

EARLY ANCESTORS

INTRODUCTION

As you know, the human evolutionary tree is constantly changing; becoming bushier and ever more complex with each new fossil find that forces anthropologists to rethink what they thought they knew of the human past. Reconstructing the ancient human past, the environmental as well as the social landscape of our ancestors, is no easy task. It requires a great deal of interpretation, especially the interpretation of clues that have been left behind. Since we cannot dig up behavior, we must look to the traces of behavior left by early hominids. But more than merely speculation, this process involves specialists from many scientific fields, all working together to shed light on past events. Most of these scientists would readily admit that the human puzzle is far from complete, and that all we can do is work with the pieces we have, fitting new pieces together as we go. As each piece is added, the picture as a whole is slightly altered, but ever more complete and accurate.

As some of the earliest fossil hominids were uncovered, they posed serious challenges to the prevailing ideas of the time about human origins and the course of human evolution in general. For one, the discovery of the australopithecines, the oldest human ancestors, lent support to Darwin's (and others) conviction that the cradle of humankind was in fact in Africa. Second, the very small brained, ape-like australopithecines also provided indisputable evidence that bipedality, rather than large brains was the first hominid trait to evolve. Third, with several different species of hominids living contemporaneously, the fossil evidence also suggested that the variation so critical to the operation of natural selection was indeed present among early hominid populations. Natural selection/Great Worldmaker was indeed experimenting with our ancestors!

Many questions about the australopithecines and the even earlier pre-australopithecines (from the Late Miocene) remain unanswered or at least, hotly debated. There still has not been any consensus in the anthropological world as to hominid ancestor-descendent relationships (phylogeny). The purpose of this and the other hominid lab exercises is to give you an idea of how challenging it is to produce such a phylogeny based on fossil evidence alone. What you will be looking for throughout these labs, are the evolutionary trends occurring in the hominid lineage.

PART ONE: Cranial comparisons between Apes & Early Hominids

Go to the table where the bonobo (*Pan paniscus*) and early hominid skulls have been placed. The four species here are *Sahelanthropus tchadensis*, *Ardipithecus ramidus*, *Australopithecus afarensis* and *Australopithecus africanus*.

EARLIEST HOMINIDS (The pre-australopithecines): *Sahelanthropus tchadensis* is not a confirmed biped, which means, it may not be a hominid. *Ardipithecus ramidus*, however, is a confirmed biped and at this time, is the *OLDEST* established biped in the fossil record as well as being the most complete ancient hominid skeleton. "Ardi" (as ramidus is nicknamed) exhibits bipedalism in most of the key areas of the skeleton: the centrally located foramen magnum, inwardly angled femur, and a slightly shortened & broader pelvis. Ardi's foot, however, retains adaptations to arboreal locomotion including a divergent and grasping big toe. Although Ardi's arms are proportionately longer than her legs, her wrist & hand bones do not show evidence of knuckle-walking, which is the skeletal and locomotive pattern of the Great Apes. Ardi's dentition indicates a mixed diet as the enamel on the teeth is neither thick (needed for processing hard food items) nor thin, which would indicated a heavy reliance on fruit. Given the "mixed"

traits exhibited in Ardi's skeleton & dentition, it's not surprising that this hominid species would have been active both in the trees and on the ground in search of food resources.

Using *Pan paniscus* (a bonobo) as a basis of comparison, describe the following features exhibited by the two hominid species

	<i>Sahelanthropus tchadensis</i>	<i>Ardipithecus ramidus</i>
Age range of species	7 my	5.8 – 4.4 my
Size of braincase in relation to overall size of skull		
Browridges: Robust? Continuous or divided?		
Forehead: Vertical or flat?		
Sagittal crest (if present)		
Occipital region (back bone of skull): Flattened or rounded?		
Dental arcade (shape of mouth) -broad or narrow?		
Size of molars: Elongated or squared/broad?		
Appearance of canine teeth		

Based on your observations and data, which features are:

1) more ape-like in *Sahelanthropus*?

2) less ape-like in *Sahelanthropus*?

1) more ape-like in *Ardipithecus*?

2) less ape-like in *Ardipithecus*?

“LUCY” AND THE AUSTRALOPITHECINES

Au. afarensis is among the oldest of our confirmed bipedal ancestors. However, despite this unique and defining adaptation, *Au. afarensis* or “Lucy” as the original fossil of this species was nicknamed, still retains very ape-like features, especially in the lower face and dentition as well as in the finger, toe, wrist, and ankle bones. This indicates that although upright walking was an obligatory form of locomotion, these small-bodied, small-brained hominids probably still spent some time in the trees, most likely for safety. Given that their cranial capacity is comparable to that of a modern day chimpanzee, we can assume they were capable of the same behaviors observed in and documented among chimpanzees. They probably lived in small, nomadic groups, ate a variety of foods, and used very simple perishable tools (similar to chimps). These species represent just a partial sample of the variation present among the early hominids, all of which served as “experiments” in the process of natural selection.

Using *Pan paniscus* (a bonobo) as a basis of comparison, describe the following features exhibited by the two hominid species.

	<i>Australopithecus afarensis</i>	<i>Australopithecus africanus</i>
Age range of species	3.9 – 3.0 my	3.5 – 2.3 my
Size of braincase in relation to overall size of skull		
Browridges: Robust? Continuous or divided ridge?		
Forehead: Vertical or flat?		
Sagittal crest (if present)		
Occipital region (back bone of skull): Flattened or rounded?		
Position of foramen magnum		
Degree of lower facial prognathism		
Dental arcade (shape of mouth) -broad or narrow?		
Size of front teeth relative to back teeth (molars)		
Size of molars: Elongated or broad & square?		
Appearance of canine teeth		

- In general, does *Australopithecus afarensis* appear more ape-like or human-like? 2) Describe the features that contributed to your conclusion.
 - 1)
 - 2)

- Does *Au. africanus* appear more ape-like or human-like? 2) Describe the features that contributed to your conclusion.
 - 1)
 - 2)

ROBUST AUSTRALOPITHECINES (aka the genus *Paranthropus*) Now, go to the table where the common chimpanzee (*Pan troglodytes*) and early hominid skulls have been placed. As a group, the robust australopithecines exhibit features not observed in the other early hominid species. Their cranio-facial-dental anatomy is reflective of their specialized dietary pattern. Their brains are not much larger than a modern day chimp's, especially when measured as relative to their body size. This group of hominids was an evolutionary side branch, one more example of the range of variation that existed among early hominids. Their features do not show up in any later hominids, so, it appears they were an evolutionary dead-end as well (that is, they became extinct; just a relative not an ancestor). Due to their distinct features & their extinction, some anthropologists assign these specimens to a different genus, ***Paranthropus*** (which is why you'll see a P. in front of their species name below)

Using the chimpanzee as your basis of comparison, describe the features exhibited by the two hominid species.

	<i>P. robustus</i>	<i>P. boisei</i>
Age range of species	2 – 1 my	2.3 – 1.2 my
Size of braincase in relation to overall size of skull		
Wide or narrow zygomatic arches/face		
Browridges: Robust? Continuous or divided ridge?		
Sagittal crest		
Position of foramen magnum		
Degree of lower facial prognathism		
Dental arcade (shape of mouth) Broad? Narrow? U or V shape?		
Size of molars: Elongated or broad & square?		

1. What physical features does this group of hominids (Paranthropines) have in common? (Be specific)
2. Describe any ape-like features exhibited by these hominids.
3. What do you think accounts for the wear on the teeth of these hominids?

PART TWO: Analysis and Review (You may need to refer to the Early Hominid Evolution Reading)

1. Describe three cranial, facial or dental differences between apes and early hominids.
 - a)
 - b)
 - c)
2. Which early hominid species is the OLDEST *established* biped?
3. What skeletal features exhibited by the early hominids below tell us that they still made use of the trees?
 - a) *Ardipithecus ramidus*
 - b) *Australopithecus afarensis*
4. Explain, based on what you know about natural selection and evolution, a) why the robust australopithecines are better classified within their own genus, *Paranthropus* and b) considered to be a “relative” rather than an ancestor.
 - a)
 - b)
5. What is the ONE feature in the skull that tells us these primates are bipedal, and therefore, classified as hominids