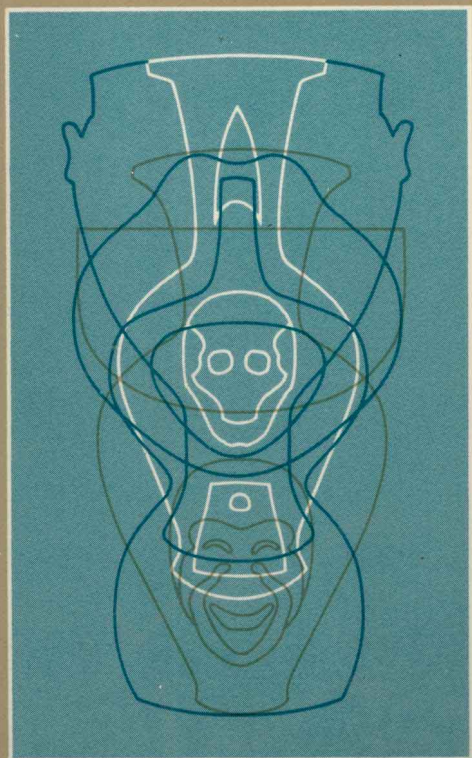


The
STAGES
of **HUMAN**
EVOLUTION

HUMAN AND CULTURAL ORIGINS

Third Edition



C. LORING BRACE

third edition

The Stages of Human Evolution

HUMAN AND CULTURAL ORIGINS

G. LORING BRACE, University of Michigan

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To Mimi

*whose contributions are even more
than those that are so graphically
apparent.*

Looked at from this point of view, the Neanderthal and Pithecanthropus skulls stand like the piers of a ruined bridge which once continuously connected the kingdom of man with the rest of the animal world.

William J. Sollas, 1908

Preface

Of all the subjects that have provoked the play of human curiosity, few equal our concern with our own prehistoric origins. At the same time, few subjects have been the target for so much unprofessional speculation. Although the present work does not reduce the quantity of speculations (quite the reverse), it is my hope that they can, technically at least, bear the label of *professional* speculations. Part of the reason for the less-than-abundant work on human origins is that, in this material world, such efforts can produce little measurable gain. Physics can produce bigger and more expensive explosions, basic biology can introduce medical breakthroughs, geology and economics can contribute to our mineral and monetary well-being. But prehistoric anthropology, in contrast, can reveal only the humble nature of human beginnings, and this has dubious value as a marketable commodity. Many have regarded it as an interesting hobby, but few have been tempted to treat it as a serious career and devote lifelong concentration to its advancement. Even at the professional level, the competition to qualify has often been less than it is for other fields. Consequently, there are fewer jobs, and hence fewer practitioners, with the result that advances and accomplishments have been far less spectacular than has been the case with, for instance, genetics or electronics. The subject is fascinating nevertheless, and for the professionals, its pursuit is quite satisfying in and of itself.

It is the purpose of this volume to communicate a modicum of this interest to the reader, young or old; perhaps to kindle the spark of what might grow to be another professional career; and to add a possible modifying influence, however minor, to the understandable human tendency to magnify our present accomplishments to the point that we are inclined to forget how precarious was the very existence of our predecessors until the recent past—and perhaps may be again in the immediate future.

C. Loring Brace

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chapter one

Interpreting Human Evolution

SCIENCE AND RELIGION

As a general rule, there need be no conflict between science and religion. Many scientists are deeply religious people, and, although occasionally their manifestations of religious belief are on the unorthodox side, they are frequently of one or another traditional denominational stance. The Darwinian theory of evolution also is not viewed as being incompatible with the vast majority of organized religious systems, even when evolutionary expectations are applied to the human condition. The largest Christian denomination, the Roman Catholic Church, has faced the matter squarely and has published the results of its deliberations in a series of key papal encyclicals—*Providentissimus Deus* and *Divina Afflante Spiritu*, in 1943, and *Humani Generis*, in 1950. In these, Pope Pius XII declared that the Bible was a religious and moral document and was not intended as a discourse on geology and natural history. He concluded that evolution was a perfectly valid hypothesis, and that evolutionary research and teaching were perfectly valid enterprises that did not conflict with or overlap the concerns of the church as long as they did not presume to deal with matters of morality and the human soul.

Most scientists and members of the clergy are perfectly content to leave it at that, but people in some denominations find aspects of science—particularly those that deal with human evolution—in conflict with their basic beliefs. Among these are certain “fundamentalist” Christian groups who declare that the words of the Bible recount literal truth, and anything else therefore is wrong by definition. According to them, evolution is in conflict with their religion. I can do nothing to help readers with such a starting presumption, other than to say that this book is not for them.

Of course, those who start from such a position also start with something of a conundrum, because at the very beginning of the Bible, Genesis 1 lists a very different order for creation than Genesis 2. If indeed

the words of the Bible are to be taken literally, then Genesis 2 must be wrong because it contradicts Genesis 1. But if the Bible "cannot be wrong," then two successive chapters that say opposite things must both be right, even if that is logically impossible.

Although this "most ingenious paradox" may worry the literal-minded theologian, it is beyond the realm of science. So too is that contradiction in terms, "creation science"—offered by the same fundamentalist Christians as deserving equal time in the classroom with evolutionary biology. The interpretations offered by evolutionary biologists can be put to the test by experiment and the collection of relevant data, and, if they are found wanting, they are discarded. "Creation science," on the other hand, cannot be tested in such a way, and its proponents will not accept the possibility that crucial experiments or collected data could lead to its rejection. For this reason, "creation science" cannot be science.

GOD AND THE GAPS

The fossil record is admittedly incomplete, because the vast majority of the creatures that lived in the past have died without leaving a trace. The appearance of change as one ascends the picture in superimposed strata tends to be discontinuous, with gaps of varying length between the earlier and the later sections. The different appearance of sequential forms has been taken by some to be a proof for the existence of God.

This, however, has to be about as demeaning a criterion for demonstrating Divine Existence as one can imagine, and it does little credit to those who accept such a test. It purports, in fact, to use human ignorance as a proof of Divinity. When gaps are filled in, as is being done year by year, what does that do for the nature of the God who was postulated to account for them? To use gaps in our knowledge as proof for the existence of God is, in effect, to deify ignorance.

We are finite creatures, and our knowledge will always have its limits. But to deny the efforts of scientists and scholars to try to extend those limits and to glory in our imperfections is to do less than justice to our potential capacity to learn about the endless variety and mechanics of the natural world—itself something that is far more worthy of the designation "Divine."

EVOLUTIONARY EXPECTATIONS

Few among the educated and no serious scholars doubt that *Homo sapiens* evolved by natural means from a creature which today would not be considered human. From this initial point of agreement, the thinking of those who are considered qualified to judge diverges to such a degree that many feel we do not have a basis which is adequate enough to warrant any interpretation at all. Yet schemes have been constructed that attempt to arrange the prehistoric evidence and account for the course of human evolution. The pages that follow present and discuss the strengths and weaknesses of a number of these.

Since it is generally agreed that evolutionary thinking should be applied to the course of prehistoric human development, it would seem

unnecessary at first glance to consider the nonevolutionary or even antievolutionary views of pre-Darwinian thought. As we shall see, however, the differences between several of the attitudes discernible at the present time can be traced in part to the lingering influence of a current of thought that has specific pre-Darwinian sources. Once this has been identified and the historical connections have been traced, the reason for the differences between the major opposing interpretations will become obvious, and we shall have some basis for making a choice between them.

Interpretations of the human fossil record can be arranged along a spectrum between two polar and opposed approaches. At one extreme is the school that takes all the known hominid fossils, arranges them in a lineal sequence, and declares that this is the course that human evolution has pursued. The other extreme is the school that declares that the great majority, if not all, of the available fossil record has nothing to do with the actual course of human evolution. The probability that any given fossil has descendants that are still alive is so vanishingly small that to declare otherwise is to be guilty of the unscientific stance of "ancestor worship." Furthermore, the course of evolution is never a straight, unbranching line—witness the diversity of related forms in the organic world today—and we should expect to find branches and specializations among human fossils. This latter view tends to regard the differing fossil hominids as "specializations" away from the main line of human evolution, which eventually became extinct without issue. And, because the chance that a given remote fossil was literally ancestral to anything still alive is clearly almost zero, it can be completely discounted for all practical intents and purposes. Countering this is the argument that, although indeed any given prehistoric individual is unlikely to have living descendants, the *population* to which it belonged certainly may be ancestral to continuing populations, and said individual is our best bet for getting a picture of what the members of that potentially ancestral population actually looked like.

People are invariably fascinated by investigating the skeletons in their closets, and, in the field of human evolution, we could say that this is *literally* the case. This fascination has led many people, amateur and professional, to write about the human fossil record—people who have not been fully qualified and who have failed to perceive the nature of the two schemes just mentioned. As a result, many authors prefer some hazy middle ground since they feel that both schemes have some merit. Consequently, few authors today represent the poles in fully developed form.

In the first edition of this book, one of the extreme positions was specifically defended—the linear scheme mentioned above—not because there was conclusive proof for it, but in an effort to follow the principles expounded by the medieval logician, William of Occam, for whom the best explanation was always the simplest. At the time, it appeared that the complexities of the most widely accepted interpretive schemes were more a product of the minds of their advocates than they were the necessary result of the available facts. Simplification, however, can be pushed too far, and the wealth of discoveries over the last twenty years have clearly shown that a rigid unilinear interpretation is, in fact, an oversimplification.

It is still true, nonetheless, that the simplest interpretation that accounts for all of the facts is the one that should be accorded top preference. And, as we shall see, the one offered here is the simplest one available. Certainly the student will discover that it is the easiest one to learn.

More of this later, but first it should be instructive to sample the various other current views on the course of human evolution. First among these, and generally regarded as most traditional, is the view that the different forms in the human fossil record are the results of the adaptive radiation of the basic human line. At present, several versions are being stressed: one that treats the entire human fossil record as a picture of divergent "specialized" lines, most of which became extinct without issue; another that concentrates on the earlier parts of the record where various "specializations" are supposed to have occurred; and finally one that concentrates on the latter part of the record where the Neanderthals are identified as "specializations" on their way to extinction. Running through all of these is the tendency to deny possible ancestral status to any fossil that differs from modern form to any marked extent. To some degree, then, these schemata focus more on assertions concerning how human evolution presumably did *not* occur than on trying to find out what was actually going on.

TIME, GEOLOGY, AND FOSSILS

To understand these applications and the criticisms that can be made of them, it is first necessary to gain some sort of perspective on the time scale in question, the fossils concerned, and the principles involved. Briefly, it has become apparent that the span during which the events of human evolution occurred was not just 300,000 or 800,000 years, as was once believed, but somewhat more than 3 million years in duration. Previous estimates were based largely upon guesswork involving sedimentation rates and stratum thicknesses. This recent reappraisal is derived from the work of geophysicists who have utilized the known and constant rates of decay of radioactive elements into their stable end products, especially the decay of Potassium 40 into Argon.

The Potassium-Argon (K/A) proportion in ancient volcanic rocks is directly related to the length of time since they have cooled, and, although many pitfalls are connected with the use of this technique to date strata in the recent past (3 million years is dewy fresh in the full perspective of geological time), it is becoming increasingly apparent that the duration of existence of the human line has been sufficient that we need not invoke an unusual rate of evolution to account for all the changes the human fossil record reveals.

The geological period during which human form did most of its evolving is called the Pleistocene, which extended from about 2 million years ago to 10,000 years ago—if indeed it can properly be considered to have ended. The oldest of our close fossil relatives are found in the Pliocene, some 3 million and more years ago, and are referred to as Australopithecines. These flourish for a span of about 2 million years, during which time they display a diversity of size, form, and robustness

that has been the subject of some vigorous scholarly disagreements. The size spectrum runs from the modern average for bulk and stature down to creatures only half as large. The earliest ones appear to be small, and the most robust ones appear to be late, but it is abundantly clear that little ones continued to exist at the same time that big ones flourished. Aside from their sometimes different bulk, the most evident points of distinction between the Australopithecines and modern humans are in the head and face. Simply stated, the Australopithecine head is smaller—the brain is scarcely more than a third the size of the modern average—while the faces and teeth are enormous.

At the moment, there is a healthy professional brawl going on over the relationships between the various robust and gracile Australopithecines to each other and to the larger continuing picture of human evolution. A solution to the controversy is suggested later in this book, but for now this initial brief sketch is offered so that the reader can have some framework on which to arrange the arguments that follow.

Another cluster of hominid fossils, which can be called Pithecanthropines, dates from the middle of the Pleistocene, some half a million years ago. Among these fossils, brain size is double that of the Australopithecine and about two-thirds that of the modern norm. Molar tooth size has dropped markedly from Australopithecine levels, and a remarkably robust skeletomuscular system is maintained. In the Upper Pleistocene, immediately prior to the appearance of people of recognizably modern form, there is a fossil group which has been called the Neanderthals. These are characterized by the achievement of fully modern levels of brain size but the preservation of most of the rest of the characteristics of the Middle Pleistocene Pithecanthropines. To be sure, other fossils are unevenly scattered, in both the geographical and temporal sense, which provides a source for much of the disagreement that still surrounds any attempt to develop a systematic view of human evolution. But the foregoing should provide a useful outline to remember while the discovery of the human fossil record is being recounted.

The scheme that is developed in later chapters essentially takes these major blocks of fossil hominids, arranges them in a temporal sequence, and explores the evolutionary logic that can be used to show how the earlier ones evolved into the later ones. These major groups form the evolutionary stages through which it is claimed that the human line passed. Yet it should also be remembered that the identification of these supposed "stages" is largely dependent upon the accident of discovery. A few rich sites have provided concentrated evidence for particular forms of human fossils, and it is not only possible but extremely likely that, had these rich sites involved different time levels, then the identification and number of important stages in human evolution would have been rather different. On the other hand, the present stages perceived are adequate to represent the changes involved, and their consideration can be justified in terms of their utility.

Ultimately, when the entire time spectrum of human existence is documented by an as-yet-unforseeable abundance of fossil evidence, the picture should be one of a gradual continuum of accumulating change,

with no visible breaks between what are here considered as stages. Even this, however, is vigorously disputed by one currently popular set of theoretical expectations, but this will be treated in a later chapter. In contrast, the view presented here is that human evolution has been continual in the past, it continues in the present, and it will continue in the future. Our concern in this book, however, is with the changes that have taken place in the past. One of the principal objects of this book, then, is to attempt to apply Darwinian principles to a field that has often honored his name while neglecting the use of his perspective.

The first concern, however, is to examine the sequence of discoveries and interpretations that led us to the position in which we now find ourselves. Interpretations of the major pieces of evidence are heavily conditioned by the attitudes prevalent at the time and place of their discovery. Traditions of interpretation, once established, tend to continue, whether or not subsequent evidence provides justification. The story of how we became aware of the evidence for our predecessors, who made the discoveries, and what they thought it all meant is a fascinating one in itself. And in its telling, we can come to see how the various modern interpretations arose. This, then, is the purpose of Chapters 2 through 6.

chapter two

Fact and Fancy before 1860

BEFORE THE NINETEENTH CENTURY

The earliest recognition of a fossil human was accorded a skull fragment discovered in the year 1700 at Canstatt, near Stuttgart in western Germany. At this early date, however, there was not even the remotest suspicion that modern living forms, including human ones, might have evolved by natural means from earlier forms ultimately quite different in appearance. Nor was there any faint hint of the vistas of geological antiquity that research was to reveal in the subsequent century. The Canstatt skull was accepted by some as evidence for human existence in ancient times, but its form was not different from that of modern human form, and "ancient times" were measured in terms of a total span since creation—thought to be somewhat less than 6,000 years.

As late as the middle of the seventeenth century, the vision of such antiquity was considered somewhat daring, although it had received a certain amount of religious sanction in the work of the biblical scholar James Ussher, the Anglican Archbishop of Armagh in northern Ireland. Computing from the named generations recorded in the Bible, Ussher arrived at the conclusion that creation had occurred in the year 4004 B.C. To this, the Reverend Dr. John Lightfoot, vice-chancellor of Cambridge University, added the pronouncement that "... heaven and earth, centre and circumference, were created all together in the same instant, and clouds full of water. This work took place and man was created by the Trinity on October 23, 4004 B.C. at nine o'clock in the morning."

By the end of the eighteenth century, 150 years later, appraisals of geological processes and accumulating knowledge of the structure and strata of the earth led to the suspicion on the part of some people that the earth was really very much older. Fossil remains of extinct and different animals had been discovered, and scholars were becoming aware that the world had been a very different place in ages gone by, and that

great changes had occurred. A few people even noted that the shaped pieces of flint discovered in prehistoric strata might be human tools made before the discovery of metallurgy, and certainly historians and students of human institutions were aware that the human world had changed even in the recent past.

Early in the nineteenth century, the French biologist Lamarck tried to promote a view that continuous and accumulating change was the normal state of affairs. He really was a thoroughgoing evolutionist, but the mechanism that he proposed to account for organic change was invested with an element of unscientific mysticism, and his position has subsequently been generally rejected. The initial reason for this rejection was the fact that many people were emotionally unprepared to accept change as the normal expectation. The traditional view that the world was created fixed and changeless had both social and religious support, and a scheme proposing the normality of constant change was regarded as a threat to the established order. Yet change could be seen in the geological record of the remote past, and some sort of explanation was demanded.

CUVIER AND CATASTROPHISM

An acceptable solution was proposed by another French scholar, Georges Cuvier, who was a younger contemporary of Lamarck. The English philosopher of science William Whewell coined the term "catastrophism" to describe Cuvier's scheme. It claimed that the various geological layers had been deposited as the results of a series of cataclysms that had overwhelmed the planet periodically, extinguishing all previously living organisms. According to this scheme, the last of these cataclysms was the Biblical flood, which meant that human remains should not be discoverable in earlier layers. Cuvier is credited with the statement: "Fossil man does not exist." And indeed, in the early nineteenth century there was very little known evidence to contradict such a position.

Cuvier was somewhat vague concerning the origin of the new animals that appeared in the strata overlying his various supposed cataclysms. Such cataclysms need not have been worldwide, he noted, because the detailed geological sequence in one part of the world tended to differ from the specifics of sequences in other parts of the world. Following the presumed cataclysm that eliminated the living forms in one given area, then, he suggested that those which had continued to live in places not so affected might just migrate into that now-empty region. Ultimately, however, in order to account for the disappearance of all former types of organisms and the continued emergence of the new and different, Cuvier's stance gave support to a philosophy of successive creations. With the development of Darwinian evolutionary theory in the middle of the nineteenth century, the view of supernaturally caused extinctions, migrations, invasions, and successive creations was superseded as a general explanation. Yet, because of a variety of historical accidents, something of this has survived into the present in the traditions of paleontology—especially that part of paleontology particularly concerned with the matter of human origins: paleoanthropology.

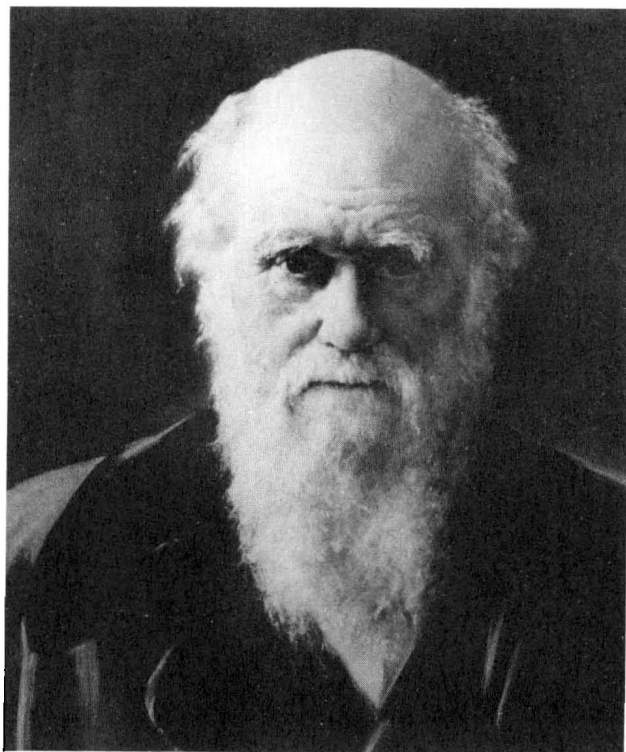


Georges Cuvier (1769–1832), zoologist, comparative anatomist, paleontologist, and unwitting influence on many of the subsequent attempts to interpret the human fossil record. (Brown Brothers.)

The discovery of the fossil and archaeological evidence for human evolution was the result of the fieldwork of people who had very little concern for the research that developed the evolutionary explanation for the origin of organic diversity and organic change, yet both realms of activity have parallel careers extending back into the eighteenth century. Archaeological and paleontological work could and did go on without much concern for theoretical implications. Even though Cuvier was specifically opposed to evolution, he can be regarded as the founder of paleontology, a discipline that, ironically, provides the most direct evidence in support of evolutionary theory. His intellectual descendants (and other unrelated antiquarians and archaeologists) pursued their diggings right up into the twentieth century, often with quite incorrect assumptions concerning their interpretations; today these figures are the principal sources of the other interpretations of the human fossil record that we discuss in later chapters. Darwin, on the other hand, used relatively little paleontological evidence to support his major insights. This was partly because of the very incomplete nature of knowledge concerning the fossil record, and partly because his concern was focused on the attempt to explain diversity in the world of *living* organisms.

DARWIN AND THE ORIGIN

Although it has remained for the twentieth century to attempt a synthesis of the study of the present with the study of the past, scholars in both areas have not been unaware of the implications each has had for the other, and the public has been sensitive to this from the beginning. This still shows in the common misconception concerning the title of Darwin's most famous book, *On the Origin of Species*. From the time of its appearance right up to the present, people who were not thoroughly familiar with the book assumed that it suggests a common ancestry for apes and people, and that the "species" in the title refers to humanity itself. This latter assumption is so strong that the title is frequently misquoted, as *The Origin of The Species*. Actually, only one brief sentence at the very end of the book makes any reference to humans at all, and this is thoroughly noncommittal. Darwin's concern for human evolution was reserved for expression in another book, *The Descent of Man*, published more than a decade after his *Origin*. Even here, however, his reference to the skimpy fossil and archaeological record of human prehistory is brief in the extreme.



Charles R. Darwin
(1809–1882), author of
On the Origin of Species
and acknowledged
father of evolutionary
thinking. (National
Portrait Gallery,
London.)