# A Journey of 6 Million Years

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BE&W

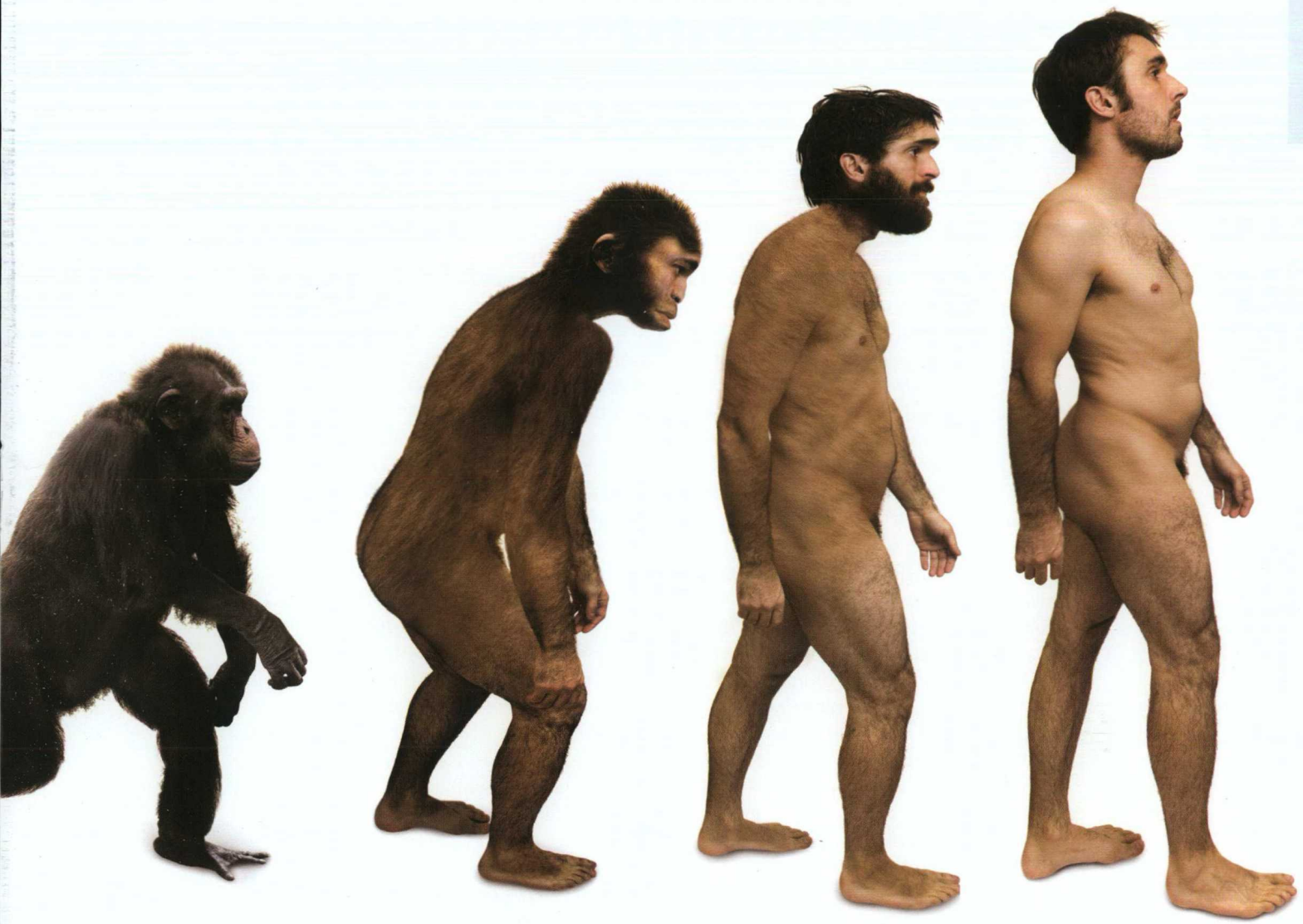
***Sahelanthropus, Orrorin tugenensis, Ardipithecus kaddaba, Australopithecus, Paranthropus* and finally *Homo*. Humans have traveled quite a long evolutionary path. Only one of these many species has managed to survive to the present day: *Homo sapiens***

Human evolution is an issue so captivating for the public that the news of even small new paleoanthropological finds, or the constantly appearing reports about new paleogenetic data on our close evolutionary relatives, manage to arouse much excitement and become front-page stories even in non-scholarly publications. The growing accumulation of fossil material from the different stages of human evolution, i.e. over the past 6-7 million years, is continually reconfiguring how we reconstruct our species' phylogenetic tree.

A few decades ago, anthropogenesis (the origin of mankind) seemed mainly uncomplicated and was perceived linearly: after *Australopithecus* came *Homo habilis*, then *Homo erectus*, then Neanderthal Man, and finally modern man. Today we have identified more than 20 paleospecies in our family tree, organized into a number of groups (six genera) and tracing out a large, quite "branchy" human evolutionary tree. The oldest forms - in chronological order - are *Sahelanthropus* (over 6 million years ago), *Orrorin tugenensis*, also known as the "Man of the Millennium" (approx. 6 million) and *Ardipithecus kaddaba* (5.8-5.2 million), followed by many species of *Australopithecus*, three species of *Paranthropus* with large molars and small front teeth, and finally the many forms of the genus *Homo*. Among the latter is the single species that still survives today, and is even thriving in numbers. That's *Homo sapiens*.

## Changing teeth and legs

Both paleoanthropological data and the molecular clock suggest that the lines leading to modern-day humans and chimps diverged between 5.5 and 7 million years ago. Unfortunately, little is known about who exactly this "Last Common Ancestor" (LCA) was and what its features were. Some scholars believe it was the Miocene *Kenyapithecus*. Until recently it was thought that the LCA had characteristics similar to the modern African apes, living in tropical rainforests and moving on the ground like a chimpanzee. A change of perspective appeared with the discovery of Ardipithecus (*Ardipithecus ramidus*). This species, like the LCA, may have had little sexual dimorphism. When walking on the ground, they engaged in knuckle-walking (i.e. carrying their body weight down on the dorsal surface of their middle



phalanges), like chimpanzees or gorillas do. They had thin tooth enamel and were omnivorous, although fruit prevailed in their diet. Socially the species was polygamous and the females were the exogamous gender, i.e. the ones who left their native groups (as in the case of apes).

The key criterion for belonging to the subfamily *Homininae* is bipedalism, and this certainly appeared before 5 million years ago - both *Ardipithecus kadabba* (5.8-5.2 million), and the later "Ardi" or *Ardipithecus ramidus* (4.4 million), certainly used this means of locomotion. On the basis of a few femoral fragments the oldest biped is believed to be *Orrorin tugenensis* from over 6 million years ago. It remains unclear whether the oldest *Sahelanthropus* (6-7 million) was bipedal, as has been conjectured solely on the basis of its skull (particularly the position of the foramen magnum). Interestingly, it is the only early hominin to have been found in Central Africa (in Chad). A second important feature of the *Homininae* is having small teeth (relative to the other apes). One of the differences between ardipithecus and orrorin is that the former has a smaller thickness of enamel (believed to be a more progressive trait). Generally, these species were the size of a chimpanzee, in other words relatively small (35-45 kilograms), and lived in rain forests.

Unfortunately, we have been unable to determine which factors of selection pressure led to the emergence of bipedalism. Most of the hypotheses relate to a change in the environment in which our most distant ancestors lived. For a long time the predominant opinion was that what crucially triggered the beginning of bipedalism was the colonization of open habitats such as the savanna. Today, however, it is believed that the oldest bipeds lived prior to that, still in the forest environment. Mosaic characteristics associated with the construction of the upper and lower limbs indicate that the oldest *Homininae* could move well both in the trees and on the ground. The proportions of the body and the type of bipedalism which occur in modern humans did not appear until the emergence of the genus *Homo*, which is approx. 2 million years ago.

The descendants of ardipithecus were the australopithecines, which appeared approx. 4.2 million years ago. The earliest, still adapted to arboreal life, was *Australopithecus ana-*

*mensis* (East Africa). But the most famous is *Australopithecus afarensis*, whose best-known representative is "Lucy" from approx. 3.2 million years ago; 40% of her skeleton was found in Hadar in Ethiopia. She was relatively small, had relatively long arms and short legs, and a brain size of 440 $cm^3$, which is slightly larger than the chimpanzee (400 $cm^3$). Her intestines were still quite long, as is known from her wide cone-shaped chest, and she had large molars (although not as large as *Paranthropes* later), and so her diet was vegetarian. A close relative, similar in morphology to afarensis, was *Australopithecus africanus*, which occurred between 3 and 2 million years ago, in Southern Africa. In the same area, but between 1.8 and 1.2 million years ago, there were still *Paranthropus* with massive molars, whose representative in Southern Africa was *Paranthropus robustus*. The robustus forms (*A. aethiopicus* - 2.7-2.3 million years ago and *A. boisei* - 2.3-1.2 million years ago) were also present in Eastern Africa. Paleoanthropologists, however, are almost unanimous about the fact that Paranthropus - well adapted to consuming very hard food - was an evolutionary dead-end and did not belong to a line which could have evolved into *Homo*.

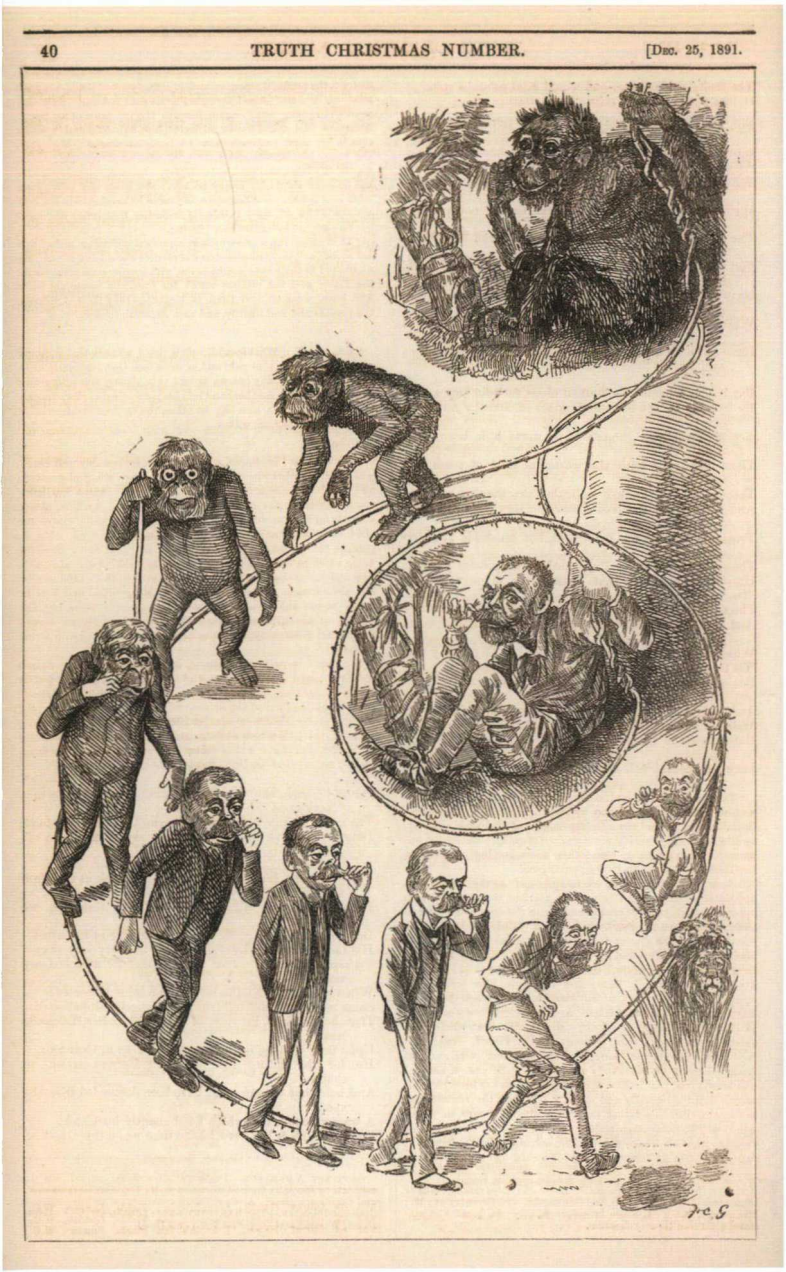
## The first Homo elite

It is postulated that the genus *Homo* evolved from gracile australopithecines in Eastern Africa. One of the first of its representatives is *H. habilis*, or "handy man" (2.4-1.4 million years ago in Olduvai Gorge in Tanzania). Its brain was admittedly a bit larger than that of Australopithecus, at approx. 600 $cm^3$, but it also had primitive characteristics such as long arms and even a moderately prognathous (protruding) face. It was also relatively small - 1-1.3 meters. The second candidate for the first Homo is *H. rudolfensis* occurring in East Africa 2.4-1.8 million years ago, whose chief representative is KNM-ER 1470 from Kenya. It had a larger brain (700 $cm^3$) and bigger premolars and molars. These forms used the stone tools that are considered to form part of the Olduvai culture (we know of such tools that are over 2.6 million years old, so it is possible that the australopithecines already used them). Scientists are still wondering about the relationship between these early *Homo* types. Perhaps both forms belong to one species?

The next typical representative of our genus is *Homo erectus* (an early African form of which is also called *H. ergaster*). In contrast to its ancestors it had body proportions clearly tailored to hot, open habitats and a bigger brain - more than 800 $cm^3$. It appeared approx. 1.9 million years ago, and approx. 1.85 million years ago was first found outside Africa, for example in what is now Georgia. This migration to the north meant that it had to cope with new climate conditions. A relatively large brain enabled it to do this, which, moreover, between 800 and 200 thousand years ago grew quite quickly and reached an average of more than 1300 $cm^3$ (with no accompanying change in body size). Undoubtedly this migration to the colder zones was helped by the ability to process and use stone tools. The first such tools we know of are from approx. 2.5 million years ago, and the data from Kanjera in Kenya show that already approx. 2 million years ago they were being transported across distances well over 10 kilometers, being used for instance as slaughtering tools (cuts on the bones of animals are clearly preserved). The fact that our ancestors' diet changed is also indicated by both the morphology of the teeth, as well as a shorter intestine - adapted to eating meat and thermally processed (i.e. roasted) food.

*H. erectus*, who appeared in Africa, Europe, and Asia, had also mastered the art of using fire. This cultural change, which took place at least 800 thousand years ago (according to some researchers even earlier), not only allowed for efficient processing of food but also provided heating and deterred predators. It likewise "lengthened" the day, thereby likely also contributing to more intense social interactions.

*H. heidelbergensis*, which appeared 0.7 million years ago and most likely derived from *Homo erectus*, is by many considered to be the direct ancestor of *Homo sapiens*. According to the British anthropologist Christopher Stringer, approx. 0.5 million years ago there were already three populations with similar numbers, which due to geographical isolation gave rise to three species: *H. neanderthalensis* in Europe and western Asia, the Denisovans in Asia-Pacific, and *H. sapiens* in Africa. The first two became extinct approx. 40 thousand years ago. The better known of the two, *H. neanderthalensis* or Neanderthal Man, was in a way the closest relative of *H. sapiens* and had body proportions adapted to a cold climate: a mas-




B&W: *Truth* magazine, Christmas issue, Dec. 1891

**Satirical Victorian-era cartoon depicting the stages of human development as a species**

sive body and large brain (about 1450 $cm^3$). Neanderthals used teeth for tanning leather, cared for the sick and old, and performed funeral rites. Recent dating of 40 European Neanderthal sites indicates that these forms became extinct between 39 and 41 thousand years ago and may have coexisted with *Homo sapiens* for a period of 2,600 to 5,400 years. We have also found that Neanderthals from the south of the Iberian Pėninsula actually date to before 50,000 years ago, and not, as until it was recently thought, about 32,000 years ago.

## Enter Homo sapiens

Modern man appeared, according to most paleoanthropologists, in Africa between 150 and 200 thousand years ago. From there many waves of migration extended out to Asia and Australia, and also to Europe. Recent genetic and craniometric surveys indicate that the first wave of dispersion to Asia occurred approx. 130,000 years ago (it was originally believed to be approx. 75,000 years ago). About 50,000 years ago, *Homo sapiens* arrived in the north of Eurasia and populated Europe, replacing *H. neanderthalensis*. Until recently it was thought that *H. sapiens* did not interbreed with Neanderthals. Current genetic studies have shown that such interbreeding did indeed occur and that a small proportion of genes in modern humans are of Neanderthal origin (approx. 2%). Such crosses also occurred with the Denisovans from the region of Siberia, as Melanesians and Australian Aborigines have been found to have approx. 4-5% Denisovan genes.

The modern human can be characterized as a hominid having a less massive skeleton than previous forms, with no supraorbital ridges, having a chin on the lower jaw bone and small teeth. It is a creature familiar with very sophisticated technologies, and religions practices can be seen to appear among its communities. It also uses a complex verbal form of communication, although we still do not know when this first arose. Complex behaviors indicate that this was possible before 400 thousand years ago, which would mean that *H. heidelbergensis* and *H. neandertalensis* also possessed such abilities. About 100,000 years ago symbolic art appeared (the oldest cave paintings are over 49,000 years old), and this points to abstract thought and complex ways of seeing the world, both in Neanderthals and *Homo sapiens*.

This, at least, is the story as we understand it today, although the long evolutionary path travelled by our ancestors surely still has many undiscovered secrets in store. We can only hope that in the future new research methods will help us better understand our over 6-million-year past. ■

**Further reading:**

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