



HUMAN EVOLUTION IN A NUTSHELL:

AN INTRODUCTION TO HUMAN EVOLUTION

PART 1.2: THE FIRST HOMININS

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In part 1.1 we learnt about the closest living relatives of humans, the African great apes. We share a common ancestor with the chimpanzee about 7 million years ago. We also defined hominins, humans and our extinct relatives.

In part 1.2 you will learn about:

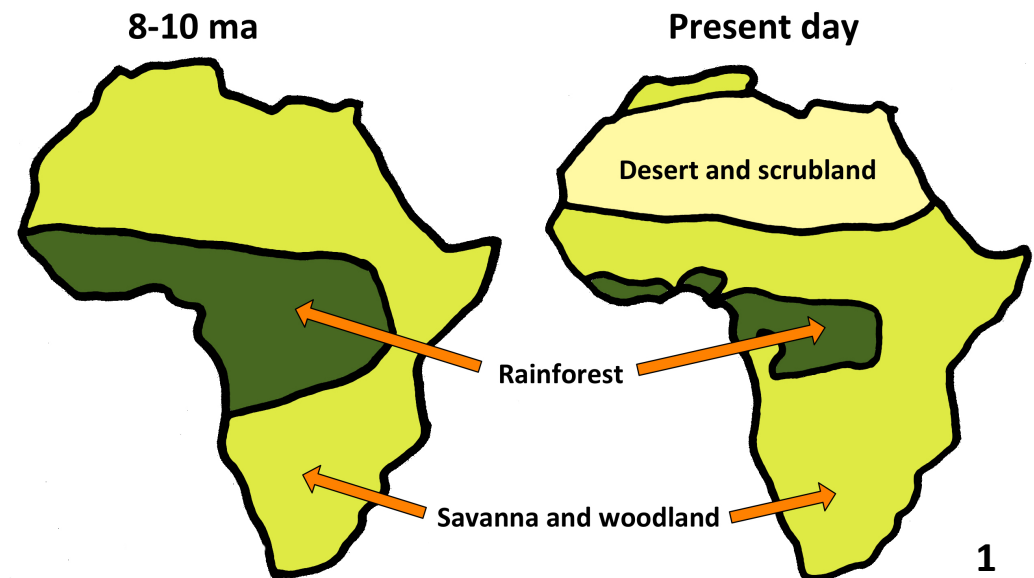
- Environmental background to human evolution
- The earliest hominins
- The origins of bipedalism - walking on two legs

THE ENVIRONMENT AND HUMAN EVOLUTION

Before we look at the earliest hominins we need to look at the environmental context of human evolution in order to better understand the lives of our extinct relatives.

Africa in the past

At around the time of the human/chimp common ancestor, Africa had more woodland and rainforest with less desert and scrubland. Over time, the climate became cooler and drier leading to the forests becoming more fragmented. This probably led to the ancestral chimpanzee and human populations becoming separated in different ecological habitats.



In addition to climate, also highly relevant was the East African Rift Valley, which started forming 20-15 million years ago. Here, the Earth's crust gradually bulged and moved apart, and the centre later sank forming the valley. Different environments emerged on either side of the rift valley. The hominins seemed to have evolved mostly inside the rift valley, chimpanzees outside.

THE FIRST HOMININS

From comparative genetic studies of humans and other apes we know that humans and chimpanzees/bonobos share a common ancestor that lived about 7 million years ago (ma).

While we know that we share a common ancestor it is at the moment hypothetical and we do not really know what it would have looked like. We can be fairly sure that it would have lived in Africa as this is where chimpanzees and bonobos live today. It would have looked like some sort of ape but not exactly the same as a chimpanzee. Remember, chimpanzees as well as humans have evolved since the common ancestor.

The exact appearance of the common ancestor is further complicated by the fact that we know practically nothing about chimpanzee evolution, so we do not know which chimpanzee characteristics derive from the common ancestor and which have evolved in the intervening millions of years (for example, does chimpanzee knuckle-walking come from the common ancestor or did it derive only later?).

Nevertheless, we think that the common ancestor was probably still a quadruped (walked on all fours). However, 6 to 7 ma bipedal apes start to appear, apes on the human side of the chimpanzee/human divide that walked upright on two legs. Let's take a look at what's been found to date.

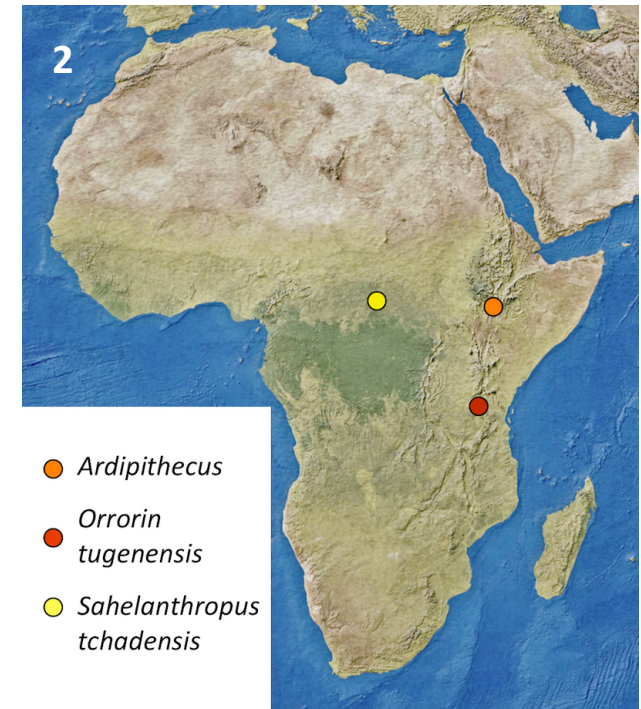
Sahelanthropus tchadensis

Found in 2002 and dated to about 7 ma. Also known as Toumaï which means ‘hope of life’.

Found in Chad, over 2000 km away from the East African Rift Valley where most of the other early hominins have been found.

It has some hominin features, such as a short face and smallish canine teeth. The brain size was relatively small at 360-370 cc, so chimpanzee-sized. The hole allowing the entry of the spinal column into the skull (the *foramen magnum*) is located under the base of the skull rather than towards the back of the skull as in apes. This suggests that the head was held erect on top of the spine, which indicates that it walked in an upright bipedal fashion. However, no postcranial remains (i.e., bones below the skull) have been found, so we cannot be sure of bipedalism. This could mean that *Sahelanthropus* is not actually a hominin.

The teeth of *Sahelanthropus* indicate that it ate mainly fruit. At the time that it lived the area would have been forested with plenty of water around. More open habitats were also nearby.



Orrorin tugenensis

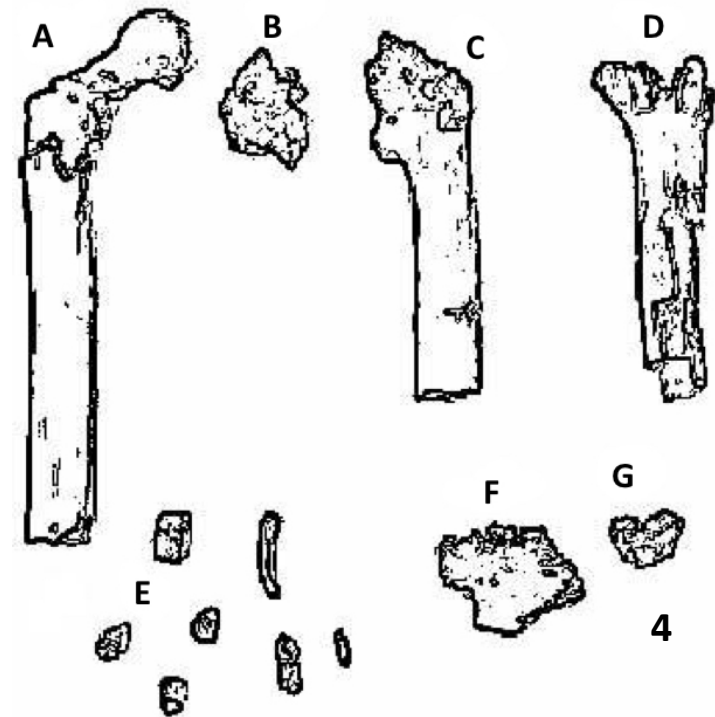
Found in Kenya in 2000 and dated to about 6 ma. *Orrorin* means 'original man' in the local language of the Tugen Hills, where it was found.

20 specimens have been found, including part of the jaw, several teeth, parts of the femur (thighbone), upper arm (humerus), and part of a thumb (fig. 4).

One of the thighbones preserves the upper part that is connected to the hip. The hip joint of bipeds is quite distinctive, and the *Orrorin* femur indicates bipedalism. In particular, there are marks on the femur left by the ligament that connects the femur to the pelvis, in a way that is found only in humans. The arm bones indicate a tree-living lifestyle. So we seem to have a biped that was also a good climber.

The teeth are apelike in their form, but have thick enamel, which is typical of most hominins and not apes.

Orrorin seems to have lived in a forested area fringed by streams with open woodland nearby.



A: left femur; B: fragmentary right femur; C: left femur; D: right humerus; E: teeth; F: left mandible fragment; G: right mandible fragments.

Ardipithecus

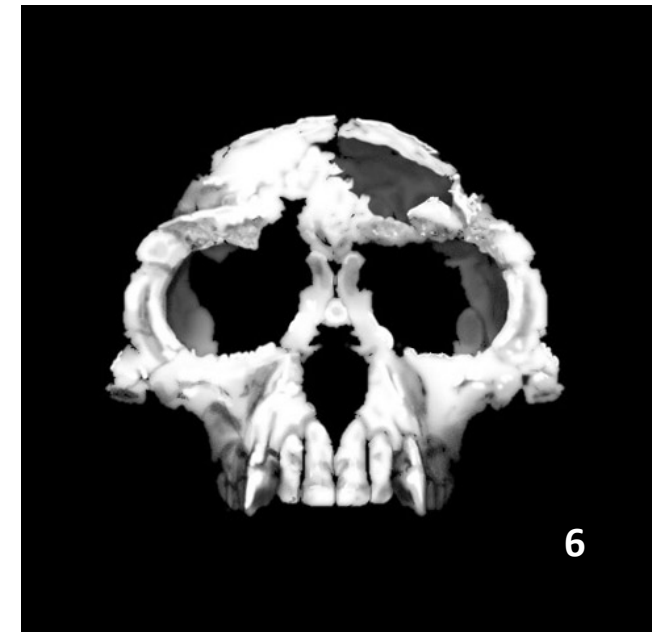
First found in 1994 in Aramis, Ethiopia. Its name means 'ground ape'. There are two species. *Ardipithecus kadaba*, dated to 5.6 ma, is known only from fragmentary teeth and skeletal remains (fig. 5).

Ardipithecus ramidus, dated to 4.4 ma, is known from fossil remains nicknamed 'Ardi'. Ardi comprises most of the skull and teeth, arm and leg bones, pelvis, hands, and feet.

The pelvis and foot bones indicate bipedalism, albeit a more primitive form than later hominins, but good climbing ability. It had a small chimpanzee-sized brain and a very apelike skull (fig. 6).

The teeth are not very specialised and so indicate a varied, perhaps omnivorous diet, though fruit would have been an important component.

Ardi lived in a closed wooded environment, more wooded than where *Sahelanthropus* and *Orrorin* lived.



THE ORIGIN OF BIPEDALISM

The hominins we have looked at so far show that bipedalism, walking on two legs, goes back as far as 7 million years, almost to the beginning of the hominin story. There are many theories regarding the evolution of bipedalism in hominins, which is a unique trait among primates.

Some believe bipedalism evolved to free the hands for **carrying**, perhaps for tools.

Gathering food would perhaps have been easier and hominins could have carried surplus food for storing.

Seeing over grass in the savannah is another idea. However, some monkeys stand tall to see over grass but are not bipedal. Plus, the earliest hominins actually lived in wooded environments.

Human bipedalism is **more energy efficient** than chimpanzee locomotion though early hominin walking was perhaps not so efficient as their gait was not quite the same as modern humans. One problem with this theory is that the earliest bipedal hominins seem not to have lived in open habitats.

Another theory centres on **thermoregulation**. An upright posture means



Hominin footprints from Laetoli, Tanzania, 3.7 million years ago

a bipedal hominin would create a smaller shadow than an ape and so have less direct exposure to sunlight which in turn would help them to keep cool - and remain more active - in open country during the height of the day, a time when many other animals are rather inactive.

A **seed-eating** hypothesis was also proposed, whereby having permanently free hands would increase feeding speed. An upright posture could also aid feeding on tall bushes and small trees. However, other primates feed in such ways and have not evolved bipedalism.

In his excellent 2003 book 'Lowly Origin', Jonathon Kingdon proposed a hypothesis whereby a forest-living **squatting ground ape** would have had the need for a flexible waist which could have led to a shortened human-like pelvis. With a shorter, squatter pelvis the changes required to adapt the pelvis for true bipedal locomotion would have required far fewer changes.

Many believe that the origins of bipedalism lie **in the trees** and not on the ground, as has been the traditional view. An upright posture could have developed from walking upright in trees whilst using hands for support. Because an upright posture would have been the norm for such a species when it came to the ground bipedalism was the most natural form of locomotion. This seems very plausible and it also takes into account that the earliest hominins still lived in wooded environments and that their anatomy still retained adaptations to climbing.

It is difficult to say which, if any, of these theories is correct. It is possible that many of them may have played their part, and there is no reason why there should have been only one cause.

SUMMARY

In this part we saw that climate around the time of common ancestor was changing, becoming cooler and drier which led to forests becoming more fragmented. The East African Rift Valley formed at this time too, and all of these factors may have led to the ancestral chimpanzee and human populations becoming separated.

Then we looked at the earliest hominins, who lived between 7 and 5 million years ago. They were *Sahelanthropus* from Chad, *Orrorin* from Kenya, and *Ardipithecus* from Ethiopia.

We know from these earliest hominins that first distinctive hominin feature to evolve was bipedalism, walking on two legs. We ended by looking at some of the reasons why bipedalism may have originated.

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