

Preface

Unlike other animals, people wonder how things got to be the way they are; and one of the things we wonder about most is how we got to be so unlike other animals. The science of human origins therefore attracts a lot of interest and attention from a wide range of audiences, from average readers to dedicated researchers. This book about paleoanthropology has been written for readers at the scholarly end of that spectrum, especially for students who have already had a beginning course in the subject. But we have tried to keep it accessible to any educated reader, because we think it is important in today's political and cultural environment to make a substantial account of human evolution available to anyone who has serious questions about it.

As its title implies, this is book about the evolutionary lineage of the human species, *Homo sapiens*. Because it is specifically centered on the *human* lineage, it touches on other aspects of the history of life on earth only to the extent that they bear on human origins. And because this book focuses on reconstructing the human lineage, it deals mainly with the facts of paleontology, which furnishes the only direct evidence we have of that lineage. Comparative anatomy, molecular biology, historical geology, archaeology, and other fields of science are brought in mainly to provide necessary background and context for the study of the human fossil record.

Opponents of scientific biology are fond of dismissing that record as a pathetic handful of controversial fragments. If that were so, this book would be a lot shorter. An often-repeated creationist canard insists that all known human fossils would fit on a billiard table. This was probably true in the late 19th century, but it has not been true for a hundred years. Known human fossils number in the thousands and represent the remains of hundreds of individuals. They are more numerous and better-studied than the fossils of any comparable vertebrate group, because the intense interest that people have in the bones of their ancestors has driven them to devote far more effort to collecting and studying fossil humans than (say) fossil horses or herring. Having seen most of the major collections of human fossils in the world's museums, we can assure our readers that those collections can no longer be laid out on a billiard table. It would be hard to cram them all into a boxcar.

The growth of the human fossil record has been especially rapid over the past half-century. In 1959, W. W. Howells could still provide a basic exposition of almost all of the significant human fossils then known in a relatively slim (384-page) volume entitled *Mankind in the Making*. Only three years later, Carleton Coon took 724 pages to present an only slightly more detailed account in his book *The Origin of Races*. Any book that

tried to survey today's human fossil collections in the same detail would not fit between a single pair of covers. A recent catalog of most of the major cranial and dental remains of currently known fossil hominins—just photographs and descriptions of skulls and teeth—occupies three quarto volumes totaling more than 1500 pages (Schwartz and Tattersall 2002, 2003, 2005). Most of the decisions involved in writing a paleoanthropology textbook thus concern what to leave out, not what to put in. In making such decisions about the fossil evidence, we have tried to focus not on the details of particular fossils, but on the temporal, regional, or taxonomic patterns that they reveal. Conversely, in covering the theoretical aspects of evolutionary biology, we have stressed those facets of the theory that are deeply involved in current paleoanthropological debates and have skimmed on others that are not.

Debates in paleoanthropology are often vigorous and contentious. Some writers would have you believe that such heated debates are both an idiosyncrasy and a shortcoming of our discipline. We think they are wrong on both counts. The scientific enterprise is grounded in the assumptions that all knowledge is provisional and that knowledge increases through the refutation of old ideas and their replacement by new ones. Each generation of scientists makes its mark by overthrowing the received wisdom of the previous generation or transcending its limitations. Active and lively sciences are arenas in which ideas and claims compete for survival. Because reputations and egos are involved in these clashes, arguments are often heated and sometimes intemperate. In these respects, debates over the meaning of fossil skulls are not different from similar debates in other sciences over such issues as the reality of polywater or the planetary status of Pluto.

In grappling with the important debates in our discipline, we have tried to do an even-handed job of laying out the core arguments and key facts that support various currently conflicting interpretations of the fossil record. It will not be difficult to figure out where we stand on most of these issues. But it should also be possible for the reader to understand why others read the facts differently, and even to come to conclusions that differ from ours. In general, we have not tried to articulate the reasoning behind ideas that nobody espouses any longer; but we have included a few such discarded ideas that seem to us to have special historical importance, set off inside boxes and labeled "Blind Alleys."

The first three chapters of this book situate the human fossil record in the larger framework of evolutionary biology and provide the necessary background for what follows. Chapter 1 surveys the development of historical geology, including brief summaries of geological dating techniques and the fossil record of life up through the early radiation of mammals. Chapter 2 lays

out a sketch of the underpinnings of evolutionary theory, with emphasis on its paleontological applications. In Chapter 3, we discuss the mammalian background and evolutionary history of the order Primates. We have undertaken a relatively complete survey of the other living members of our order, because we think that doing so helps put humans in their proper biological context. Our overview of fossil primates focuses more narrowly on those that have some relevance to the earlier stages of the human lineage, either as potential ancestors or as comparative cases that illustrate relevant concepts and phenomena.

The final five chapters cover the specifically human (hominin) part of the lineage of our species. The initial hominin radiation in Africa, including the origin of the genus *Homo*, is reviewed and discussed in Chapter 4. Chapters 5 and 6 deal respectively with fossils commonly assigned to *Homo erectus* and *Homo heidelbergensis*. This division is not intended as a proxy for a taxonomic distinction or as a presentation of "stages" of human evolution, but only as a heuristic structure to organize the relevant material. A full chapter (Chapter 7) is devoted to the Neandertals, because these are the best-known pre-modern humans and offer unique insights into the pattern of later human evolution. Chapter 8 deals with the emergence and radiation of modern humans—people fundamentally like us. Finally, we provide an appendix detailing the anatomical points and measurements used in the book.

Unless otherwise indicated, all illustrations were drawn by one of us (MC). Some of them are diagrammatic or conceptual, but most were redrawn from photographs, with an eye to both anatomical accuracy and ease of interpretation. Figures for which no published source is credited are based on our own ideas, observations, and photographs.

Most of this book's contents represent other people's work. We have relied heavily on the published work and private thoughts of our colleagues, which have of course greatly enriched our own ideas and interpretations as well. In producing the text and figures for this book, we have tried diligently to give credit to our colleagues for their work and ideas and have attempted to be as thorough as possible in providing citations and references. Despite our best efforts, it is inevitable that we have overlooked some important sources and misinterpreted some others. We accept responsibility for such errors and omissions, and we ask that our colleagues bring them to our attention.

Writing a book like this one brings clearly into focus for us the high quality of research and researchers in paleoanthropology. Of all the pleasures involved in working on this book, none has been greater than our interactions with colleagues. This project could not have been completed without their input, information, and encouragement. Many of them have kindly provided

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