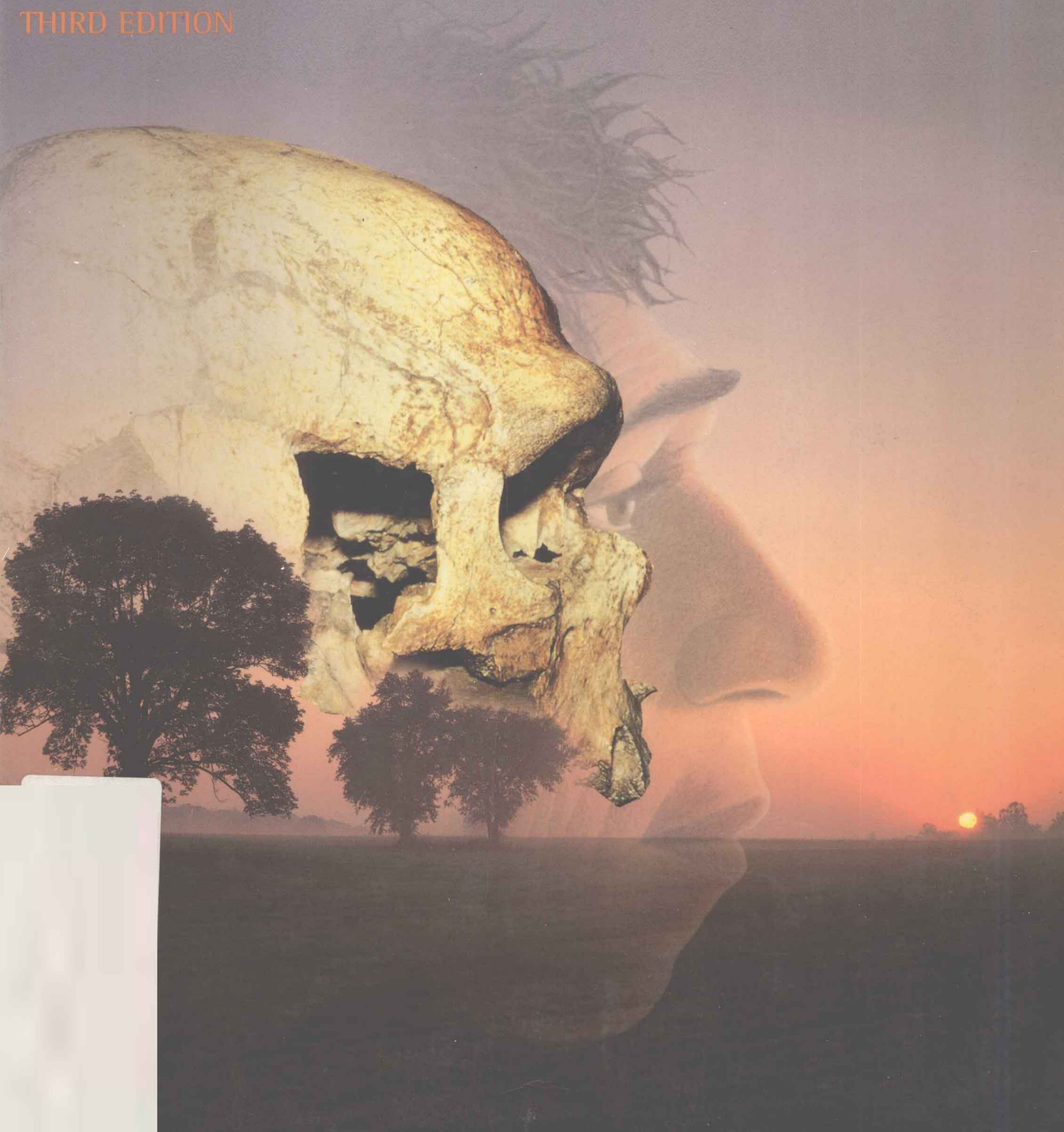


OBERT JURMAIN / HARRY NELSON / LYNN KILGORE / WENDA TREVATHAN

ESSENTIALS OF PHYSICAL ANTHROPOLOGY

THIRD EDITION





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As with earlier versions, this edition of *Essentials of Physical Anthropology* is designed as a condensed approach to introducing the field of physical anthropology. This text is meant to provide a complete overview of our field, but in a more concise format than in our full text, *Introduction to Physical Anthropology*. As such, many topics are reorganized and much of the supplementary boxes and so forth found in the full text is not included here. On the other hand, recognizing a distinctive audience, some features *not* presented in the larger text are part of this book (such as the photo essays and the final chapter, “Lessons from the Past, Lessons for the Future”).

This edition also has numerous components not found in the second edition. The most apparent is the inclusion of a new author, Wenda Trevathan. Her addition to our writing team we think broadens and strengthens our approach; specifically, her contribution of a new chapter, “Growth and Development” (Chapter 7), provides an important perspective to our coverage of physical anthropology.

Readers familiar with earlier editions will also notice the text has been updated throughout to include new details regarding DNA, such as cloning, recent discoveries of fossil hominids, especially from Africa, new dating of key sites from Asia and Europe, and new and dramatic archaeological discoveries. Because new discoveries from Ethiopia (of *Ardipithecus*) and from Kenya (of the earliest *Australopithecus*) are potentially so significant, they are discussed in some detail and are incorporated into provisional reinterpretations of early hominid evolution (Chapter 12). As stimulated by other important recent finds, including a spectacular cave art site in France, the entire topic of Paleolithic “art” and its interpretation are also considerably expanded (Chapter 15).

In order to make the technical materials in the text more accessible, we have continued our use of a variety of pedagogical aids, including a running glossary, a complete glossary at the end of the text, full-page maps, and anatomical charts. We have also added timelines to the chapters dealing with evolutionary history (Chapters 10–15). These graphic displays should assist students in placing the relevant discoveries in a clearer chronological context. We have also added a new appendix (Appendix B) on population genetics, to better illustrate the mathematical principles which underlie this perspective. Finally, at the end of each

chapter, a list of “web sites” is provided to allow students more easy access to current and relevant Internet sources of information.

As both teachers and students of physical anthropology, we understand the challenges faced in presenting this material and in attempting to master it. Physical anthropology has much to offer, and we hope this text helps readers capture both the interest and excitement of our field.

For their detailed and insightful comments, we wish to thank our reviewers of this edition:

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Robert Jurmaine
Harry Nelson
Lynn Kilgore
Wenda Trevathan

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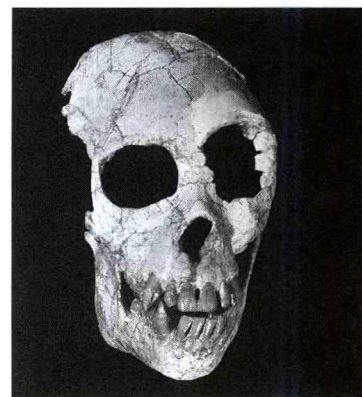
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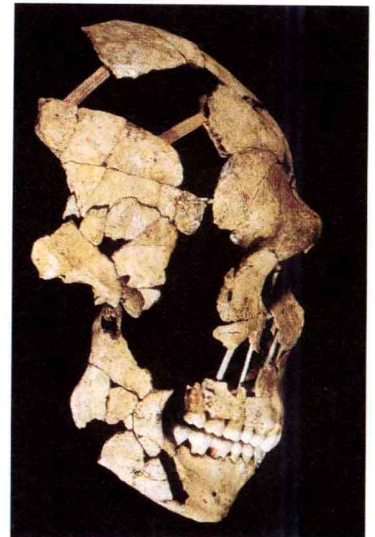
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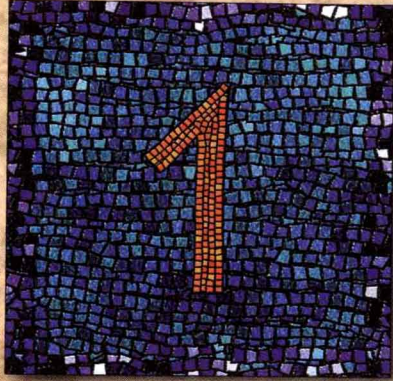
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INTRODUCTION



HOMINIDAE

The taxonomic family to which humans belong; also includes other, now extinct, bipedal relatives.



HOMINIDS

Members of the family Hominidae.



BIPEDALLY

On two feet. Walking habitually on two legs is the single most distinctive feature of the Hominidae.



SPECIES

A group of organisms that can interbreed to produce fertile offspring. Members of one species are reproductively isolated from members of all other species (i.e., they cannot mate with them to produce fertile offspring).

One day, perhaps at the beginning of the rainy season some 3.7 million years ago, two or three individuals walked across a grassland savanna in what is now northern Tanzania. These individuals were early members of the taxonomic family **Hominidae**, the family that also includes ourselves, modern *Homo sapiens*. Fortunately for us (the living descendants of those distant travelers), a record of their passage on that long-forgotten day remains in the form of fossilized footprints, preserved in hardened volcanic deposits.

As chance would have it, shortly after heels and toes were pressed into the dampened soil and volcanic ash of the area, a volcano, some 12 miles distant, erupted. The ensuing ashfall blanketed everything on the ground surface, including the footprints of the **hominids** and those of numerous other species as well. In time, the ash layer hardened into a deposit which preserved a quite remarkable assortment of tracks and other materials that lay beneath it (Fig. 1–1).

These now-famous Laetoli prints indicate that two hominids, one smaller than the other, perhaps walked side by side, leaving parallel sets of tracks. But because the prints of the larger individual are obscured, possibly by those of a third, it is unclear how many actually made that journey so long ago. What is clear from the prints is that they were left by an animal that habitually walked **bipedally** (on two feet). It is this critical feature that has led scientists to consider these ancient passersby as hominids.

In addition to the preserved footprints, scientists at Laetoli and elsewhere have discovered numerous fossilized skeletal remains of what most now call *Australopithecus afarensis*. These fossils and prints have volumes to say about the beings they represent, provided we can learn to interpret them.

What, then, have we actually gleaned from the meager evidence we possess of those creatures who beckon to us from an incomprehensibly distant past? Where did their journey take them that far-gone day, and why were they walking in that particular place? Were they foraging for food within the boundaries of their territory? Were they simply walking to a nearby water source? Did the two (or three) indeed travel together at all, or did they simply use the same route within a short period of time?

We could ask myriad questions about these individuals, but we will never be able to answer them all. They walked down a path into what became their future, and their immediate journey has long since ended. It remains for us to sort out what little we can know about them and the **species** they represent. In this sense, their greater journey continues.

From the footprints and from fossilized fragmentary skeletons, we know that these hominids walked in an upright posture. Thus, they were, in some respects, anatomically similar to ourselves, but their brains were only about one-third the size of ours. Although they may have used stones and sticks as tools, much as modern chimpanzees do, there is no current evidence to suggest they manufactured stone tools. In short, these early hominids were very much at the mercy of nature's whims. They certainly could not outrun most predators, and their lack of large projecting canine teeth rendered them relatively defenseless.

Modern chimpanzees often serve as living models for our early ancestors, but in fact, the earliest hominids occupied a different habitat, exploited different resources, and probably had more to fear from predators than do chimpanzees. However much we may be tempted to compare early hominids to living species,

**FIGURE 1-1**

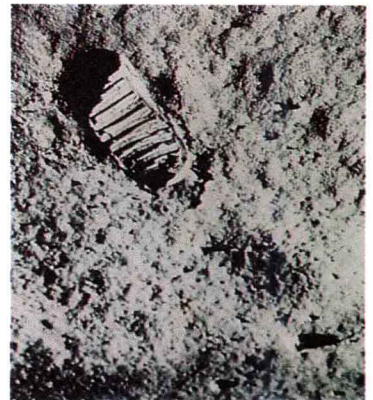
Early hominid footprints at Laetoli. The tracks to the left were made by one individual, while those to the right appear to have been formed by two individuals, the second stepping in the tracks of the first.

we must remind ourselves that there is no living form that adequately represents them. Just like every other living thing, they were unique.

On July 20, 1969, a television audience numbering in the hundreds of millions watched as two human beings stepped out of a spacecraft and onto the surface of the moon. To anyone born after that date, this event is taken more or less for granted, even though it has not been repeated often. But the significance of that first moonwalk cannot be overstated, for it represents humankind's presumed mastery over the natural forces that govern our presence on earth. For the first time ever, people actually walked upon the surface of a celestial body that (as far as we know) has never given birth to life.

As the astronauts gathered geological specimens and frolicked in near weightlessness, they left traces of their fleeting presence in the form of footprints in the lunar dust (Fig. 1-2). On the atmosphereless surface of the moon, where no rain falls and no wind blows, the footprints remain undisturbed to this day. They survive as mute testimony to a brief visit by a medium-sized, big-brained creature who presumed to challenge the very forces that created it.

We humans uncovered the Laetoli footprints, and we question the nature of the animal who made them. Perhaps one day, creatures as yet unimagined will ponder the essence of the being that made the lunar footprints. What do you suppose they will think?

**FIGURE 1-2**

Human footprint left on the lunar surface during the Apollo mission.



PRIMATE

A member of Primates (pronounced “pry-may-tees”), the order of mammals which includes prosimians, monkeys, apes, and humans.



CULTURE

All aspects of human adaptation, including technology, traditions, language, and social roles. Culture is learned and transmitted from one generation to the next by nonbiological means.



EVOLUTION

A change in the genetic structure of a population. The term is also frequently used to refer to the appearance of a new species.



BIOCULTURAL EVOLUTION

The mutual, interactive evolution of human biology and culture; the concept that biology makes culture possible and that culture further influences the direction of biological evolution; a basic concept in understanding the unique components of human evolution.

We humans, who can barely comprehend a century, can only grasp at the enormity of 3.7 million years. We want to understand the essence of those creatures who traveled that day across the savanna. By what route did an insignificant but clever bipedal **primate** give rise to a species that would, in time, walk on the surface of a moon some 230,000 miles from earth? How did it come to be that in the relatively short span (in geological time) of fewer than 4 million years, an inconsequential savanna dweller evolved into the species that has developed the ability to dominate and destroy much of life on the planet?

How did it happen that *Homo sapiens*, a result of the same evolutionary forces that produced all other life on this planet, gained the power to control the flow of rivers and alter the very climate in which we live? As tropical animals, how were we able to leave the tropics and disperse over most of the earth's land surfaces, and how did we adjust to the varied local environmental conditions we encountered? How could our species, which numbered fewer than 1 billion individuals until the mid-nineteenth century, come to number nearly 6 billion worldwide today and, as we now do, add another billion every 11 years?

These are some of the many questions that physical (or biological) anthropologists attempt to answer, and these questions are largely the focus of the study of human evolution, variation, and adaptation. These issues, and many more, are the topics covered directly or indirectly in this text, for physical anthropology is, in part, human biology seen from an evolutionary perspective. However, physical anthropologists are not exclusively involved in the study of physiological systems and biological phenomena. When such topics are placed within the broader context of human evolution, another factor must also be considered: the role of **culture**.

Culture is an extremely important concept, not only as it pertains to modern human beings, but also in terms of its critical role in human evolution. It has been said that there are as many definitions of culture as there are people who attempt to define it. Quite simply, culture can be said to be the strategy by which humans adapt to the natural environment. In this sense, culture includes technologies that range from stone tools to computers; subsistence patterns ranging from hunting and gathering to agribusiness on a global scale; housing types, from thatched huts to skyscrapers; and clothing, from animal skins to high-tech synthetic fibers (Fig. 1–3). Because religion, values, social organization, language, kinship, marriage rules, gender roles, inheritance of property, and so on, are all aspects of culture, each culture shapes people's perceptions of the external environment, or world view, in particular ways that distinguish that culture from all others.

One fundamental point to remember is that culture is *learned* and not biologically determined. Culture is transmitted from generation to generation independent of biological factors (i.e., genes). For example, if a young girl of Vietnamese ancestry is raised in the United States by English-speaking parents, she will acquire English as her native language. She will eat Western foods with Western utensils and will wear Western clothes. In short, she will be a product of Western culture, because that is the culture she will have learned. We are all products of the culture in which we are socialized, and since most human behavior is learned, it clearly is also culturally patterned.

But as biological organisms, humans are subject to the same evolutionary forces as all other species. On hearing the term **evolution**, most people think of the appearance of new species. Certainly, new species formation is one consequence of evolution; however, biologists see evolution as an ongoing biological process with a precise genetic meaning. Quite simply, evolution is a change in the genetic makeup of a population from one generation to the next. It is the accumulation of such changes, over considerable periods of time, that can result in