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通识读本

人类进化简史

Human Evolution

A Very Short Introduction

Bernard Wood 著
冯兴无 译

外语教学与研究出版社
FOREIGN LANGUAGE TEACHING AND RESEARCH PRESS

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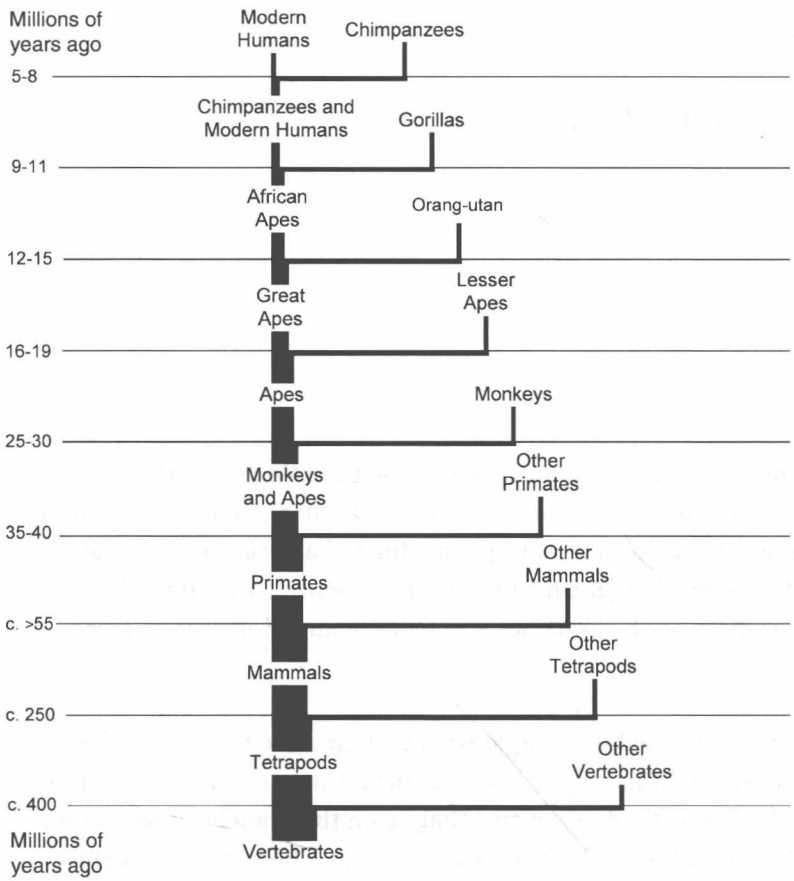
Chapter 1
Introduction

Many of the important advances made by biologists in the past 150 years can be reduced to a single metaphor. All living, or extant, organisms, that is, animals, plants, fungi, bacteria, viruses, and all the types of organisms that lived in the past, are situated somewhere on the branches and twigs of an *arborvitae* or Tree of Life.

We are connected to all organisms that are alive today, and all the organisms that have ever lived, via the branches of the Tree of Life (TOL). The extinct organisms that lie on the branches that connect us to the root of the tree are our ancestors. The rest, on branches that connect directly with our own, are closely related to modern humans, but they are not our ancestors.

The 'long' version of human evolution would be a journey that starts approximately three billion years ago at the base of the TOL with the simplest form of life. We would then pass up the base of the trunk and into the relatively small part of the tree that contains all animals, and on into the branch that contains all the animals with backbones. Around 400 million years ago we would enter the branch that contains vertebrates that have four limbs, then around 250 million years ago into the branch that contains the mammals, and then into a thin branch that contains one of the subgroups of mammals called the primates. At the base of this primate



1. A diagram of the vertebrate part of the Tree of Life emphasizing the branches that led to modern humans

branch we are still at least 50–60 million years away from the present day.

The next part of this 'long' version of the human evolutionary journey takes us successively into the monkey and ape, the ape and then into the great ape branches of the Tree of Life. Sometime between 15 and 12 million years ago we move into the small branch that gave rise to contemporary modern humans and to the living African apes. Between 11 and 9 million years ago the branch for the

gorillas split off to leave just a single slender branch consisting of the ancestors of both extant (i.e. living) chimpanzees and modern humans. Around 8 to 5 million years ago this very small branch split into two twigs. One of the twigs ends on the surface of the TOL with the living chimpanzees, the other leads to modern humans. Palaeoanthropology is the science that tries to reconstruct the evolutionary history of this small, exclusively human, twig.

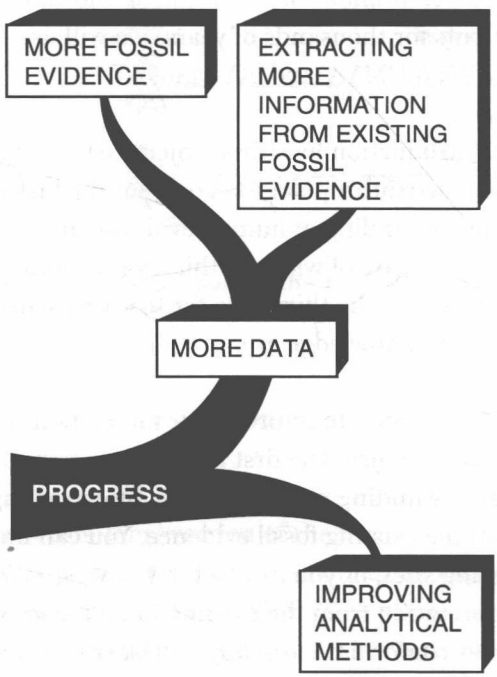
This book focuses on the last stage of the human evolutionary journey, the part between the most recent common ancestor shared by chimpanzees and humans and present-day modern humans. To understand this we need to use some scientific jargon. So instead of referring to 'twigs' we need to use the proper biological term 'clade': extinct side branches are called 'subclades'. Species anywhere on the main human twig, or on its side branches, are called 'hominins'; the equivalent species on the chimp twig are called 'panins'. And instead of writing out 'millions of years' and 'millions of years ago' (and the equivalents for thousands of years) we will use instead the abbreviations 'MY' and 'MYA' and 'KY' and 'KYA'.

This Very Short Introduction has three objectives. The first is to try and explain how paleoanthropologists go about the task of improving our understanding of human evolutionary history. The second is to convey a sense of what we think we know about human evolutionary history, and the third is to try to give a sense of where the major gaps in our knowledge are.

We use two main strategies to improve our understanding of human evolutionary history. The first is to obtain more data. You can get more data by finding more fossils, or by extracting more information from the existing fossil evidence. You can find more fossils from existing sites, or you can look for new sites. You can extract more information from the existing fossil record by using techniques such as confocal microscopy and laser scanning to make more precise observations about their external morphology. You can also gather information about the internal morphology and

biochemistry of fossils. This ranges from using non-invasive medical imaging techniques such as computed tomography to obtain information about structures like the inner ear, to using new types of microscopes to investigate the microscopic anatomy of teeth, and the latest molecular biology technology to detect small amounts of DNA in fossils.

The second strategy for reducing our ignorance about human evolutionary history is to improve the ways we analyse the data we do have. These improvements range from more effective statistical methods to the use of novel methods of functional analysis. Researchers also try to improve the ways they generate and test hypotheses about the numbers of species in the hominin fossil record, and about how those species are related to each other and to modern humans and chimpanzees.



2. Diagram showing how progress can be made in palaeoanthropology research

I begin Chapter 2 by reviewing the history of how philosophers and then scientists came to realize that modern humans are part of the natural world. I then explain why scientists think chimpanzees are more closely related to modern humans than they are to gorillas, and why they think the chimp/human common ancestor lived between 8 and 5 MYA.

In Chapter 3 I review the lines of evidence that can be used to investigate what the 8–5 MY-old hominin clade looks like. Is it 'bushy', or straight like the stem of a thin spindly plant? How much of it can be reconstructed by looking at variation in modern humans, and what needs to be investigated by searching for, finding, and then interpreting fossil and archaeological evidence? Where do researchers look for new fossil sites, and how do they date the fossils they find? In Chapter 4 I explain how researchers decide how many species there are within the hominin clade. I also review the methods researchers use to determine how many hominin subclades there are, and how they are related to one another.

In Chapter 5 I consider 'possible' and 'probable' early hominins. The chapter reviews four collections of fossils that represent each of the 'candidate' taxa that have been put forward for being at the very base of the hominin clade. Then in Chapter 6 I look at 'archaic' and 'transitional' hominins. These are fossil taxa that almost certainly belong to the hominin clade, but which are still a long way from being like modern humans. Chapter 7 looks at hominins researchers believe might be the earliest members of the genus *Homo*: we call these 'pre-modern' *Homo*. I look at the earliest fossil evidence of pre-modern *Homo* from Africa, and then follow *Homo* as it moves out of Africa into the rest of the Old World.

Chapter 8 considers evidence about the origin and subsequent migrations of anatomically modern humans, or *Homo sapiens*. When and where do we find the earliest fossil evidence of anatomically modern humans? Did the change from pre-modern *Homo* to anatomically modern humans happen several times and in