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Archaeology and Humanity's Story: A Brief Introduction to World Prehistory

Chapter 2: Humanity's Roots

Chapter Outline

A Word about Classification
***Timeline**: Early Hominins*

Bipedalism and the Earliest Hominins
Why Is Bipedalism Important?
Advantages of Bipedalism
Origins of Bipedalism
Evolutionary Processes

"Cousins" in the Early Hominin Lineage

Tool Use and Manufacture
Stone Tools
***Peopling the Past**: Culture in the Prehistoric Record*
Which Hominins Made and Used Stone Tools
***The Big Picture**: Oldowan Industrial Complex*

Early Hominin Culture
***Peopling the Past**: Hunting versus Scavenging*

Summary

Endnotes

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Key Terms and Definitions

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.

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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

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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.

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Lecture Outline: Humanity's Roots

Introduction

- We *Homo sapiens* are the only living hominin species on the planet, but the paleoanthropological record reveals many traits we share with extinct members of our evolutionary lineage: skeletal structure, behavior, intelligence, and adaptability.

- Some of the strongest evidence for our adaptability occurs in the form of stone tools, first produced over 3 million years ago. This is millions of years *after* our earliest potential ancestors lived in South, East, and Central Africa 6–7 million years ago.

- The human story begins there.

A Word about Classification

- Linnaean **taxonomy** is a classification system first developed in the AD 1730s to organize living things at multiple levels, from the most general groupings (e.g., the kingdom Animalia) to the most specific (in our case, *Homo sapiens*).

- **Hominoidea** is a taxonomic superfamily that includes humans and our ancestors, as well as apes such as chimpanzees, bonobos, gorillas, orangutans, and gibbons—and their (ape) ancestors. Living hominoids share physical and behavioral traits with one another, so they are a good starting point for inferring possible behaviors of extinct hominoids.

- Recent genetic research shows that humans, common chimpanzees, and bonobos are closely related enough to be grouped together in the subfamily Homininae. However, Homininae is divided into two tribes: Hominini (humans and ancestors, called **hominins**) and Panini (chimps and bonobos, called **panins**).

    - See ***Timeline****: Early Hominins* for an overview of hominin genera and species identified in the fossil record.

- The genetic similarities between panins and us make them our closest living relatives. Chimps and bonobos are both members of the same **genus** *Pan*, but separate **species**, *Pan troglodytes* and *Pan paniscus*, respectively. Humans are the only living members of the genus *Homo*, with the species designation *Homo sapiens*.

- **Australopiths** is a general term for the extinct hominin genera *Sahelanthropus*, *Ardipithecus*, *Australopithecus*, and *Paranthropus* (see timeline).

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- Fossil hominins are identified based on two traits that distinguish them from apes. These are **bipedalism** and **nonhoning chewing**.

Bipedalism and the Earliest Hominins

- Two traits that distinguish humans from other animals are our large brains and **bipedal** locomotion. For decades, paleoanthropologists debated which of these features developed first, with little evidence to support either side.

- Now we can definitively say that our ancestors walked on two feet long before developing brains comparable to those of modern humans in size or complexity.

- We can determine how bipedal an extinct species was by examining characteristics of the lower body, spine, and even the skull:

    - The shape of the pelvis (those of bipeds are "shorter" and more bowl-shaped than **quadrupeds**).

    - The angle of the femur from pelvis to knee (bipeds with knees and feet directly underneath center of gravity, quadrupeds with more bowed legs, and knees splayed out).

    - Other features of the knee joint, lower legs, and feet that indicate they combined to aid walking, at the expense of reduced climbing/grasping ability.

    - "A fossil also can be recognized as a biped from features of the skull, such as the **foramen magnum** (the opening where the spinal column articulates with the skull) that is directly beneath the skull in a biped, as well as an S-shaped spinal column, a shape that helps with weight-bearing stresses (Fig. 2.3)" (Olszewski 2019:40).

- Genetic evidence suggests that the **chimpanzee-human last common ancestor** (LCA) of panins and hominins lived between 6.3 and 5.4 million years ago. It is assumed that this LCA would not yet have been habitually bipedal, but some even earlier specimens, like ***Sahelanthropus tchadensis*** from Chad (see Fig. 2.5), have some traits associated with upright walking.

- ***Ardipithecus ramidus*** (nicknamed "Ardi") from Ethiopia, dates to 4.4 million years ago and is widely accepted as a hominin. However, this species has a mosaic of arboreal (tree-living) and terrestrial (ground-living) traits, most notably a grasping big toe.

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- ***Australopithecus afarensis*** (species of the famed "Lucy"), found in Ethiopia, Kenya, and Tanzania, dates between 3.7 and 3 million years and was likely a more habitual biped than Ardi.

- The relatively complete skeleton of Lucy, 13 individuals of the "First Family," and **Laetoli** footprints (see Figure 2.6) all support this interpretation, although *afarensis* did have very arboreal arms and fingers.

- The first recognized australopith specimens, from the species ***Australopithecus africanus***, were discovered by Raymond Dart at the South African **Taung** site in 1925. *Au. africanus* (See Fig. 2.5) dates to between 3.3 and 2.5 million years, yet has ambiguous characteristics of both terrestrial and arboreal life.

Why Is Bipedalism Important?

- Hominins are defined by bipedalism, a trait we share with them. But there are features where early hominins are distinctly different from modern humans.

    - Body size: Many ranged in height between 3.8 and 4.5 feet, and 66 and 175 pounds (owing to **sexual dimorphism**).

    - Brain size: 400 to 500 cubic centimeters (modern chimps average 350 to 400 cc).

    - Cranial features: Early hominins tended to have low, sloping foreheads, flaring cheekbones, and projecting faces.

Advantages of Bipedalism

- As bipeds, this mode of locomotion seems perfectly natural and preferable to us. But why were the necessary mosaic of bipedal adaptations selected for in our evolutionary history? What advantages did these adaptations confer on our ancestors?

- Some proposed explanations:

    - The hands are freed up to manipulate objects and tools, and allow males to carry food to provision mothers and offspring.

    - Thermoregulation: the ability to withstand the heat of a more open savanna landscape. Upright bipeds, especially those with less body hair, expose less surface area to the sun overhead, and more surface area to breezes that blow parallel to the ground.

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  - Habitual bipedalism may confer energy and efficiency advantages, though the weight of these advantages is debated.

  - The ability to see long distances, spot prey, and avoid predators.

- "All of these views about the advantages of bipedalism, however, still leave us with questions about how early hominins became bipeds" (Olszewski 2019:44).

Origins of Bipedalism

- The LCA lived approximately 6 million years ago toward the end of the **Miocene**, a period of climatic drying in which forested areas became patchier mosaics of forest and open savanna. The expectation is that **natural selection** strongly favored those individuals who were better-adapted to the changing environment, and encouraged (via differential reproductive fitness) a shift toward bipedal adaptations.

  - See ***Evolutionary Processes*** box for a brief overview of four major processes: natural selection, **gene flow**, genetic drift, and **mutation**.

    - Natural selection: Individuals who are better-adapted to their environments tend to leave more offspring, increasing the proportion of those advantageous traits in the gene pool.

    - Gene flow: Interbreeding between neighboring populations, which prevents them from splitting into separate species.

    - Genetic drift: Sometimes the composition of a gene pool is altered by processes that have little to do with selective advantage (e.g., founder's effect, natural disasters, "bad luck").

    - Mutation: "Copying errors" in the genetic code. These introduce novel variations into the gene pool. Mutations are most often negative or neutral, but occasionally confer some selective advantage and increase within a population.

- One model of bipedal origins focuses on the relationship between group size and daily travel distance. Those members of the LCA species that split into small groups moved toward the quadrupedalism of modern chimps and bonobos (panins). Those that maintained large groups shifted toward bipedalism and us (hominins).

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  - Panin small group strategy: Easier to feed in times of resource scarcity, but more prone to predation and being outcompeted by larger groups. In this scenario, quadrupedal locomotion would be retained by members of small groups.

  - Hominin large group strategy: More mouths to feed, but more competitive advantage and defense against predators. In this scenario, it is proposed that bipedal locomotion would be more energy efficient.

- "It should be pointed out that while there are many ideas about the origins of bipedalism, it is quite likely that we may never be able to demonstrate which ideas are the most relevant.[i] This is because these origins do not leave a trace. The traces we have relate to changes in skeletal structures over time but not to the initial reason of "why." " (Olszewski 2019:45-46).

"Cousins" in the Early Hominin Lineage

- Other australopiths, such as those in the genus *Paranthropus*, can be envisioned as our evolutionary cousins, i.e., we share ancestry, but have different "parents." These cousins fall on a separate branch of the hominin tree, one that went extinct.

- *Paranthropus* species, often referred to as robust australopiths, lived in South Africa between 1 and 2 million years ago and in East Africa between 1.3 and 2.4 million years ago.

- *Paranthropus* fossils are marked by specialized traits that distinguish them from the "gracile" *afarensis* and *africanus*. Simply, the robust australopiths were "chewing machines." They are called **megadonts** because of their large, grinding molars, and parts of the skull where chewing muscles attach (such as the **sagittal crest**) are exceptionally robust.

- Owing to these cranial features, the robusts are often depicted like gorillas that sit around all day munching on hard foods. (In fact, Mary and Louis Leakey nicknamed an early specimen "Nutcracker Man.") There is probably an element of truth to that image, but recent carbon isotope analyses suggest they also ate a variety of other plant and animal foods.

- Paranthropus' "extremely large premolar and molar teeth and well-developed chewing muscle complex… reflect a type of diet not shared to any large degree by other australopiths" (Olszewski 2019:47).

- The term **mosaic evolution** highlights the fact that evolution is not directional, leading inexorably toward human-like traits. Different selective pressures affect different

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features at different times. For example, many australopiths retained ape-like arms and fingers long past the point that they were habitually bipedal.

- The evolution of "human" upper limbs and a rapid increase in relative brain size did not occur in our ancestors until after 2 million years ago.

Tool Use and Manufacture

- The record of hominin tool use and manufacture is largely one of stone. Though our ancestors probably worked with organic materials such as wood and plant fiber, these materials rarely preserve in the archaeological record. Bone is a material that is easier to work than flaked stone (thus may predate stone tools), and it does survive.

- The Swartkrans, South Africa faunal assemblage includes bones with use-wear patterns similar to those found on bones experimentally used to dig in termite mounds, a behavior observed in modern chimpanzees.

    - See ***Peopling the Past****: Culture in the Prehistoric Record* for a discussion of tool use by African and Asian great apes.

Stone Tools

- For decades, the earliest stone tools were associated with members of *Homo* and used to mark the beginning of our genus. There is a growing body of evidence supporting the idea that earlier australopiths made stone tools, or at least made use of naturally occurring stone.

    - 3.3 million-year-old stone tools were recently discovered at the Lomekwi 3 site in West Turkana, Kenya. This is 700,000 years earlier than the **Oldowan** tool industry associated with early *Homo*.
    - These tools include cores, flakes, stone anvils, and percussors.
    - While there have been no hominin fossils found at Lomekwi 3, the age of the site coincides with the dates for *Au. afarensis*.

- In our times of rapid technological change, Oldowan tools do not look like much. But they indicate the crossing of a behavioral threshold: hominins modifying external objects to compensate for our relatively useless (at least in terms of butchery) teeth and fingernails.

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- See ***The Big Picture****: Oldowan Industrial Complex* for a description of Oldowan choppers and flake tools.

- In order to create these artificial accessories, hominins had to understand the properties of stone, be able to work that stone into useable form, and have the foresight to transport good tool stone from its source (current evidence suggests at least 9 miles).

- Among many other benefits, bipedalism facilitates this type of long-distance transport; both tool stone and animal carcasses.

Which Hominins Made and Used Stone Tools?

- ***Homo habilis*** (2.4 to 1.8 million years ago) was first found at Olduvai Gorge in Tanzania.

- In the 1960s, Oldowan tools were found associated with *Homo habilis* (in fact, *habilis*, or "handy man," is named for its tool use). Its combination of human-like skeletal traits, brain size, and tools was used to mark the beginning of our genus.

- Since the 1960s, additional specimens, with ape-like traits, have led some to argue that *habilis* should be classified as an australopith.

- The recently identified species ***Australopithecus sediba*** (1.95 to 1.78 million years ago) from the Malapa site in South Africa combines many traits thought to be distinctively australopith or *Homo*—in a time frame well within the range when stone tools have been found.

- "Regardless of whether we consider them all australopiths or whether one of the species is genus *Homo*, studies of the bones of their hands, where available, indicate that they had grips capable of holding stones and knapping them" (Olszewski 2019:52).

- In any event, the solid line separating australopiths from tool-using *Homo* has been erased, and we must carefully reinterpret sites like **FLK 22**. The bigger question is whether the ability to make and use stone tools developed once or multiple times independently.

Early Hominin Culture

- The archaeological record is a partial material record of past human behavior and culture. The incomplete nature of this record, especially the disproportionate representation of stone tools, makes interpretation challenging.

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- "…the archaeological record provides evidence of culture because it contains materials that have been made and used by hominins" (Olszewski 2019,53).

- For example, FLK 22 at Olduvai Gorge contains thousands of stone fragments and animal bones that are, in places, concentrated in dense clusters. It is easy to formulate an explanation for this spatial patterning (e.g., living floor, butchery areas, wind breaks, etc.).

- Unfortunately, the natural and cultural processes that affect site formation (site taphonomy) defy simple explanations. Many animals transport animal bone, but only hominins use stone tools to access meat and marrow.

- Importantly, utilizing animal carcasses for food resources, does not necessarily prove that hominins hunted and killed those animals. There is still debate about whether the early hominins of Olduvai Gorge were passive scavengers, active scavengers, hunters, or some combination of these methods.

    - See ***Peopling the Past****: Hunting versus Scavenging* for a discussion of three proposed models of FLK 22 subsistence strategies.

Class Activities and Projects

A Look at deep Time

The ChronoZoom web site features a scalable timeline that zooms from the history of the cosmos through the formation of the solar system, the evolution of life on Earth, and the earliest hominins. Deep time can be difficult to conceptualize, and this tool can help to situate humans and our ancestors within a larger temporal context.
http://www.chronozoom.com/#/t00000000-0000-0000-0000-000000000000@x=0

The Evolutionary Tree of Life

While the Linnaean system of classification (ranks from kingdom through species) remains useful, scientists are increasingly turning to DNA analysis and more complex categorizations to determine evolutionary relationships. The Tree of Life web site allows you to zoom in to particular lineages—including primates—to see relationships based on genetic analysis. Branch points on the tree indicate years since the last common ancestor. This is a great tool for discussion and looking in more depth at biological relationships.

https://www.onezoom.org/life/@=304358#x702,y287,w0.0773

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PBS Nova Documentary: *Dawn of Humanity* (2015)

"NOVA and National Geographic present exclusive access to an astounding discovery of ancient fossil human ancestors. Deep in a South African cave, a special team of experts has brought to light an unprecedented wealth of fossils belonging to a crucial gap in the record of our origins that spans the transition between the ape-like australopithecines (such as the famous Lucy) and the earliest members of the human family. At the center of the discovery is paleoanthropologist Lee Berger, a character brimming with enthusiasm and opinions, whose claims have stirred long controversy in the contentious field of human origins. Join NOVA to solve a 2 million-year-old 'crime scene' and dig into extraordinary new clues about what made us human" (http://www.pbs.org/wgbh/nova/evolution/dawn-of-humanity.html).

This 120-minute documentary covers the recently discovered South African hominin *Homo naledi*. We still have much to learn about this hominin, including whether it truly is a distinct species, but the video presentation is an interesting discussion starter about paleoanthropological research.

Osteology and Locomotion Project

This project requires access to bone specimens or replicas, and it may be adapted to fit the specific materials available.

- Provide students with as many mammal skulls (including a human) as possible to illustrate how variable the position of the foramen magnum is. Ask them to infer how quadrupedal or bipedal the animal is based on the orientation of the foramen magnum.

- Depending on the bones available, this same process may be repeated with the pelvis, femur, vertebrae, or foot bones (although the foramen magnum comparison is most intuitive for students and requires less osteological experience).

Class Discussions

Ape Analogues

Are modern chimpanzees a useful model for the anatomy and behavior of the last common ancestor (LCA) of panins and hominins? Why and why not? (Optional: classes may be divided into "why" and "why not" camps to create an evidence-based debate.)

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Origins of Bipedalism

After reading Chapter 2, discuss the many proposed advantages of bipedalism. Why do you think early hominins shifted from arboreal to terrestrial life? Based on late Miocene conditions (and without the benefit of hindsight), would you predict the evolution of bipedal hominins?

The Discovery of a Lifetime

If you could discover any hominin fossil imaginable, what would it be? What would this particular find reveal about our evolutionary history? Do you think it would be controversial?

Biology or Culture?

Have the class brainstorm a list of human universals—things that are common traits of humans everywhere. This list may include language, sleeping, clothing, eating, sex, death, breathing, etc. Once you have that list, which (if any) of these are entirely biological? Many students may argue, for example, that sleep is a biological function—though the idea of sleeping for an uninterrupted 8-hour block is one cultural interpretation of a biological need (for more details, research biphasic and polyphasic sleep). Similarly, though all humans eventually die the meanings and rituals associated with death are deeply cultural. Are any human traits entirely biological? What are the implications of culture for the archaeology of ancient hominins?

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Archaeology and Humanity's Story:
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Chapter 2 Test Bank—Humanity's Roots

Multiple-Choice Questions (30)

1. Modern humans are members of the genus _____.
A) *Australopithecus*
B) *Ardipithecus*
C) *Homo**
D) *Paranthropus*

2. *Ardipithecus ramidus* is approximately how old?
A) 100,000 years
B) 1.5 million years
C) 4.4 million years*
D) 3.6 billion years

3. _____: a classification system that divides animal and plant groups into categories based on their evolutionary relationships.
A) Morphology
B) Primatology
C) Taphonomy
D) Taxonomy*

4. Which of these species is farthest removed from us in time?
A) *Ardipithecus ramidus*
B) *Australopithecus afarensis*
C) *Homo habilis*
D) *Sahelanthropus tchadensis**

5. Which of these hominin species was probably the most arboreal?
A) *Paranthropus boisei*
B) *Ardipithecus ramidus**
C) *Homo habilis*
D) *Australopithecus africanus*

6. Which of these species has the largest average brain size (measured in cubic centimeters)?

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A) *Homo sapiens**
B) *Homo habilis*
C) *Pan troglodytes*
D) *Sahelanthropus tchadensis*

7. Which genus is associated with “robust” features like a sagittal crest and large molars?
A) *Ardipithecus*
B) *Microtus*
C) *Homo*
D) *Paranthropus**

8. Which primate has been observed “termite fishing” in the wild?
A) Chimpanzees*
B) Gibbons
C) Gorillas
D) Orangutans

9. Ancient hominins most likely made tools from:
A) bone.
B) stone.
C) wood.
D) all of the above*

10. Prior to recent finds in Ethiopia and Kenya, _____ was the oldest known stone tool industry.
A) Acheulian
B) Mousterian
C) Oldowan*
D) Solutrean

11. Chapter 2 discusses the _____ site at Olduvai Gorge.
A) FLK 22*
B) Lomekwi 3
C) Apollo 11 Cave
D) Liang Bua

12. The famous “Lucy” was a member of which species?
A) *Australopithecus afarensis**
B) *Paranthropus robustus*
C) *Sahelanthropus tchadensis*
D) *Zea mays*

13. Chapter 2 focuses primarily on which hominin characteristic?

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A) Absolutism
B) Bipedalism*
C) Prognathism
D) Sexual dimorphism

14. To which taxonomic subfamily do you belong?
A) Gorillinae
B) Homininae*
C) Pongidae
D) None of the above

15. Modern humans are generally _____ the earliest hominins.
A) shorter than
B) taller than*
C) the same size as
D) less intelligent than

16. What Tanzanian site included a trail of fossilized *Australopithecus afarensis* footprints?
A) Laetoli*
B) La Venta
C) Lascaux
D) Liang Bua

17. The generic term *australopith* refers to members of what genus (genera)?
A) *Ardipithecus*
B) *Australopithecus*
C) *Paranthropus*
D) All of the above*

18. Which of these hominin species was first discovered in East Asia?
A) *Ardipithecus ramidus*
B) *Australopithecus sediba*
C) *Homo habilis*
D) None of the above*

19. Which of these has not been proposed as a mode of subsistence at FLK 22?
A) Active scavenging
B) Farming*
C) Hunting
D) Passive scavenging

20. Which of these hominin species was first discovered in Europe?
A) *Ardipithecus ramidus*
B) *Australopithecus afarensis*

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C) *Homo habilis*
D) None of the above*

21. Oldowan choppers would have been particularly useful for _____.
A) breaking open bones for marrow*
B) throwing at fast-moving prey
C) scraping hair off of hides
D) scaring away carnivores

22. _____ occurs when individuals from two different groups within the same species mate and produce offspring.
A) Gene flow*
B) Genetic drift
C) Mutation
D) Natural selection

23. _____ is when a change occurs in a gene or when other types of errors occur in chromosomes (long strands of genes).
A) Gene flow
B) Genetic drift
C) Mutation*
D) Natural selection

24. _____ is most easily seen when populations become isolated from one another. For example, if a small group moves to a new area, the genes present in that group represent only a sample of the total genes present in their original population.
A) Gene flow
B) Genetic drift*
C) Mutation
D) Natural selection

25. During the late Miocene, much of Africa became _____ and _____.
A) drier; less forested*
B) drier; more forested
C) wetter; less forested
D) wetter; more forested

26. According to one model, the LCA species split into small groups, which remained _____, and large groups, which became _____.
A) bipedal; quadrupedal
B) carnivorous; herbivorous
C) quadrupedal; bipedal*
D) terrestrial; arboreal

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27. Where is the sagittal crest located?
A) Ethiopia
B) Finger bones
C) Pelvis
D) Skull*

28. Chapter 2 describes members of the genus *Paranthropus* as our evolutionary_____.
A) ancestors
B) children
C) cousins*
D) siblings

29. A site in the Dikika area of Ethiopia featured animal bones with cut marks dating to _____ years ago.
A) 6000
B) 40,000
C) 2.18 million
D) 3.39 million*

30. Hominin fossils have been found in each of these regions except _____.
A) Central Africa
B) East Africa
C) South Africa
D) West Africa*

True/False Questions (10)

1. The *foramen magnum* is located in the pelvis. (False)

2. The last common ancestor (LCA) of panins and hominins lived about 6.3 – 5.4 million years ago. (True)

3. The first fossils of *Australopithecus africanus* were found at the Taung site in South Africa. (True)

4. The oldest hominin fossils are found in Asia. (False)

5. One of the ancestors of *Homo sapiens* is *Pan paniscus.* (False)

6. The LCA lived during the miocene. (True)

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7. Tribe Panini includes all of the following: bonobos, common chimpanzee, and orangutans. (False)

8. The most remarkable part of “Ardi’s” skeletal structure was a grasping big toe. (True)

9. The Oldowan tool industry includes arrowheads. (False)

10. Natural selection is based on the principle that certain features are selected for, selected against, or are neutral. (True)

Short-Answer Questions (10)

1. What archaeological evidence supports pre-*Homo* tool use?

*3.39 million-year-old cut-marked bones in Dikika, Ethiopia, and 3.3 million-year-old stone tools at the Lomekwi 3 site in Kenya.

2. Describe the concept of mosaic evolution using examples from the text.

*“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” (Olszewski 2019:48).

3. What do we know about the diet of the genus *Paranthropus*? What evidence are these interpretations based on?

*Megadont teeth suggest specialization for a diet of hard foods. However, recent enamel studies indicate a broader diet including sedges, termites, grass roots, grasshoppers, bird eggs, lizards, grass seeds, rodents, small antelope, and so forth.

4. What kinds of tool use have been observed among modern primates (humans excluded)?

*“Termite fishing” by chimps in Assirik and Gombe. Chimps cracking nuts with a hammerstone in Bossou and the Taï Forest. Orangutans processing fruits with sticks on the island of Sumatra.

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5. What do Oldowan tools reveal about the cognitive capacity of *Homo habilis*?

*They understood the process of selecting good tool stone, showed great foresight by transporting stone far from its source, and understood the mechanics of producing thin, sharp flakes.

6. Can you briefly explain why we are *not* descended from chimpanzees?

*Contrary to popular opinion, we share a common ancestor with chimpanzees (LCA), but we are not, ourselves (hominins), descended from modern chimps (panins). They are our evolutionary cousins.

7. We often describe hominin skulls in terms of how "ape-like" or "human-like" they are. What are some ape-like features of early hominin skulls?

*Low, sloping foreheads, flaring cheekbones, prognathic faces, lack of a protruding chin, generally more "robust" features like browridges, sagittal crests, and so on.

8. How might bipedalism aided in the *thermoregulation* of early hominins?

*By exposing less surface area to the sun overhead and more surface area to horizontal breezes and air flow.

9. Describe the evolutionary process of genetic drift.

*Random (i.e., nonselective) changes in allele frequency in a population, most clearly represented by the Founder's Effect, usually only important in small breeding populations.

10. What is the purpose of taxonomy?

*To classify and categorize living things based on their evolutionary relationships to one another.

Essay Questions (5)

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1. Chapter 2 discusses several possible explanations for the origin of bipedalism. What do you think was the most significant advantage bipedalism provided for our ancestors? What evidence supports your choice?

*Answers will vary (see pp. 42–43): availability of hands for manipulating objects and provisioning offspring, thermoregulation, energetic efficiency of bipedalism, sight distance increases.

2. Natural selection is a relatively simple, but often misunderstood, evolutionary process. How would you explain it, simply yet accurately, to someone who has no previous experience with biology?

*Individuals who are better-adapted to their environments tend to have more offspring, increasing the proportion of adaptive traits in a population.

3. Bones may be transported and modified by many natural and cultural processes. What are some ways that archaeologists can discern natural patterning from cultural patterning?

*Bones can be examined for weathering damage, carnivore damage, damage produced by hominin butchery (including its location and diagnostic attributes). Species and skeletal part profiles may be informative, and so forth.

4. Imagine that modern humans had all of the attributes that we actually have, but were fully *quadrupedal*. Would life as we know it be possible? How would the world be a different place?

*This question requires imagination, and an understanding of bipedalism, but may inspire a variety of different answers. Ideally, it will help students recognize how fundamental upright walking is to our existence.

5. The paleoanthropological record is dominated by stone. Do you think our ideas about early hominin culture would change if we had perfect preservation of all materials? How so?

*This should prompt the recognition that archaeology is often the study of stones and bones, but living people make use of many more perishable materials. This preservational bias likely results in an overemphasis on hunting (at the expense of gathering) large game (at the expense of smaller animals, plant foods), and so forth.

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