INTRODUCTION

Light on the Origin of Man

CHARLES DARWIN'S SEMINAL WORK *ON THE ORIGIN OF SPECIES*, PUBLISHED 150 years ago next month, contains just one understated sentence on the implications of his theory for human evolution: "Light will be thrown on the origin of man and his history." As Darwin implied in his introduction to *The Descent of Man*, he felt that those implications were obvious; he appreciated, as events quickly showed, that it would be only natural to look at evolution foremost from our human perspective and contemplate what makes us unique among other primates—our large brains and ability to communicate, to create, and to understand and investigate our history and nature; our culture, society, and religion; the ability to run fast on two legs and manipulate tools; and more innovations that separate us from our primate relatives.

Tracing our evolution and how we came to acquire these skills and traits, however, has been difficult. Genetic data now confirm that our closest living primate relative is the chimpanzee. We shared and evolved from a common ancestor some 6 million or more years ago. But identifying our unique genes and other genetic differences between us and our primate cousins does not reveal the nature of that ancestor, nor what factors led to the genetic changes that underlie our divergent evolutionary paths. That requires a fossil record and enough parts of past species to assess key anatomical details. It also requires knowing the habitat of early humans well, to determine their diet and evaluate what factors may have influenced their evolution through time. Many early human fossils have been found, but with a few exceptions, these are all less than 4 million years old. The key first several million years of human evolution have been poorly sampled or revealed.

This issue presents 11 papers authored by a diverse international team (see following pages) describing an early hominid species, *Ardipithecus ramidus*, and its environment. The hominid fossils are 4.4 million years old, within this critical early part of human evolution, and represent 36 or more individuals, including much of the skull, pelvis, lower arms, and feet from one female. The papers represent three broad themes. Five focus on different parts of the anatomy that are revealing for human evolution. These show that *Ardipithecus* was at home both moving along trees on its palms and walking upright on the ground. Three characterize *Ardipithecus*'s habitat in detail, through analysis of the hosting rocks and thousands of fossils of small and large animals and plants. These show that *Ardipithecus* lived and ate in woodlands, not grasslands. The first paper presents an overview, and it and the last two papers trace early human evolution and synthesize a new view of our last common ancestor with chimps. One conclusion is that chimps have specialized greatly since then and thus are poor models for that ancestor and for understanding human innovations such as our ability to walk.

These papers synthesize an enormous amount of data collected and analyzed over decades by the authors. Because of the scope of these papers and the special broad interest in the topic of human evolution, we have expanded our usual format for papers and coverage. The papers include larger figures, tables, and discussions, and the overview and two concluding papers provide extended introductions and analyses.

In addition, to aid understanding and introduce the main results of each paper, the authors provide a one-page summary of each paper, with an explanatory figure aimed at the general reader. Our News Focus section, written by Ann Gibbons, provides further analysis and coverage, and it includes maps and a portrait of the meticulous and at times grueling field research behind the discoveries. Available online are a video interview and a podcast with further explanations.

To accommodate this material and allow the full papers, this print issue presents an Editorial, News coverage, the authors' summaries, and four papers in full: the overview paper and one key paper from each thematic group above. The other research papers, and of course all content, are fully available online. In addition, a special online page (www.sciencemag.org/ardipithecus/) links to several print and download packages of this material for AAAS members, researchers, educators, and other readers.

This collection, essentially an extra issue of *Science* in length, reflects efforts by many behind the scenes. Every expert reviewer evaluated, and improved, multiple papers, and several commented on all 11 of them. The authors provided the summaries on top of an already large writing and revision effort. Paula Kiberstis helped in their editing. The figures and art were drafted and improved by J. H. Matternes, Henry Gilbert, Kyle Brudvik, and Josh Carlson, as well as Holly Bishop, Nathalie Cary, and Yael Kats at *Science*. Numerous other *Science* copyediting, proofreading, and production staff processed this content on top of their regular loads. Finally, special thanks go to the people of Ethiopia for supporting and facilitating this and other research into human origins over many years, and for curating *Ardipithecus ramidus* for future research and for all of us to admire.

Ardipithecus ramidus thus helps us bridge the better-known, more recent part of human evolution, which has a better fossil record, with the scarcer early human fossils and older ape fossils that precede our last common ancestor. *Ardipithecus ramidus* is a reminder of Darwin's conclusion of *The Origin*:

There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved.

– BROOKS HANSON

Ardipithecus ramidus

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**Full Research Article available online at www.sciencemag.org/ardipithecus/*

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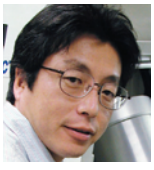

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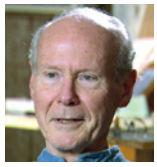

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