Chapter 2: Humanity’s Roots

# Chapter Summary [Copied from Olszewski 2019, Chapter 2]

* Paleoanthropologists use a classification system or taxonomy to organize humans and their ancestors into a hierarchy of relationships. This taxonomy also shows the relationships between humans and the great apes, as well as more distantly related species such as monkeys.
* Nonhoning chewing and bipedal locomotion help define humans and their ancestors. They are two of the earliest changes in the hominin lineage and distinguish hominins from the great ape lineages. The earliest hominins were not habitual bipeds, however, because it took time for skeletal changes necessary for full-time bipedalism to become established through natural selection. The specific type of habitual bipedalism characteristic of modern humans appeared about 2 million years ago.
* There have been many ideas or hypotheses about how or why bipedalism originated. These include the advantages of freeing the arms to carry things, exposing more of the body to breezes and wind that would help cool it, sexual selection by females of males who could carry more food as provisions to the female and her offspring, and the possibility that bipedalism was eventually more efficient in traveling longer distances.
* There are many species of early hominins, all of whom are found in Africa. They can be divided into early australopiths (*S. tchadensis, Ar. ramidus*) and later gracile australopiths (*Au. afarensis, Au. africanus, Au. sediba*), robust australopiths (several species of genus *Paranthropus*), and early genus *Homo* (*H. habilis* and one or two other species).
* The species of genus *Paranthropus* are hominins that did not lead to modern humans. *Paranthropus* specialized in plant foods low in nutritive value and would have spent most of their day eating to gain enough energy from food. This can be seen in the cranial features associated with their massive chewing muscle complex and their extremely large premolar and molar teeth.
* The skeletal features of the early hominins indicate patterns of mosaic evolution. That is, natural selection acts on features at different rates of change and at different times. Skeletal evidence for bipedalism thus appears much earlier than increases in brain size or modifications to apelike arms and finger bones.
* Beginning 3.3 million years ago, the first Early Stone Age period stone tools appear in the African archaeological record and are called the Lomekwian industry. By 2.6 million years ago, stone tools are more common; these are called the Oldowan industry and are characterized mainly by choppers, flakes, and a few other forms such as scrapers. These early stone tool industries show that hominins understood the flaking properties of different types of stone. They also show that hominins were transporting stone artifacts over some distance, a pattern of behavior that is not typical of our close relatives, the common chimpanzees and bonobos.
* Stone tools were advantageous to early hominins who lacked specialized teeth for removing meat from animal bones or cracking open those bones for marrow. Whether the hominins were able to hunt large animals or relied instead on scavenging carcasses of animals killed by large cats is still a matter of debate.

# Key Terms

***Ardipithecus ramidus***: a fossil hominin from 4.4 million years ago in East Africa, this species has some skeletal features indicating a trend toward bipedalism but also ape-like features such as long arms and a grasping foot. Similar body size and reduced size of the canines in males and females has been interpreted as possible evidence for monogamous pair-bonding, reduced aggression between males, and greater investment of males in raising offspring.

***Australopithecus afarensis***: a fossil hominin dating between 3.7 and 3 million years ago in East Africa. It was a habitual biped but still retained the long arms and curved finger bones that are ape-like traits. There is some evidence indicating sexual dimorphism.

***Australopithecus africanus***: a fossil hominin known from South Africa in the interval between about 3.3 and 2.5 million years ago. Although it was a habitual biped, there are some features of the big toe and knee that suggest these areas of the skeleton were still somewhat ape-like. Like other gracile australopiths, it also had long arms and curved finger bones, indicating that it spent at least some of its time in the trees.

**Australopithecus sediba**: a fossil from South Africa dating between 1.95 and 1.78 million years ago. It has some typical australopith features such as long arms and curved finger bones, as well as a small brain size. However, its skeleton also shows features that are more like the genus *Homo*, such as smaller molars, lack of flaring cheek bones, and its bipedal structure.

**Australopiths**: a generic term for the subtribe taxonomic category of Australopithecina; it includes genera such as *Sahelanthropus*, *Ardipithecus*, *Australopithecus*, and *Paranthropus*.

**Bipedal**: the use of the lower limbs (legs) to move around when walking or running.

**Chimpanzee-human last common ancestor:** also known as the LCA, is the ancestor of both hominin and panin lines. The LCA is believed to have lived 6.3 – 5.4 million years ago.

**FLK 22 Site**: an important archaeological and hominin fossil site in Tanzania (Africa) that produced remains of *Paranthropus* and *Homo habilis*, as well as a well-preserved animal bone assemblage and flaked stone artifacts.

**Foramen Magnum**: the opening in the skull where the spinal column joins the head. The position of the foramen magnum can be used to determine if a fossil species was a biped or a quadruped.

**Gene Flow**: an evolutionary process in which interbreeding between neighboring populations allows genes from one population to enter the gene pool of another population; over geographical space, this transmission of genes from one group to another maintains similarity in the genetic structure of populations that are widely separated from one another.

**Genus**: a taxonomic category that includes all similar species that share a common ancestry.

**Hominin**: the generic term for the tribe taxonomic category of Hominini; it includes humans and their ancestors.

**Hominoidea**: the superfamily taxonomic category that includes gibbons, orangutans, gorillas, common chimpanzees/bonobos, and modern humans and their ancestors.

***Homo habilis***: the slightly larger brain size of this fossil species from East Africa led Louis Leakey to place it in the genus *Homo* (our genus) rather than that of *Australopithecus*. However, it has some ape-like features such as long arms and curved finger bones.

***Homo sapiens***: the genus and species name for skeletally modern humans, who first appeared in Africa 195,000 years ago; movement out of Africa by some groups begins shortly before 100,000 years ago. People living today are members of *Homo sapiens* (sometimes shown as *Homo sapiens sapiens* to distinguish skeletally modern humans from Neandertals).

**Laetoli**: a site in Tanzania that yielded *Australopithecus afarensis* fossils as well as a trail of fossilized footprints attributed to *Australopithecus afarensis*.

**Lomekwian:** The Early Stone Age period, dating to 3.3 million years ago, with tools including cores, flakes, stone anvils, and percussors. The period is named for the site of Lomekwi 3 Kenya.

**Megadont**: term often used to describe the enormous molar teeth of most australopith species, such as *Australopithecus afarensis*, *Au. africanus*, and species of *Paranthropus*.

**Miocene**: a geological epoch from about 23 to 5 million years ago. The first hominins appear in Africa during the late Miocene.

**Mosaic Evolution**: represents a situation in which natural selection acts at different rates of change on various parts of the body. One example in the hominins is the combination of habitual bipedalism with ape-like long arms and curved finger bones. In this case, natural selection acted earlier on structural changes leading to bipedalism than it did on structural changes to the arm and hand.

**Mutation**: changes in genetic material found in genes; most of these are disadvantageous and are subject to negative selection so that they are quickly removed from the gene pool of a population. A few mutations are advantageous and are subject to positive selection, for example, mutations in the FOXP2 gene that are useful for language in humans.

**Natural Selection**: refers to a major principle of evolution (sometimes called Darwinian evolution) that is based on the individuals who are best adapted to an environment having the best chance of surviving to reproduce and pass along their genes to the next generation. This process leads to gradual evolutionary change over time.

**Nonhoning chewing:** characteristic of hominins and other animals with smaller canines and no tooth gap in the tooth row. In non-hominin apes, the large upper canine is honed (sharpened) by rubbing through a gap in front of the lower pre-molar.

**Oldowan**: the earliest stone tools found, they appear beginning about 2.6 million years ago. The most common types are choppers, flakes, hammerstones, and scrapers.

**Panin**: a generic term for the tribe taxonomic category of Panini; it includes the common chimpanzee (*Pan troglodytes*) and the bonobo (*Pan paniscus*).

***Paranthropus***: genus name for the robust australopith species found in both South and East Africa. These groups have specialized features, such as extremely large molar teeth, massive chewing muscles, and males have a sagittal crest, which indicate a low-nutrition diet requiring them to eat most of the day. They are a side-branch to the lineage leading to modern humans.

**Quadrupedalism**: the use of all four limbs to move around.

**Sagittal Crest**: dating techniques that provide a sequence of “older” and “younger” rather than calendar dates; examples include stratigraphy and seriation.

***Sahelanthropus tchadensis***: a fossil from Central Africa in the period between 7 and 6 million years ago. It is usually described as a hominin, but some researchers have argued against this classification, suggesting that maybe it represents either the Last Common Ancestor (LCA) or a group related to the LCA.

**Sexual Dimorphism**: differences between males and females, such as (on average) greater weight and height, and more visible body hair in males, as well as differences in sex organs.

**Species**: a taxonomic category generally based on the biological species concept in which interbreeding natural populations are reproductively isolated from other populations.

**Taung**: a site in South Africa that yielded the first fossil recognized as a human ancestor (in 1925); led to the naming of *Australopithecus africanus*.

**Taxonomy**: a classification system that divides animal and plant groups into categories based on their evolutionary relationships, for example, modern humans/our ancestors and common chimpanzees/bonobos are members of the same subfamily (Homininae) but are different tribes (Panini for common chimpanzees/bonobos and Hominini for modern humans/our ancestors) within that subfamily.