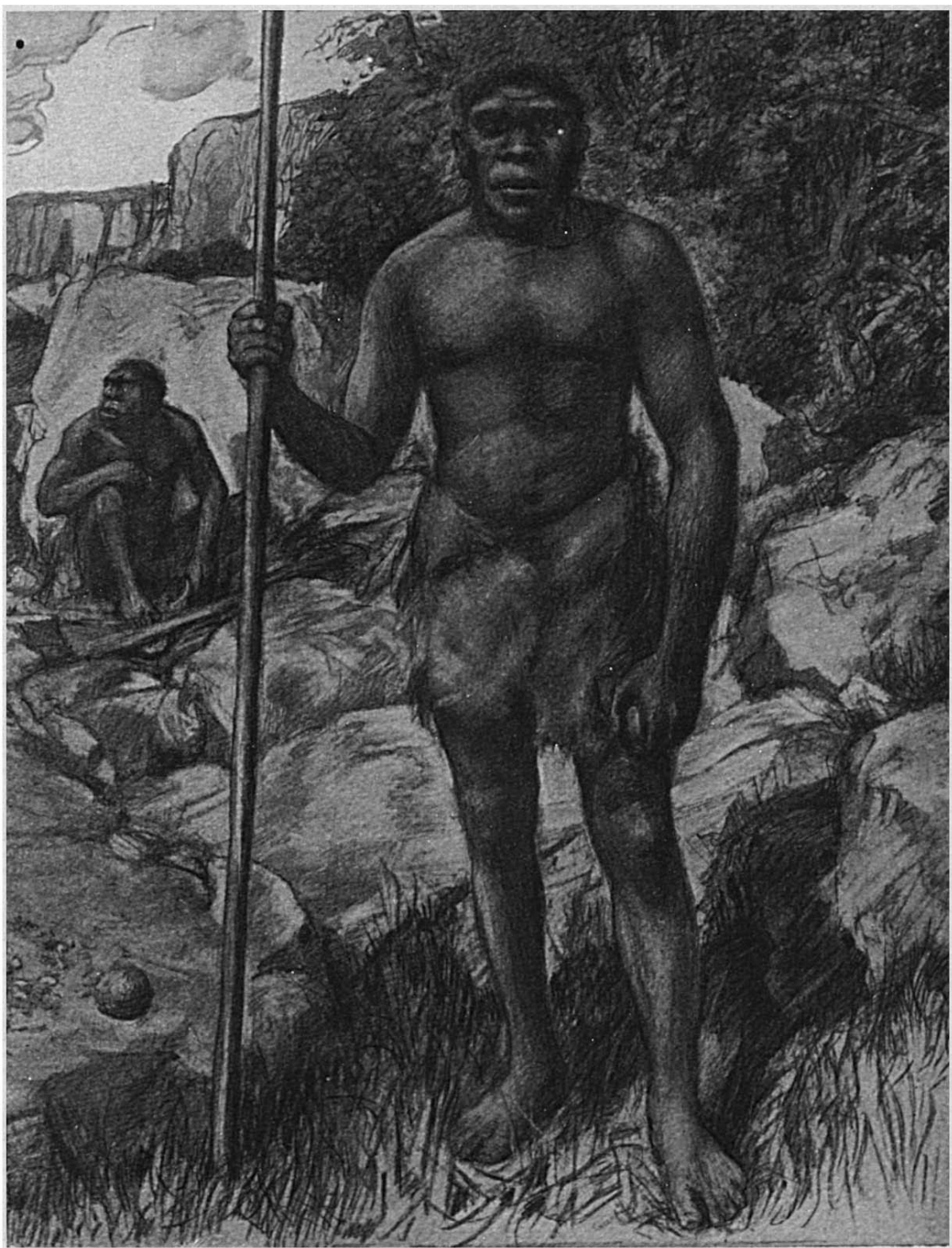
The men of this race lived in Europe from the Third Interglacial period through the Fourth Glacial. They disappeared somewhat suddenly, being replaced by the Modern Man type, such as the Cromagnards. Many regard the Neanderthal Men as a distinct species.



RESTORATION BY A. FORESTIER OF THE RHODESIAN

Attention may be drawn to the beetling eyebrow ridges, the projecting upper lip, the large eye-sockets, the well-poised head, the strong shoulders.

The figure in the right foreground, holding a staff, shows the erect attitude and the straight legs. His left hand holds a flint implement.



MAN WHOSE SKULL WAS DISCOVERED IN 1921.

The squatting figure to the left is crushing seeds with a stone, and a crusher is lying on the rock to his right.

On the right, behind the sitting figure, is seen the entrance to the cave. This new Rhodesian cave-man may be regarded as a southern representative of a Neanderthal race, or as an extinct type intermediate between the Neanderthal Men and the Modern Man type.

of soft food, with beliefs concerning life and death similar to those that swayed their contemporaries in Western and Southern Europe. Very interesting is the manipulative skill they showed on a large scale in erecting standing stones (probably connected with calendar-keeping and with worship), and, on a small scale, in making daring operations on the skull. Four

thousand years ago is given as a probable date for that early community in Kent, but evidences of Neolithic man occur in situations which demand a much greater antiquity—perhaps 30,000 years. And man was not young then!

We must open one more chapter in the thrilling story of the Ascent of Man—the Metal Ages, which are in a sense still continuing. Metals began to be used in the late, Polished Stone (Neolithic) times, for there were always overlappings. Copper came first, Bronze second, and Iron last. The working of copper in the East has been traced back to the fourth millennium B.C., and there was also a very ancient Copper Age in the New World. It need hardly be said that where copper is scarce, as in Britain, we cannot expect to find much trace of a Copper Age.

The ores of different metals seem to have been smelted together in an experimental way by many prehistoric metallurgists, and bronze was the alloy that rewarded the combination of tin with copper. There is evidence of a more or less definite Bronze Age in Egypt and Babylonia, Greece and Europe.

It is not clear why iron should not have been the earliest metal to be used by man, but the Iron Age dates from about the middle of the



Photo: British Museum (Natural History).

SIDE VIEW OF A PREHISTORIC HUMAN SKULL, DISCOVERED IN 1921 IN BROKEN HILL CAVE, NORTHERN RHODESIA.

Very striking are the prominent eyebrow ridges and the broad massive face. The skull looks less domed than that of modern man, but its cranial capacity is far above the lowest human limit. The teeth are interesting in showing marked rotting or "caries," hitherto unknown in prehistoric skulls. In all probability the Rhodesian man was an African representative of the extinct Neanderthal species hitherto known only from Europe.

second millennium B.C. From Egypt the usage spread through the Mediterranean region to North Europe, or it may have been that discoveries made in Central Europe, so rich in iron-mines, saturated southwards, following, for instance, the route of the amber trade from the Baltic. Compared with stone, the metals afforded much greater possibilities of imple-

ments, instruments, and weapons, and their discovery and usage had undoubtedly great influence on the Ascent of Man. Occasionally, however, on his descent.

Looking backwards, we discern the following stages: (1) The setting apart of a Primate stock, marked off from other mammals by a tendency to big brains, a free hand, gregariousness, and good-humoured talkativeness. (2) The divergence of marmosets and New World monkeys and Old World monkeys, leaving a stock—an anthropoid stock—common to the present-day and extinct apes and to mankind. (3) From this common stock the Anthropoid apes diverged, far from ignoble creatures, and a humanoid stock was set apart. (4) From the latter (we follow Sir Arthur Keith and other authorities) there arose what may be called, without disparagement, tentative or experimental men, indicated by Pithecanthropus "the Erect," the Heidelberg man, the Neanderthals, and, best of all, the early men of the Sussex Weald—hinted at by the Piltdown skull. It matters little whether particular items are corroborated or disproved—e.g. whether the Heidelberg man came before or after the Neanderthals—the general trend of evolution remains clear. (5) In any case, the result was

the evolution of *Homo sapiens, the man we are*—a quite different fellow from the Neanderthal. (6) Then arose various stocks of primitive men, proving everything and holding fast to that which is good. There were the Palæolithic peoples, with rude stone implements, a strong vigorous race, but probably, in most cases, supplanted by fresh experiments. These may have arisen as shoots from the growing point of the old race, or as a fresh offshoot from more generalised members at a lower level. This is the eternal possible victory alike of aristocracy and democracy. (7) Palæolithic men were involved in the succession of four Great Ice Ages or Glaciations, and it may be that the human race owes much to the alternation of hard times and easy times—glacial and interglacial. When the ice-fields cleared off Neolithic man had his innings. (8) And we have closed the story, in the meantime, with the Metal Ages.

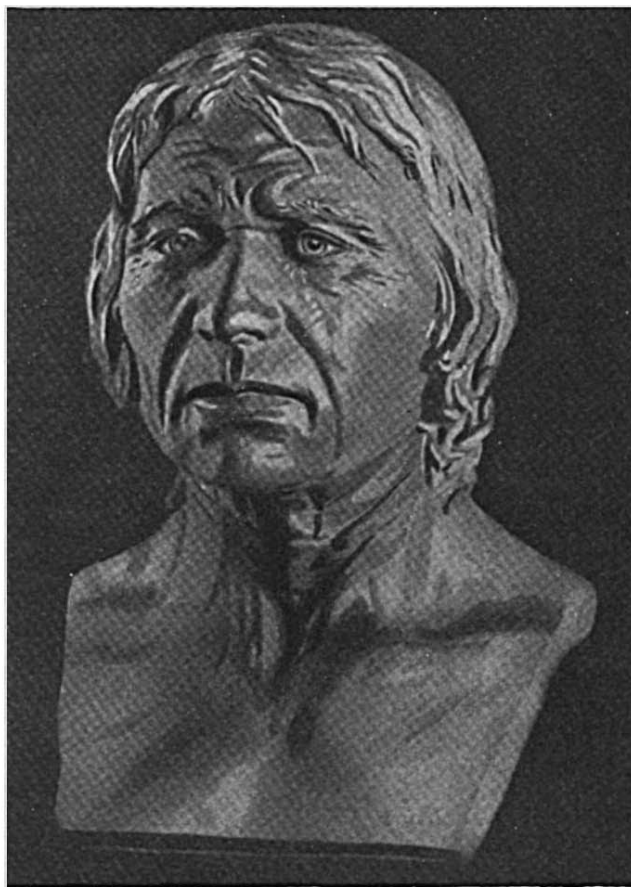
It seems not unfitting that we should at this point sound another note—that of the man of feeling. It is clear in William James's words: "Bone of our bone, and flesh of our flesh, are these half-brutish prehistoric brothers. Girdled about with the immense darkness of this mysterious universe even as we are, they were born and died, suffered and struggled. Given over to fearful crime and passion, plunged in the blackest ignorance, preyed upon

by hideous and grotesque delusions, yet steadfastly serving the profoundest of ideals in their fixed faith that existence in any form is better than non-existence, they ever rescued triumphantly from the jaws of ever imminent destruction the torch of life which, thanks to them, now lights the world for us."

Given a variable stock spreading over diverse territory, we expect to find it splitting up into varieties which may become steadied into races or incipient species. Thus we have races of hive-bees, "Italians," "Punics," and so forth; and thus there arose races of men. Certain types suited certain areas, and periods of in-breeding tended to make the distinctive peculiarities of each incipient race well-defined and stable. When the original peculiarities, say, of negro

and Mongol, Australian and Caucasian, arose as brusque variations or "mutations," then they would have great staying power from generation to generation. They would not be readily swamped by intercrossing or averaged off. Peculiarities and changes of climate and surroundings, not to speak of other change-producing factors, would provoke fresh new departures from age to age, and so fresh racial ventures were made. Moreover, the occurrence of out-breeding when two races met, in peace or in war, would certainly serve to induce fresh starts. Very important in

Races of Mankind.



After the restoration modelled by J. H. McGregor.

A CROMAGNON MAN OR CROMAGNARD, REPRESENTATIVE OF A STRONG ARTISTIC RACE LIVING IN THE SOUTH OF FRANCE IN THE UPPER PLEISTOCENE, PERHAPS 25,000 YEARS AGO.

They seemed to have lived for a while contemporaneously with the Neanderthal Men, and there may have been interbreeding. Some Cromagnards probably survive, but the race as a whole declined, and there was re-population of Europe from the East.



Reproduced by permission from Osborn's "Men of the Old Stone Age."

PHOTOGRAPH SHOWING A NARROW PASSAGE IN THE CAVERN OF FONT-DE-GAUME ON THE BRUNE.

Throughout the cavern the walls are crowded with engravings; on the left wall, shown in the photograph, are two painted bison. In the great gallery there may be found not less than eighty figures—bison, reindeer, and mammoths. A specimen of the last is reproduced on the opposite page.

the evolution of human races must have been the alternating occurrence of periods of in-breeding (endogamy), tending to stability and sameness, and periods of out-breeding (exogamy), tending to changefulness and diversity.

Thus we may distinguish several more or less clearly defined primitive races of mankind—notably the African, the Australian, the Mongolian, and the Caucasian. The woolly-haired African race includes the negroes and the very primitive bushmen. The wavy- to curly-haired Australian race includes the Jungle Tribes of the Deccan, the Vedda of Ceylon, the Jungle

Folk or Semang, and the natives of unsettled parts of Australia—all sometimes slumped together as "Pre-Dravidians." The straight-haired Mongols include those of Tibet, Indo-China, China, and Formosa, those of many oceanic islands, and of the north from Japan to Lapland. The Caucasians include Mediterraneans, Semites, Nordics, Afghans, Alpines, and many more.

There are very few corners of knowledge more difficult than that of the Races of Men, the chief reason being that there has been so much movement and migration in the course of the ages. One physical type has mingled with another, inducing strange amalgams and novelties. If we start with what might be called "zoological" races or strains differing, for instance, in their hair (woolly-haired Africans, straight-haired Mongols, curly- or wavy-haired Pre-Dravidians and Caucasians), we find these replaced by *peoples* who are mixtures of various races, "brethren by civilisation more than by blood." As Professor Flinders Petrie has said, the only meaning the term "race" now can have is that of a group of human beings whose type has been unified by their rate of assimilation exceeding the rate of change produced by the infiltration of foreign elements. It is probable, however, that the progress of precise anthropology will make it possible to distinguish the various racial "strains" that make up any people. For the human sense of race is so strong that it convinces us of reality even when scientific definition is impossible. It was this the British sailor expressed in his answer to the question "What is a Dago?" "Dagoes," he replied, "is anything wot isn't our sort of chaps."

Real men arose, we believe, by variational uplifts of considerable magnitude which led to big and complex brains and to the power of reasoned discourse. In some other lines of mammalian evolution there were from time to time great advances in the size and complexity of the brain, as is clear, for instance, in the case of horses and elephants. The same is true of birds as compared with reptiles, and everyone recognises the high level of excellence that has been attained by their vocal powers. How these great cerebral advances came about we do not

Steps in
Human
Evolution.

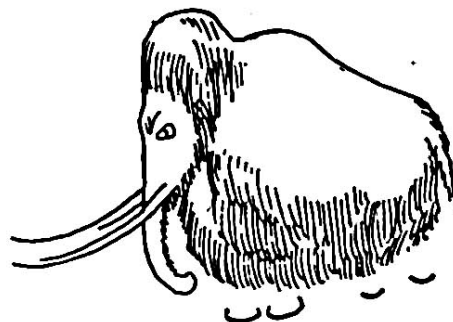
know, but it has been one of the main trends of animal evolution to improve the nervous system. Two suggestions may be made. First, the prolongation of the period of ante-natal life, in intimate physiological partnership with the mother, may have made it practicable to start the higher mammal with a much better brain than in the lower orders, like Insectivores and Rodents, and still more Marsupials, where the period before birth (gestation) is short. Second, we know that the individual development of the brain is profoundly influenced by the internal secretions of certain ductless glands, notably the thyroid. When this organ is not functioning properly the child's brain development is arrested. It may be that increased production of certain hormones—itsself, of course, to be accounted for—may have stimulated brain development in man's remote ancestors.

Given variability along the line of better brains and given a process of discriminate sifting which would consistently offer rewards to alertness and foresight, to kin-sympathy and parental care, there seems no great difficulty in imagining how Man would evolve. We must not think of an Aristotle or a Newton, except as fine results which justify all the groaning and travailing; we must think of average men, of primitive peoples to-day, and of our forbears long ago. We must remember how much of man's advance is dependent on the external registration of the social heritage, not on the slowly changing natural inheritance.

Looking backwards it is impossible, we think, to fail to recognise progress. There is a ring of truth in the fine description *Æschylus* gave of primitive men that—"first, beholding they beheld in vain, and, hearing, heard not, but, like shapes in dreams, mixed all things wildly down the tedious time, nor knew to build a house against the sun with wicketed sides, nor any wood-work knew, but lived like silly ants, beneath the ground, in hollow caves unsunned. There came to them no steadfast sign of winter, nor of spring flower-perfumed, nor of summer full of fruit, but blindly and lawlessly they did all things."

Contrast this picture with the position of man to-day. He has mastered the forces of Nature and is learning to use their resources more and more economically; he has harnessed electricity to his chariot and he has made the ether carry

his messages. He tapped supplies of material which seemed for centuries unavailable, having learned, for instance, how to capture and utilise the free nitrogen of the air. With his telegraph and "wireless" he has annihilated distance, and he has added to his navigable kingdom the depths of the sea and the heights of the air. He has conquered one disease after another, and the young science of heredity is showing him how to control in his domesticated animals and cultivated plants the nature of the generations yet unborn. With all his faults he has his ethical face set in the right direction. The main line of movement is towards the fuller embodiment of the true, the beautiful, and the good in healthy lives which are increasingly a satisfaction in themselves.



A MAMMOTH DRAWN ON THE WALL OF THE FONT-DE-GAUME CAVERN.

The mammoth age was in the Middle Pleistocene, while Neanderthal Men still flourished, probably far over 30,000 years ago.

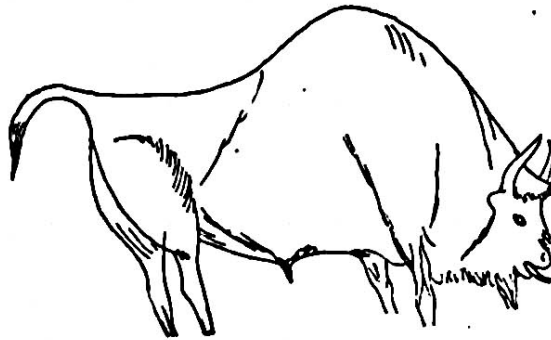
Many, we believe, were the gains that rewarded the arboreal apprenticeship of man's ancestors. Many, likewise, were the results of leaving the trees and coming down to the solid earth—a transition which marked the emergence of more than tentative men. What great steps followed?

Some of the greatest were—the working out of a spoken language and of external methods of registration; the invention of tools; the discovery of the use of fire; the utilisation of iron and other metals; the taming of wild animals such as dog and sheep, horses and cattle; the cultivation of wild plants such as wheat and rice; and the irrigation of fields. All through the ages necessity has been the mother of invention and curiosity its father; but perhaps we miss the heart of the matter if we forget the importance of some leisure time—wherein to observe and think. If our earth had been so clouded that the stars were hidden from

men's eyes the whole history of our race would have been different. For it was through his leisure-time observations of the stars that early man discovered the regularity of the year and got his fundamental impressions of the order of Nature—on which all his science is founded.

If we are to think clearly of the factors of human progress we must recall the three great biological ideas—the living organism, its environment, and its functioning. For man these mean (1) the living creature, the outcome of parents and ancestors, a fresh expression of a bodily and mental inheritance; (2) the surroundings, including climate and soil, the plants and animals these allow; and (3) the activities of all sorts, occupations and habits, all the actions and reactions between man and his milieu. In short, we have to deal with **FOLK, PLACE, WORK**; the *Famille, Lieu, Travail* of the LePlay school.

As to **FOLK**, human progress depends on intrinsic racial qualities—notably health and vigour of body, clearness and alertness of mind, and an indispensable sociality. The most powerful factors in the world are clear ideas in the minds of energetic men of good will. The differences in bodily and mental health which mark races, and stocks within a people, just as they mark individuals, are themselves traceable back to germinal variations or mutations, and to the kind of sifting to which the race or



A GRAZING BISON, DELICATELY AND CAREFULLY DRAWN, ENGRAVED ON A WALL OF THE ALTAMIRA CAVE, NORTHERN SPAIN.

This was the work of a Reindeer Man or Cromagnard, in the Upper or Post-Glacial Pleistocene, perhaps 25,000 years ago. Firelight must have been used in making these cave drawings and engravings.

stock has been subjected. Easygoing conditions are not only without stimulus to new departures, they are without the sifting which progress demands.

As to **PLACE**, it is plain that different areas differ greatly in their material resources and in the availability of these. Moreover, even when abundant material resources are

present, they will not make for much progress unless the climate is such that they can be readily utilised. Indeed, climate has been one of the great factors in civilisation, here stimulating and there depressing energy, in one place favouring certain plants and animals important to man, in another place preventing their presence. Moreover, climate has slowly changed from age to age.

As to **WORK**, the form of a civilisation is in some measure dependent on the primary occupations, whether hunting or fishing, farming or shepherding; and on the industries of later ages which have a profound moulding effect on the individual at least. We cannot, however, say more than that the factors of human progress have always had these three aspects, **Folk, Place, Work**, and that if progress is to continue on stable lines it must always recognise the essential correlation of fitter folk in body and mind; improved habits and functions, alike in work and leisure; and bettered surroundings in the widest and deepest sense.

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