

Humankind Emerges: Tools and Toolmakers

Scholars customarily draw a sharp distinction between *prehistory* and *history*. Prehistory is taken to be the long era from the biological beginnings of humankind over 2 million years ago to the origins of our civilization about 5,000 years ago in the first urban centers of the Near East.

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Foraging for a Living

Prehistorians classify the period from 2 million years ago to the end of the last Ice Age.

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Table 1.1
A Chronology of Chinese Dynasties

<i>Early China</i>	
Xia Dynasty	21st–17th Century BCE
Shang Dynasty	~ 1600–1046 BCE
Zhou Dynasty	
Western Zhou	1046–771 BCE
Eastern Zhou	771–256 BCE
Warring States Period	475–221 BCE



Fig. 1.1. The Whirlpool Galaxy (also known as Messier 51a, M51a, or NGC 5194) is an interacting[4] grand-design[5] spiral galaxy located at a distance of approximately 23 million light-years in the constellation Canes Venatici. It is one of the most famous spiral galaxies in the sky. The galaxy and its companion (NGC 5195) are easily observed by amateur astronomers, and the two galaxies may even be seen with binoculars.

Galaxies and the Age of Man

The Whirlpool Galaxy was discovered by Lord Rosse in 1845. Its companion galaxy, NGC 5195, was discovered in 1781 by Pierre Lechain. It was however not until 1845 that the Whirlpool became the first galaxy to be recognized as a spiral. This was achieved by Lord Rosse employing a 72-inch reflecting telescope which he constructed at Birr Castle, Ireland. In 2005 a supernova (SN 2005cs) was observed in the Whirlpool Galaxy, peaking at apparent magnitude 14. Sometimes M51 is used to refer to the pair of galaxies, in which case the individual galaxies may be referred to as M51A (NGC 5194) and M51B (NGC 5195).

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The Whirlpool Galaxy is also a popular target for professional astronomers, who study it to further understand galaxy structure (particularly structure associated with the spiral arms) and galaxy interactions.



Fig. 1.2. The cross within the nucleus of M51 indicating two dust rings around the black hole at the center of the nebula. A black hole, surrounded by a ring of dust, is thought to exist at the heart of the spiral. The dust ring stands almost perpendicular to the relatively flat spiral nebula. A secondary ring crosses the primary ring on a different axis, a phenomenon that is contrary to expectations. A pair of ionization cones extend from the axis of the main dust ring.[9]

Properties

With the recent SN 2008cs derived estimate of 23 Mly distance, and an angular diameter of roughly 11.2', it can be inferred that M51's bright circular disk has a radius of about 38,000 light-years. Its mass is estimated to be 160 billion solar masses.

The timeline of the evolution of life outlines the major events in the development of life on the planet Earth (See Organism). For a thorough explanatory context, see the history of Earth, and geologic time scale. The dates given in this article are estimates based on scientific evidence.

In biology, evolution is the process by which populations of organisms acquire and pass on novel traits from generation to generation. Its occurrence over large stretches of time explains the origin of new species and ultimately the vast diversity of the biological world. Contemporary species are related to each other through common descent, products of evolution and speciation over billions of years.

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Fig. 1.3. The timeline of human evolution outlines the major events in the development of human species, and the evolution of humans' ancestors. It includes a brief explanation of some animals, species or genera, which are possible ancestors of Homo sapiens sapiens. It begins with the origin of life and presents a possible line of descendants that led to humans. This timeline is based on studies from paleontology, developmental biology, morphology and from anatomical and genetic data. The study of human evolution is a major component of anthropology.

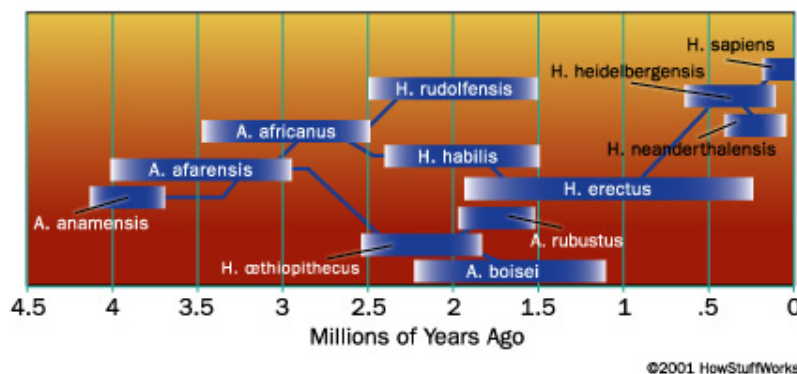


Fig. 1.4. The timeline of human evolution outlines the major events in the development of life on the planet Earth (See Organism). For a thorough explanatory context, see the history of Earth, and geologic time scale. The dates given in this article are estimates based on scientific evidence. It includes a brief explanation of some animals, species or genera, which are possible ancestors of Homo sapiens sapiens. It begins with the origin of life and presents a possible line of descendants that led to humans. This timeline is based on studies from paleontology, developmental biology, morphology and from anatomical and genetic data. The study of human evolution is a major component of anthropology.

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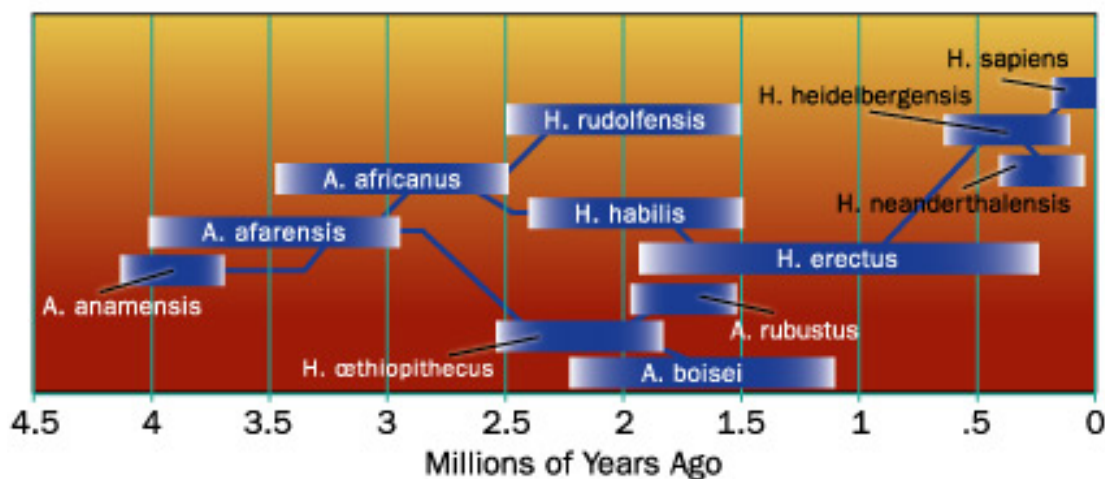
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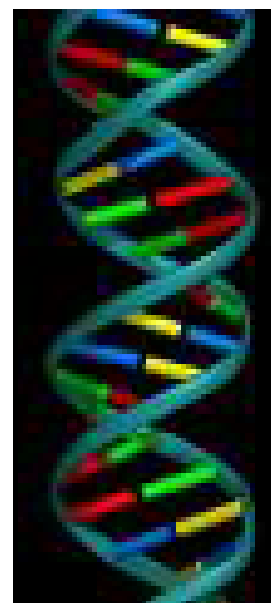
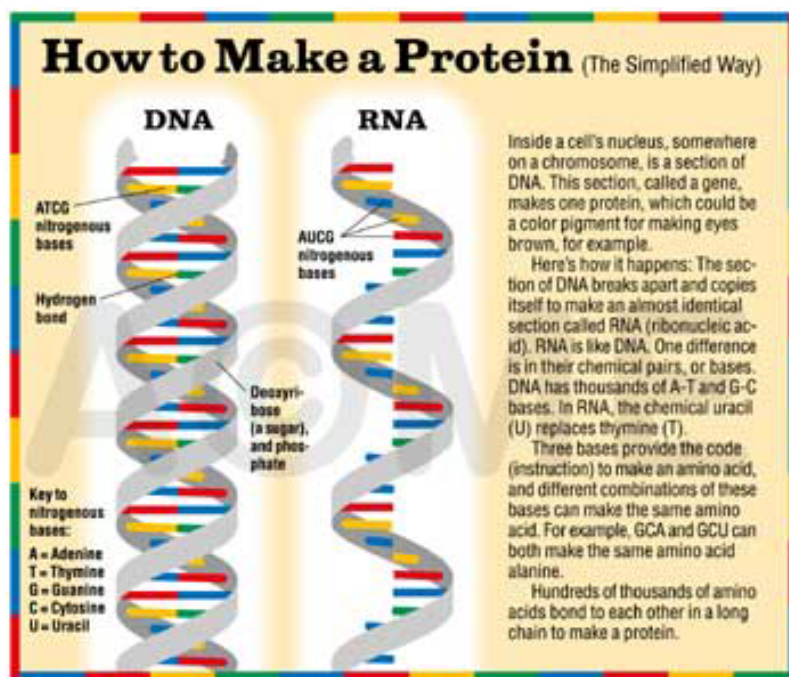
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Fig. 1.5. The term DNA sequencing encompasses biochemical methods for determining the order of the nucleotide bases, adenine, guanine, cytosine, and thymine, in a DNA oligonucleotide. Sequencing methods have evolved from relatively laborious gel-based procedures to modern automated protocols based on dye labelling and detection in capillary electrophoresis that permit rapid large-scale sequencing of genomes and transcriptomes.

Guide to Resources

General Orientations

Given the nature of this book as an introduction to the histories of science and technology for the general reader, it was thought best not to clutter up the pages with citations and references.

Web Resources

Virtual Library: History: Science, Technology and Medicine:

vlib.iue.it/history/topical/science.html

Society for Social Studies of Science (4S):

www.4sonline.org

History of Science Society:

www.hssonline.org

CHAPTER 1. Humankind Emerges

The evolutionary origin of human beings is inherently fascinating and is now the subject of several well-written, semipopular books.

CHAPTERS 11–13. The Scientific Revolution—General

The story of the Scientific Revolution is one of the centerpieces of the history of science.