Understanding Human Evolution

Human life, and how we came to be, is one of the greatest scientific and philosophical questions of our time. This compact and accessible book presents a modern view of human evolution. Written by a leading authority, it lucidly and engagingly explains not only the evolutionary process, but the technologies currently used to unravel the evolutionary past and emergence of *Homo sapiens*. By separating the history of paleoanthropology from current interpretation of the human fossil record, it lays numerous misconceptions to rest, and demonstrates that human evolution has been far from the linear struggle from primitiveness to perfection that we've been led to believe. It also presents a coherent scenario for how *Homo sapiens* contrived to cross a formidable cognitive barrier to become an extraordinary and unprecedented thinking creature. Elegantly illustrated, *Understanding Human Evolution* is for anyone interested in the complex and tangled story of how we came to be.

Ian Tattersall is Curator Emeritus in the Division of Anthropology of the American Museum of Natural History, New York, USA. With around 400 papers and 30 books published in primatology and evolutionary biology, he has received prizes from organizations ranging from the American Association of Physical Anthropologists to the Accademia Lincei of Rome and the Monuments Conservancy. He has conducted fieldwork in countries as diverse as Madagascar, Yemen, Vietnam, and Mauritius.

The ***Understanding Life*** series is for anyone wanting an engaging and concise way into a key biological topic. Offering a multidisciplinary perspective, these accessible guides address common misconceptions and misunderstandings in a thoughtful way to help stimulate debate and encourage a more in-depth understanding. Written by leading thinkers in each field, these books are for anyone wanting an expert overview that will enable clearer thinking on each topic.

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CAMBRIDGE
UNIVERSITY PRESS

Shaftesbury Road, Cambridge CB2 8EA, United Kingdom

One Liberty Plaza, 20th Floor, New York, NY 10006, USA

477 Williamstown Road, Port Melbourne, VIC 3207, Australia

314–321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre, New Delhi – 110025, India

103 Penang Road, #05–06/07, Visioncrest Commercial, Singapore 238467

Cambridge University Press is part of Cambridge University Press & Assessment, a department of the University of Cambridge.

We share the University's mission to contribute to society through the pursuit of education, learning and research at the highest international levels of excellence.

www.cambridge.org
Information on this title: www.cambridge.org/9781009101998

DOI: 10.1017/9781009106177

First published 2022

A catalogue record for this publication is available from the British Library

ISBN 978-1-009-09875-5 Hardback
ISBN 978-1-009-10199-8 Paperback

"For years, Ian Tattersall has been *the* go-to source for the latest facts and interpretations of human evolution. Here, in his clear, pithy style, he brings us up to date on the latest discoveries, weaving them skillfully into a coherent outline of hominid history extending back millions of years. It's all here – from the latest on DNA and radiometric dating of fossils, to the nature and origin of the still-mysterious self-consciousness that is unique to modern humans. A terrific resource and wonderful read!"

Niles Eldredge, Curator Emeritus in the Division of Paleontology, American Museum of Natural History, USA

"Ian Tattersall provides in this short and engaging book the story of how humans evolved, and, as importantly, how we have come to learn about our evolutionary history and the nature of being human through great discoveries and great scientific debates."

Robert Foley, Leverhulme Professor of Human Evolution, University of Cambridge, UK

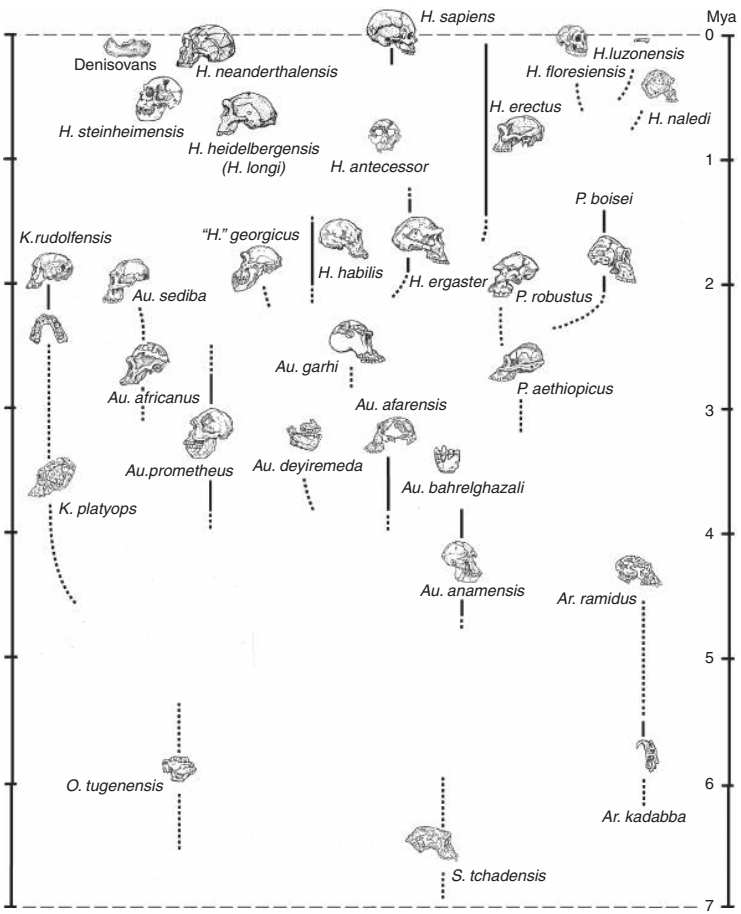
"*Understanding Human Evolution* provides a sweeping overview of the field of human evolution, giving equal attention to the history of the discipline as well as current thoughts and ideas about our attainment of the milestones of human evolution – upright posture and bipedal locomotion, the evolution of tool use, the expansion of the brain and human cognition, the development of language, and the spread of humans out of Africa around the globe. All of this is presented in a concise and accessible package by one of the most well-known popularizers of the field today. This is an excellent resource for anyone looking for an introduction to the fossil evidence for human evolution, as well as those who want to catch up on the current state of knowledge in this fast-moving discipline."

Leslie C. Aiello FBA, Professor Emerita, University College London, UK

"An enjoyable, highly informative, and scholarly read. Tattersall is at his best here. Engaging the reader with his inimitable style, he interprets and explains the convoluted evidence for how we became human. Written largely for the non-specialist, there is much here that will inform and even stimulate professional paleoanthropologists."

Donald Johanson, Founding Director of the Institute of Human Origins at Arizona State University, USA

To the memory of
Jakov Radovčić (1946–2021)
Paleontologist, Curator, Friend



Distribution of fossil hominin species in time, showing how several different species typically coexisted prior to the arrival of *Homo sapiens*. Dotted lines are indications of depth of lineage, and not indicators of relationship.

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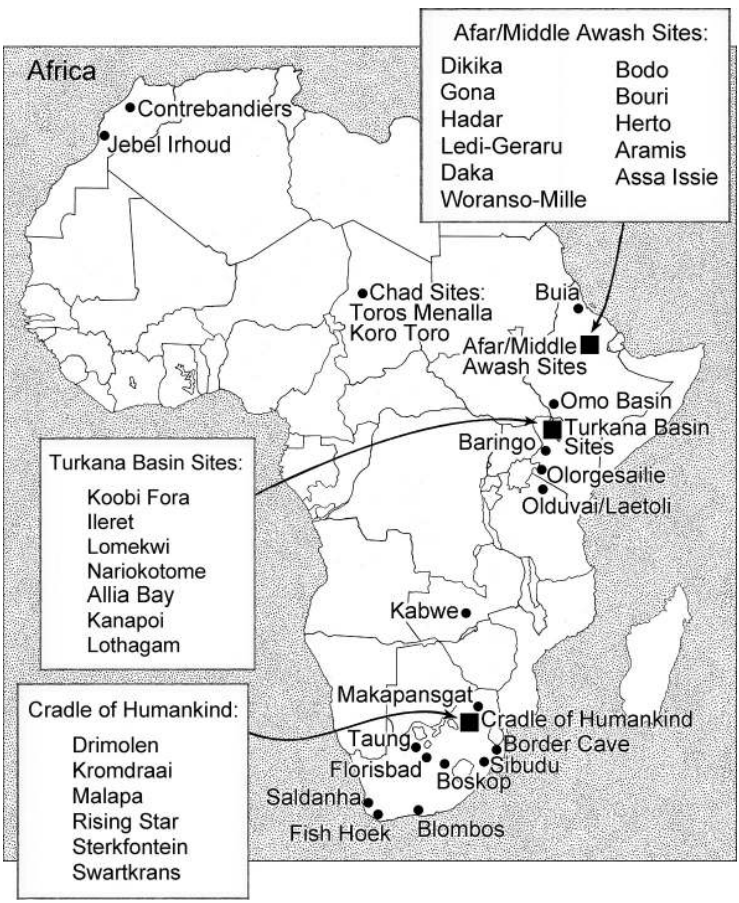
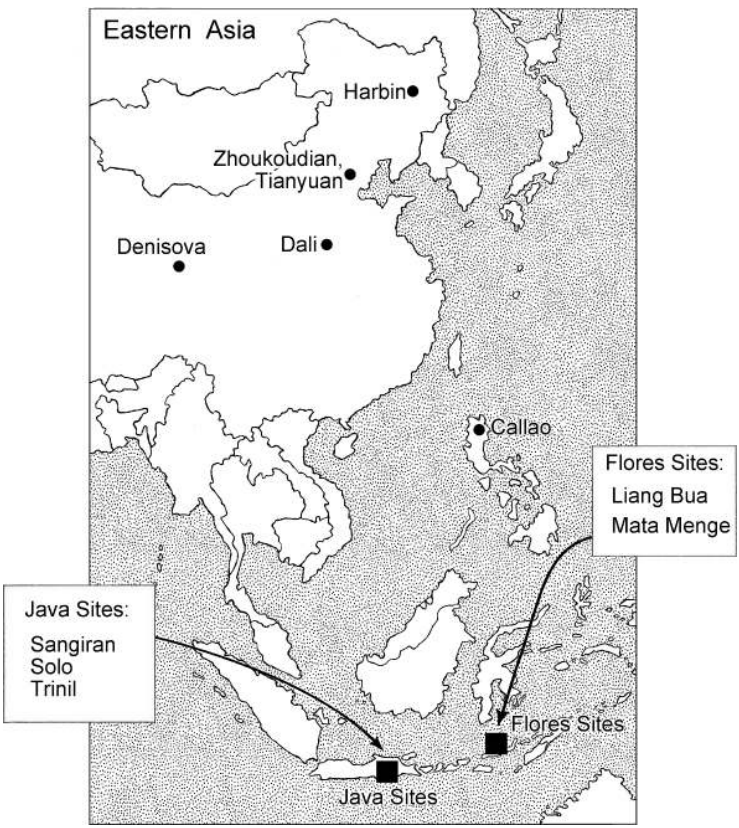
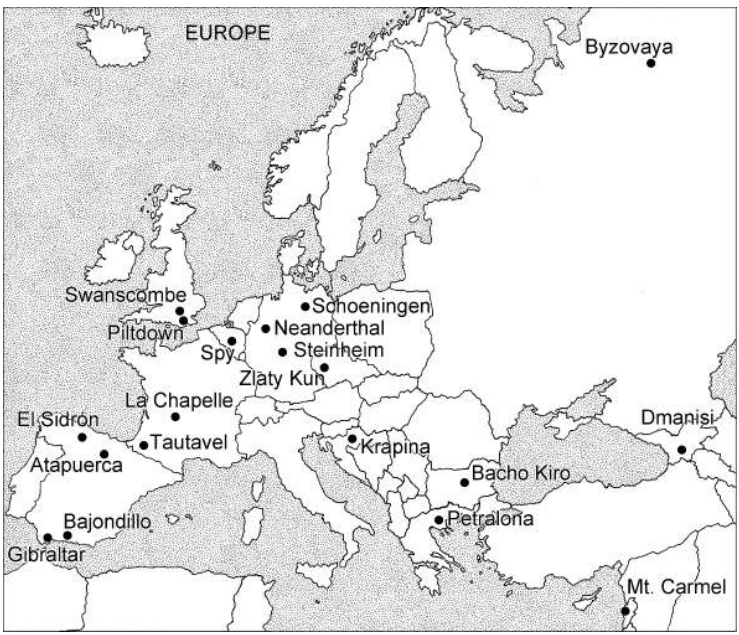


Map 1 The major African hominin fossil sites mentioned in this book.



Map 2 The major Asian hominin fossil sites mentioned in this book.



Map 3 The major European hominin fossil sites mentioned in this book.

Foreword

Who are we, where do we come from, and how have we come to be what we are? These are questions that have been puzzling humans for thousands of years, at least since the first written evidence of philosophical and metaphysical reflections. It is very well known that different kinds of answers have been given to these questions over the years from various scholarly, and not so scholarly, domains. However, what do the biological sciences, and especially paleoanthropology – the study of human evolution – have to say about these questions? In this splendid book, Ian Tattersall provides an amazingly rich account of what we have come to know during the last 200 years or so about human evolution – not only about the evolution of our own species, *Homo sapiens*, during the last 200,000 years, but also of other hominin species. As the author explains, there is so much evidence from several independent sources that has established human evolution as a fact of life. There is thus no question that we have common ancestors with the apes, from which our ancestors diverged over the last few million years. But at the same time, the author also highlights how much we do not know about the details of these processes, which we may never be able to figure out in detail. The reason for this is that the evidence for paleoanthropology, as for any historical science, is always fragmented and scarce. Therefore, there will always be questions that we will not manage to answer. But as Ian Tattersall explains, there are many crucial questions about who we are and where we come from that we have already managed to answer in sufficient detail. We are a unique hominin species that has dominated our planet, perhaps outcompeting any other with which our ancestors coexisted. But this only shows that we are an integral part of this natural world, which we need to respect and treat with modesty – we

are not special in any nonbiological sense. The author invites you on a magnificent journey into the human past. Join him, and by the end of the book you will feel extremely rewarded, as you will have understood what it means to be human – biologically speaking.

Kostas Kampourakis, Series Editor

Preface

Homo sapiens is a strange animal. Not only do the requirements of our ungainly, two-footed posture reverberate in odd ways throughout our bodily anatomy, from our large, globular heads, balanced precariously atop our strangely curving vertical spines, right down to our springy, short-toed feet, but even more importantly, we human beings process information about ourselves and the world we inhabit in an unorthodox and entirely unprecedented way. Looking at this rather implausible creature, the proverbial Martian could be forgiven for concluding that human beings must have taken a very long time indeed to become so unlike other animals, including even our own closest living relatives, the great apes. Amazingly, though, our rather impressive fossil and archaeological records are telling us pretty clearly that the transition from a relatively run-of-the-mill large anthropoid to the world's most peculiar primate (outdoing even the bizarre aye-aye of Madagascar) happened amazingly fast, indeed in an evolutionary eyeblink: No animal alive in the world today is more radically unlike its own ancestor of a mere two million years ago than we *Homo sapiens* are.

This book is an attempt to explain that fast and bumpy human journey: a roller-coaster ride that currently appears to have begun somewhere in Africa, around seven million years ago, and that ultimately resulted in the colonization by *Homo sapiens* of every habitable corner of our planet. I say "appears," by the way, because understanding what happened during this epic odyssey is the province of paleoanthropology, a branch of science, and all scientific knowledge is by its nature provisional. Scientists are not trying to dispense wisdom for the ages. What they do endeavor to provide is the most accurate possible

description of the observable world, and of the interactions that animate it, based on what they know at the time. The idea that scientists are out there searching for enduring "proof" of anything is one of humankind's supreme misconceptions, no matter how hard advertisers may try to convince you that the benefits of their products are "scientifically proven." Science progresses not by proving anything to be true forever, but by testing ideas about how the world works and systematically rejecting those that are shown to be false, thereby iterating toward an increasingly accurate picture of ourselves and our surroundings. It is this constant questioning and testing that most clearly distinguishes science from all the other ways humans have of knowing, and which explains why scientists are always hungry for new data – in the case of paleoanthropology, principally in the form of new fossils and of new information that sheds light on them.

This short book is thus necessarily a progress report, although by now so much is known of the human fossil past that it is very unlikely that a single future fossil discovery will send textbook writers scurrying to write new editions; and I have tried to paint with a sufficiently broad brush that much of the story it tells should prove reasonably durable. I will start by looking in Chapter 1 at evolution, the process that underwrites our human biological history, and without which we would not be here writing or reading about it. Evolution is itself a prime example of how ideas change. Charles Darwin's basic mid-nineteenth-century insight of descent with modification has been amazingly robust, but within my academic lifetime it has become widely understood (albeit perhaps less in paleoanthropology than in most evolutionary sciences) that the old equation of time with inexorable change needs to be abandoned. Readers wanting more detail on this would do well to consult Kostas Kampourakis's volume in this series, *Understanding Evolution*. In Chapter 2 I briefly examine some of the new technologies that are deepening and enlivening the study of the human past by allowing us to do such things as accurately dating fossils recovered from an amazing range of geological contexts; to peer at ancient diets; to "virtually" reconstruct badly distorted fossils; and to use variations in our genomes to understand the complex process by which modern humans took over the world.

In tackling the fossil evidence for human evolution, I first devote Chapters 3 and 4 to outlining the history of discovery in paleoanthropology. I do this

separately from my review of the fossils themselves, because it is my firm belief that if we were to discover the entire human fossil afresh tomorrow, our interpretation of it would look very different from the one we currently espouse. Both the order in which fossils were found, and the preconceptions of their discoverers, have deeply affected not only the interpretations offered at the time, but also what we still believe today; and we are only able to understand why we hold our current beliefs about human evolution if we are consciously aware of what our predecessors believed before us. Separating history from discussion of the evidence in this way means that readers may find themselves paging back and forth a bit to find illustrations, for which I apologize; but I believe this disadvantage is amply compensated by the clarity imparted by introducing the characters before embarking on the play. For the reader's convenience, each chapter concludes with a table summarizing the principal extinct relatives discussed, and all hominin fossil sites (and some archaeological ones) that appear both in these chapters and elsewhere in the book are localized in the Maps section that precedes the text.

I then look at how we (or perhaps I should say I) interpret the human fossil record right now, bearing in mind that any account must basically be provisional. I do this chronologically, starting in Chapter 5 with the very early bipeds that ushered in the human story, before proceeding in Chapter 6 to the muddle around the emergence of our own genus *Homo*. In Chapter 7 I consider both *Homo heidelbergensis*, the first cosmopolitan hominin, and *H. neanderthalensis*, our best-known extinct relative; and in Chapter 8 I examine the emergence of our own species *Homo sapiens*, both as a physical entity and as a cognitive one, and glance at how our immediate predecessors so rapidly took over the world. It might be useful to note that graphics mapping how ancient populations moved may be found in a companion volume to this one, *Understanding Race*. Finally, in keeping with the convention established for this series, I conclude with a brief review of some major misunderstandings associated with the evolution of humankind.

Acknowledgments

Anyone writing about human evolution owes a huge practical and intellectual debt to every one of the innumerable scientists, living and departed, who helped to shape paleoanthropology as we currently understand it. May their contributions never be forgotten, especially in a world that seems ever more ready to dismiss the past as an irrelevance. On a more personal level I am deeply grateful to all the many colleagues, from all over the world, whose company, ideas, and often hospitality I have enjoyed over the past five decades. They are too numerous to mention individually here, but I extend my warmest thanks to all of them. I cannot, though, neglect to record my special gratitude to my amazing teachers, David Pilbeam and the late Elwyn Simons, as well as to four friends and colleagues with whom I have worked particularly closely over the years: Niles Eldredge, the late Bob Sussman, Jeffrey Schwartz, and Rob DeSalle. My associations with these extraordinary scientists taught me a great deal, hugely enlarged my perspective, and most importantly were a lot of fun. Parts of a draft of this book were kindly read and improved by Rob DeSalle, John Van Couvering, Will Harcourt-Smith, and David Hurst Thomas, none of whom is to blame for any of its remaining deficiencies.

One of the great pleasures of working in a very visual science is the opportunity it gives one to collaborate closely with some very gifted artists. I have been particularly fortunate in this regard, and the work of several of these colleagues is represented in this book. So my deepest thanks go, yet again, to Patricia Wynne, Jay Matternes, the late Nick Amorosi, Don McGranaghan, Diana Salles, Jennifer Steffey, and Kayla Younkin, whose enormous talents have

not only given essential context to the written content of this book, but have made it so much more attractive to peruse.

I am also hugely indebted to Kostas Kampourakis, editor of Cambridge University Press's unique *Understanding Life* series, both for inviting me to write this volume and for suggesting numerous improvements to an initial draft. And at Cambridge University Press itself, I am immensely grateful to my editors, Katrina Halliday, who started the ball rolling, and Jessica Papworth, who steered the project to completion. Olivia Boult kept everything on track during the editorial process, and Sam Fearnley and Jenny van der Meijden cheerfully and efficiently saw the book through production in Cambridge, while Mathivathini Mareesan did the same in Pondicherry. Gary Smith undertook a very thoughtful copy-edit, and Judith Reading compiled the excellent index. My thanks to you all; working with everyone has been wonderfully rewarding.