

# Choosing One's Ancestors

by SOLLY ZUCKERMAN

My theme has two beginnings. One relates to the remote ancestry of the Mammalian Order of which man is a member. The other concerns my own ancestral relationship to the subject about which I write.

First, a very brief outline of the Order of Primates. Like all other Mammalian Orders, the one to which we belong emerged some 70 million years ago at the start of the geological epoch known as the Eocene. It soon differentiated into two sub-orders, of which the first and more ancestral was the Prosimii. This is represented today by the lemuriform lemurs of Madagascar, the loriform lemurs of Africa and parts of the Orient, together with the spectral tarsier of the East Indies and the Philippines and perhaps the tree shrews. The second sub-order was the Anthroidea, which today consists of the gibbons and the three great apes, as well as the monkeys of the Old and New Worlds. Man is also one of its members. However isolated the geographical area or areas in which our species *Homo sapiens* may have evolved, we are the only primate which today lives in all habitable parts of our planet—and sometimes even in parts which are not habitable.

The particular division of the Anthroidea to which we, and the apes, belong, and in which all related fossil forms are classified, is called the Hominoidea. A fragmentary series of fossils allows us to track the history of this whole group back some 30 million years into the Oligocene, and that of indisputably human forms back about half a million years.

In theory animals are classified by evaluating resemblances and differences in the largest possible number of their structural and functional characters, and not by reference to some preconceived view of their evolutionary relationships. There is, however, a vast difference between theory and practice; for while the number of characters which could be evaluated in living animals is theoretically almost unlimited, in practice the number that is considered is relatively few. Taxonomists and systematists proceed on the assumption that characters are correlated, and that relatively few are needed to establish the "character complex" of a species.

The gulf between theory and practice does, however, lead to a confusion of the two needs of describing and diagnosing a species. Describing still implies the consideration of as many characters as possible. Diagnosis can often be adequately based on a very small number, whose value as diagnostic features would be simply that they are adequate for the purpose of diagnosis. But this does not

endow the features concerned with any particular merit in the determination of evolutionary relations.

So much for one of my beginnings. The other relates to my own professional interest in the subject of human evolution. This goes back almost 50 years to a time when the human fossil record was mainly limited to a few specimens of Neanderthal man, those beetle-browed, allegedly stooping cavemen who lived in various parts of Europe in its last glacial phases—and who have since been found in other parts of the world. There were also the ape-man *Pithecanthropus* of Java, and a fossil type known as Piltdown man, after the name of the Sussex village near which it had been unearthed. At the time about which I am speaking, fossil apes were essentially limited to a few remnants, clearly ape-like, most of which had been assigned to the genus *Dryopithecus*—the ape of the forests.

But living as I was in South Africa, there were also some black races which were regarded as primitive, and of which at least one, the Bushman, was referred to as a living fossil. Bushmen still exist, but in much fewer numbers than when I was a boy. And then, just before I left South Africa, the picture was abruptly transformed by the recovery of the skull of a young ape-like creature in the Taungs limestone quarry in what is now Botswana. This fossil was immediately proclaimed to be the so-called missing link between apes and man for which people had been searching. It was christened *Australopithecus africanus*, an unauthorized confusion of Latin and Greek.

All this was more than enough to stimulate the imagination, and I must confess that but for an accident I might have become a professional speculator in the wares of physical anthropology, as opposed to having become, over the years, a professional skeptic and critic or, let me say, an anthropological agnostic.

I had already embarked on some research into the comparative anatomy of apes and monkeys and I must have been one of the first of those who had ever studied the skulls of monkeys and apes who was allowed to handle the original *Australopithecine* skull. That was toward the end of 1925, when the newly appointed professor of anatomy in South Africa's second medical school, Raymond Dart, visited Cape Town and took the opportunity of discussing the Taungs skull with his opposite number, Professor M. R. Drennan, who was the first professional anatomist to work in the country. I can still recall my astonishment when, as I was sitting at my bench chipping bits of limestone from a fossil baboon skull. I

## An anthropological agnostic reflects on the subjective and arbitrary nature of the recognition of an ancestor

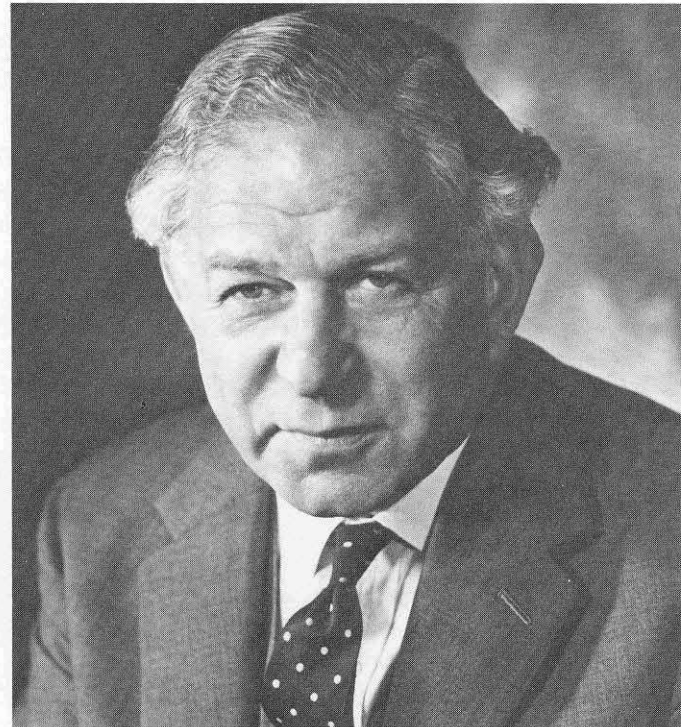
was shown the skull of a young gorilla—at the time one of at most two or three skulls of young apes available for study in Cape Town—and asked whether it was the skull of a chimpanzee or gorilla. I found it remarkable that while Professor Dart had no difficulty in diagnosing that the ape-like young *Australopithecus* was a unique creature totally different from the family of existing apes, and that it was in the direct line of human descent, he could be uncertain about what to call the skull of one of the extant apes.

That was my first real introduction to the presumed techniques—or methods of revelation—used in the study of fossil primates. It was something of a shock.

Soon after I had moved to London as a medical student, I came under the influence of both Grafton Elliot Smith and Arthur Keith, then the two leading British authorities on the subject of the ancestry of man. Neither was much impressed by the extravagant claims which Dart was making about his missing link. Thus in 1931, Keith, after a careful analysis, dismissed Dart's claims; but in 1949 he qualified this judgment and wrote, in deference to the views of his old friend Dr. Robert Broom, who had entered the fray on Dart's side, that whereas he, Keith, differed from Broom about the matter of the evolutionary separation of the Australopithecines from the living apes, he was ready to concede that "of all the fossil forms known to us, the Australopithecines are the nearest kin to man." Broom's view, however, was that the common ancestor of both had already separated in the Pliocene from the line which led both to the great apes of today and to related extinct fossil forms. To him *Australopithecus* was one of man's lineal ancestors.

Elliott Smith, who was a far more distinguished and critical scientist than Keith, was Dart's mentor; but although he probably wished to lend him his support, he knew that at that time Dart was no expert in the comparative osteology of the primates, so that in spite of all Dart's efforts at persuasion, he refused to give his support to this one of his disciples.

On the other hand, he had already lent all the weight of his authority to the claims of Davidson Black, also a former member of his school, who had become responsible for the first official description of the newly discovered Peking man, and who had declared that the Chinese fossil differed sufficiently from *Pithecanthropus*, the Java ape-man, as well as from Neanderthal man, to be placed in a genus, *Sinanthropus*, of its own.



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Elliot Smith, like almost all other anthropologists, accepted and proclaimed this view, but one day, in 1931, he asked me to make an independent review of the subject for a lecture to be given at the Royal Anthropological Institute. I accepted the invitation, but soon found that in their metrical characters—the fossils all looked fairly similar to the naked eye—there were fewer differences between those *Sinanthropus* remains which were then available and certain Neanderthal skulls, than there were in the whole group of skulls that were classified as *Homo neanderthalensis*. Nor were there any significant dimensional differences between *Sinanthropus* and *Pithecanthropus*.

Since it was known that the Neanderthal specimens, although widely separated from each other both geographically and in time, were no more variable than a sample drawn from a homogeneous population of contemporary man, it was clear that something was wrong. Unequal significance had obviously been attached to the peculiarities of all these fossil men, and I therefore felt that one either had to include Peking and Java man in the same genus, or revise the classification of all extinct human fossils. That seemed preferable, so I suggested

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that we should subdivide the Family Hominidae, to which both fossil and living men belong, into the two sub-families, Palaeanthropidae and Neanthropidae—into the latter of which modern man would fit. Elliot Smith immediately abandoned his previous view and accepted this conclusion and, in due course, so far as I am aware, so did other students of the subject. The terms I proposed are no longer used, but to some extent they are implicit in the two that are—*Homo erectus* and *Homo sapiens*.

Once again the subjective and arbitrary nature of the recognition of an ancestor had been driven home to me—but I must confess, this time with hardly any surprise. The more I became aware of the personalities engaged in the subject, the less the subject seemed to be a science than a free-for-all in speculation. When, therefore, the Piltdown story blew up as it did, I was again not surprised—although I still may be when its final chapter comes to be written, if ever it is.

Let me recall the bare outline of the story. Over a period of a few years beginning in 1908, some pieces of a brain case, a piece of jaw, and a lower canine tooth were found by three different sets of men in a gravel pit near Piltdown in the County of Sussex in England. When fitted together, and reconstructed, the cranial fragments were clearly human—whichever of nine opposing reconstructions one considered; to some, however, the jaw and tooth seemed to be those of an ape and not a man. Arguments became shrill. Most of the world's authorities, including men like Alex Hrdlicka, then the leading physical anthropologist in the USA, and Elliot Smith and Arthur Keith in England, were convinced that the skull and jaw came from the same individual, and that the ape-like appearances of the jaw and tooth were, in fact, illusory. Only a few took the contrary view.

Then in 1935 a dental surgeon named Marston discovered another and indubitably human fossil skull, now known as the Swanscombe skull, after the name of the village in Kent near which it was found, and his suspicions became aroused about the Piltdown specimen. He was convinced that the jaw was that of a chimpanzee. Other people's interest was then stirred, and it was decided to use the fluorine test to see if the jaw and skull were of the same age—the fluorine content of bone increases with geological age. It soon became apparent from this and other tests carried out later that the Piltdown jaw, tooth, and skull did not belong to the same individual. All had been planted, and the whole thing was a deliberate hoax.

I seem to have been the only person who in public comment at the time was far less interested in the fraud itself than in the fact that it showed that the most distinguished anatomists and primate palaeontologists were unable to diagnose, by reference to so-called anatomical

criteria, what was human and what was ape-like. This brings me back to *Australopithecus*.

The key persons in this story after Dart were Broom and Le Gros Clark. I say key persons because, as I think I have shown, the assessment of fossil remains which might bear on human ancestry has depended up to now far less on science than on advocacy and authority and on *ex cathedra* statement. One reads time and time again in the literature of the subject that this or that must be so because more people believe that it is than do not. Scientific truth has, however, never depended on a counting of heads!

Broom was the only South African scientist of any renown at the time *Australopithecus africanus* was unearthed. He was a Scot by birth and, after graduating in medicine from Glasgow, had emigrated, first to Australia, and then to South Africa, where he built up a considerable reputation as a palaeontologist. He was a man of colossal energy, and soon became the leading authority in the world on Triassic mammal-like reptiles, for the collection and study of which he was prepared to sacrifice anything and everything. Sometimes he practiced

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as a country doctor, sometimes he served as a professor, sometimes he was a dealer in fossils; but whatever he did, his main concern was palaeontology. He was a man of firm belief and considerable character. At one point in his intermittent career as a general practitioner he had taken up the job of medical officer for two gold mines. That was in 1909. Within three months of making his home in what was then the township of Springs on the East Rand, he was mayor of the town and president of its chess and revolver clubs!

Fossil reptiles were the central interest of the main part of Broom's scientific life, but there was no fossil about which he was not prepared to offer an opinion. He did a certain amount of not very profound work on South African fossil mammals. He had also entered the debate about the significance of a fossil human skull found in a place called Boskop about 150 miles from Taungs. This skull clearly falls into the range of modern man, but to Broom (presumably because it was a fossil) it was a primitive species of man for whom a separate species—*Homo capensis*—had to be created.

Broom believed himself to be capable of recognizing immediately whether a fossil which came into his hands

was something he had seen before, or something he wished to declare unique. He was what is known in the world of taxonomy as a “splitter,” the opposite of a “lumper,” and he loved inventing new species. He had a considerable visual memory, and an ability to remember the detailed characters of a particular specimen. But he was little concerned with the degree of variation to which all species are subject. There are some revealing passages in the official biography written of him for the Royal Society of London by the late Professor D. M. S. Watson. One is worth quoting in the light of what is to come. “As soon as he had satisfied himself about the structure of a specimen,” wrote Watson, “he made a drawing of it . . . and as sutures in Karroo skulls are commonly obscure and not easy to follow, he inked them in, thus nearly ruining the specimen by preventing any other person from forming an unbiased opinion.” No wonder Watson also writes that in his later years Broom did not move with the times!

For Broom, who believed that physical evolution had come to an end, and that modern man was the pinnacle of the Lord’s design, the Taungs and other Australopithecine skulls which have been unearthed since 1924 were not only a godsend, but—and this he stated in a personal record he left—a godsend designed by Providence personally for him.

With Elliot Smith’s death, and the retirement of Arthur Keith, the late Professor Le Gros Clark became the doyen of British anatomy. His research interests were modeled on those of Elliot Smith, and in addition to neuroanatomy, they included primate phylogeny and human evolution.

At first Le Gros Clark was among those who were wary of the claims that Dart and Broom were making about the Australopithecines. But soon after the end of the Second World War, he was persuaded by them—and I believe by the late Dr. Leakey as well—to abandon his earlier scepticism and to agree that the South African Australopithecine fossils were “early representatives of the hominid line of evolution and quite distinct from the pongid (i.e., simian) line.” As he put it, “The Australopithecinae conform very closely to theoretical postulates for an intermediate stage of human evolution,” and are “exceedingly primitive representatives of the family which includes modern and extinct types of Man.”

Largely owing to Le Gros Clark’s support for the views of Dart and Broom, the Australopithecine story soon became part of textbook orthodoxy. Analyses which pointed to a contrary view were either ignored or brushed aside as uninformed and inaccurate. Clark had embarked on a new mission and was unwilling to face or to answer the results of studies which showed that the anatomical facts about the Australopithecines were not always those claimed for them.

No one, not even the most ardent Australopithecine addict, has suggested that the general appearance of the Australopithecine skull is human—as opposed to ape-like. No specimen yet found has a cranial capacity even as large as the largest recorded figure for one of the living great apes. Several specimens—including *Zinjanthropus*—have sagittal and nuchal cranial crests of the kind found in the great apes, and particularly in male chimpanzees and gorillas.

The great Cuvier is reported to have said: “Give me any bone of an animal, and by correlation I’ll be able to reconstruct the whole skeleton.” The school of Australopithecine enthusiasts seemed to be saying: “We know what one of our ancestors should look like—give us any bone, or bony fragment, and we’ll be able to describe it in such a way that it fits a picture of a skeleton which we are certain was the frame of one of man’s lineal ancestors. And for good measure we will also tell you about its love life—that is, if you want us to. Or how it lived, what its birth weight was, and so on, and so on.” As it has turned out, however, the attempt to turn anatomical principles inside out so as to uphold a preconceived phylogenetic conclusion has proved to be as unnecessary as it was unconvincing.

The three critical sets of change which transformed a presumably simian into a human form have for generations been supposed to be the development of the brain, associated with the continued elaboration of the visual, tactile, and acoustic sensory pathways, and with it of speech and a conceptual language; the emancipation of the forelimb, with the retention by the hand of many primitive features, such as a fully opposable thumb; and the assumption of an upright stance. I shall say nothing further at this point about the brain of the Australopithecines, except to remark that their cerebral equipment was even smaller than was previously claimed—and that was small enough! Nor, because little that can be relied upon has been either released or published on the subject, shall I deal with the forelimb and the hand. Let me return to the question of upright stance.

The suggestion that the Australopithecine creatures were, in effect, small, pinhead but upright, men was first made, as I have said, because of the assumption that the head was balanced on the trunk as in man and not as in apes. It was then backed up by reference to the apparently human characteristics of the pelvic bones. Still later came vague statements to the effect that the inference that the Australopithecines walked and ran as we do was also implied by the anatomical nature of certain limb bones.

I have already spelt out in print why all these *ex cathedra* pronouncements have to be rejected. In brief, the

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**The subject seems to be less than a science and more of a free-for-all in speculation**

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Australopithecine enthusiasts have simply been focusing on features which they regarded as human, and have disregarded others which might be more simian, or which are neither human nor simian. The most extensive and detailed bio-mechanical and statistical analysis of the pelvic girdle of living primates that has yet been carried out, and which has only recently been published, showed that while the locomotor pattern of *Australopithecus* cannot be deduced with certainty, it must—because of the almost certain lack of any powerful source of abduction of the hip—have been significantly different from that typical of man. In features relating to weight bearing, the creature resembled man rather than the sub-human primates, whereas in features relating to muscular pull it was the other way round. The locomotor pattern of *Australopithecus* was probably therefore unique, since in the whole complex of functionally significant features, the pelvic girdle of these creatures was markedly different from all living primates—man included. Also recently published is a study which shows that many of the reconstructions of Australopithecine fragments on which students have based their work incorporate major anatomical errors, including the misidentification of the midline in the fossil pelvic material. It also now turns out that until recently we have also been misled about the mid-sagittal line of the original Taungs skull itself. A revised reconstruction of the fossil by Holloway (1970), shows that the endocranial volume of the Taungs skull is some 25 percent less than what had been claimed hitherto, and that previously published values of *all* the South African fossils were “highly over-estimated.” Even when highly over-estimated, they still fell well within the ranges for existing apes!

Mistakes in the diagnosis of the midline of hominid fossils have been made

before. One of the more celebrated concerned the Piltdown skull, and resulted in an acrimonious dispute between several distinguished anatomists of the time. Another has recently come to light in connection with the mandible of what is still described as the most ancient of all hominid remains, a specimen called *Ramapithecus wickeri*, which was found by L. S. B. Leakey in Tanzania and which he had classified with corresponding mandibular and maxillary remains found in Miocene deposits in India. The basic reason for regarding *Ramapithecus* as more human than ape-like was the belief that its dental arcade was rounded as in man. A recent and more careful reconstruction by Walker and Andrews (1973) now shows that a mistake was made about the midline of the specimen, and that when this is corrected, the general disposition of the jaws is less parabolic than it is U-shaped, as it is in apes.

Almost more important than all this, and indicating that the Australopithecines were probably on some kind of sideline in the story of human descent, is the fact that some fossil remains have recently been unearthed in East Rudolph in Northern Tanzania from a deposit which is estimated by radiometric and palaeomagnetic determinations to be nearly three million years old—two million years older than anyone assumes the limestone deposits were in which previous Australopithecines were found. The new finds included the fragments of a skull and a complete left femur. The cranial fragments have lent themselves to what appears to be a fairly undistorted reconstruction of a skull which, while certainly not human, is equally less simian than any other Australopithecine. The sides of the cranial vault are not sloping, as in the typical Australopithecine and ape, but more vertical, as in man. There is no sagittal, and no indication of a nuchal, crest. The endocranial capacity is estimated at 800 cc. The associated femur is said to have been predominantly human in character.

Enough has already been published about these finds to make me believe that if this skull and the associated femoral remains had been found 20 or 30 years ago, few of the writers on the Australo-

pithecines would have wished to turn anatomical sense inside out in order to prove that these ape-like creatures were men who had disguised themselves with false cranial crests and other simian characteristics in order to test our anthropological faith. Whatever the new skull turns out to be when properly studied, it has already proved the futility of anatomists, and sometimes amateur anatomists and journalists, staking their reputations on a presumed ability to recognize marginal hominid characters in a mythical “total morphological pattern”—to use Le Gros Clark's phrase.

But, as the history of the subject has shown time and time again, there will never be any dispassionate study if it is merely based on so-called anatomical judgment. Measurement and statistical analysis have to come into the assessment of marginal differences in the shape of corresponding bones. Happily, the development of high-powered electronic computers has opened up the way to methods of analysis which were inconceivable even ten years ago. When properly used—and this means that the anatomist or physical anthropologist needs to be guided by a professional, even if he is himself mathematically minded—such techniques can help significantly in checking anatomical judgments.

I am certainly no professional, and in these matters I—and this means my students too—have always insisted on collaboration with the best help available. But judging by some of what I have been reading lately, this lesson has not been learned by the majority of anatomists now attempting to assess the significance of anatomical features which can be defined metrically.

This is not the only lesson which one should bear in mind when one approaches the problem of choosing one's ancestors. Another is that it is an incredibly difficult choice, one so difficult that the sceptic could justifiably argue that it is not one which could ever be part of a branch of science proper. The problem is difficult not only when one tries to delve into the remote past of our Mammalian Order. It is equally difficult when one tries to unfathom the

relations of different races of man in a period of, say, the past ten to fifty thousand years, for which there is immeasurably more material available for study than for the longer period with which this paper deals. Cavalli-Sforza, who has attempted to make a phylogenetic study of human ethnic groups by genetic analysis associated with field studies of food-gatherers and hunters, and who postulates that the genetic divergence between two populations increases with their separation in time, holds that there are only three major ethnic groups. Carleton Coon tries to persuade us that modern man has a polyphyletic origin—in his particular variant of the theory, the belief that *Homo sapiens* consists of five distinct sub-species (whites, mongols, australoids, and two kinds of black men), all of which have descended independently from different variants of the now extinct human type *Homo erectus* which lived in Java and China some half a million years ago. Buffon, Immanuel Kant, Lamarck are among the many who count as Carleton Coon's illustrious predecessors. But most of what they wrote on the subject, like much of what modern writers have written, constitutes no more than speculation, and some provide the reader with light entertainment rather than serious science. I remember one book, which first appeared in 1924, under the title of *The Mongol in Our Midst*, from the pen of a well-known English physician of the day named Dr. F. G. Crookshank, in which it was forcefully and wittily argued that the mongol and the orang-utan share a common ancestor, the negro and gorilla another, and what he called the Mesopotamian Semite and the chimpanzee a third.

If, in spite of the help provided by genetical, biochemical, and serological analysis, we are unable to make much progress in the study of modern racial relations, why should we pay all the attention we do to speculations about our remote past? Hundreds, perhaps thousands of millions of members of the Hominoidea must have walked on earth since the Miocene. Of these, only a few hundreds at most, distributed in various parts of the globe over a time scale of ten, twenty, thirty million years, have

left us fossilized fragments of their skeletons, and of these only a few not so crushed and distorted, or so fragmentary, as to allow of reasonable reconstruction. It stands to reason that only by chance could more than a handful, if indeed any, be in the direct line of human descent. Alternatively, we could assume that all were, in which case the whole concept of a single line of descent becomes spurious. As Gaylord Simpson has put it: "Much of the rectilinearity of evolution is more a product of the tendency of the minds of scientists to move in straight lines than of a tendency for Nature to do so." As an alternative hypothesis, we could therefore suppose that there was some radiating network of hominoids within which one, two, or even more strains became selected as creatures which were going to develop human characteristics, and above all the capacity to use an articulate language as a vehicle for both real and abstract concepts. For that is the critical point. An upright, inarticulate pinhead like the mythical *Australopithecus* would not climb as far on any evolutionary ladder to humanity as the beetle-browed, slouching caveman of the upper Palaeolithic of twenty to thirty thousand years ago, who left us those superb paintings in the caves of Lascaux, and in southern Europe. Even if they walked on all fours, those cave-men artists of the old stone age would have been superior to an upright *Australopithecus*, given there ever was such a thing!

If any credibility is ever to attach to the subject of human and simian palaeontology, we shall need to be assured of certain vital conditions. First, there should be no secrecy on the subject. If a fossil is found it should not be hoarded and studied in some ignorant isolation, but disseminated to serious students in the form of photographs, measurements, and accurate casts of the separate fragments—separate and not assembled in some total reconstruction which as often as not proves inaccurate.

Second, the dating of the deposits in which fossils are found, and of the fragments themselves, where this is possible, should be carried out by competent people who have no interest in the answers, one way or the other, but who

should also be able to give an objective judgment about the contemporaneity of relatively adjacent finds.

Third, the task of studying the fossils should be entrusted to people who know both their anatomy, human and comparative, and who also know, or are ready to learn, how to use and analyze measurements, and how to apply modern methods of analysis to stress configurations. There must be an end, as it were, to people who have never been to an art gallery or who have never studied the subject, telling us that a picture that they happened to buy for \$5 in a junk shop is a Rembrandt.

Fourth, the work should be done by people who know something about population genetics and about rates of evolutionary change in vertebrates as a whole.

And fifth, and last, it should be done by people who start out knowing that what has been left by chance in a fossil deposit need not necessarily have any significance whatever to the story of our human lineage.

Several years ago there was a chimpanzee in the London Zoo with a presumed artistic bent, that painted pictures—some of which were indeed sold. But after the man who was then curator of mammals left (he was later the author of a popular book called *The Naked Ape*), the zoo's chimpanzees went back to their old degenerate ways as apes, and showed no inkling of any human artistic feeling. I sometimes have a notion that when some modern students of the behaviour of apes and monkeys in the wild turn their backs on their subjects, the animals may fail to live up to what is due to be written about them! Equally I realize that the hominoid fossils that are already available will enjoy an even greater constancy than do the living apes, and that perhaps they may still provide us with an ancestor when what has so far been written about them is largely forgotten. It is salutary to think how much more confusing the whole story would be if the great apes of today were known only from fragments of fossil bone, and if we had had to speculate about their ancestral relationship to us, as well as that of the *Australopithecines*! □