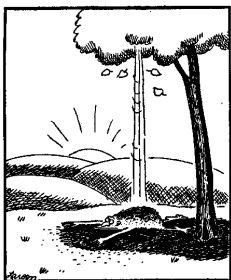


Early Human Evolution

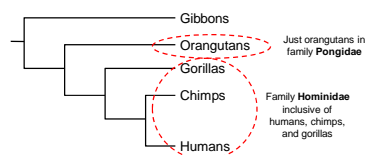
- Overview and Chronology
- What makes us human?
- Ardipithecus and early Australopithecus
- Robust and gracile australopithecines
- Oldowan tools



The Dawn of Man

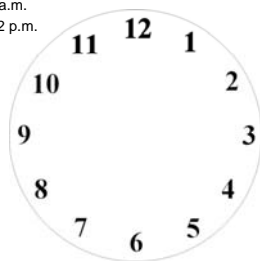
Overview

- First hominins appeared late in the Miocene, but most hominin fossils date to Pliocene and Pleistocene epochs
- **Hominid**
 - Family that includes apes and humans (both current and fossil)
- **Hominin**
 - Tribe that includes humans and early ancestors



Chronology of Hominid Evolution

- If we compare Earth's history to a 24-hour day (1 second = 50k yrs)
 - Earliest fossils deposited at 5:45 a.m.
 - First vertebrates appeared at 9:02 p.m.
 - Earliest mammals, at 10:45 p.m.
 - Earliest primates, at 11:43 p.m.
 - Earliest hominins, at 11:57 p.m.
 - *Homo sapiens* arrived 36 seconds before midnight



Epochs of the Cenozoic Era

Era	Period	Time
Cenozoic	Quaternary	1.8 m.y.a.
	Tertiary	65 m.y.a.
	<ul style="list-style-type: none"> Oligocene 166 m.y.a. Jurassic 208 m.y.a. Triassic 245 m.y.a. 	
Mesozoic	Permian	285 m.y.a.
	Carboniferous	360 m.y.a.
	Devonian	410 m.y.a.
	Silurian	440 m.y.a.
Paleozoic	Ordovician	505 m.y.a.
	Cambrian	544 m.y.a.

Epoch	Climate and Life Forms
Holocene	Transition to agriculture; emergence of states
Pleistocene	11,000 a.p.
	Climatic fluctuations; gladiators; <i>Homo A. boisei</i>
Pliocene	1.8 m.y.a.
Pliocene	5 m.y.a.
Miocene	23 m.y.a.
Oligocene	Cooler and drier in the north; anthropoids in Africa (Australopithecus); separation of catarrhines and platyrrhines; separation of hominoids from gongylids and hominids
Eocene	38 m.y.a.
Eocene	Warm tropical climates become widespread; modern orders of mammals appear; primate-like primates; anthropoids appear by late Eocene
Paleocene	65 m.y.a.
Paleocene	First major mammal radiation

Hominins emerged in late Miocene, but most fossils are from Pliocene and Pleistocene epochs.

Overview of Species

- *Ardipithecus* (6 million years)
- *Australopithecus* (4 million years)
- *A. Africanus* and *A. Robustus*
- By 2 million years ago two distinct hominin groups
 - *Homo* and *A. boisei*

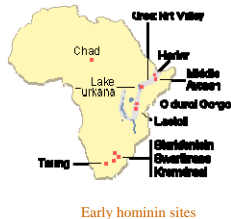
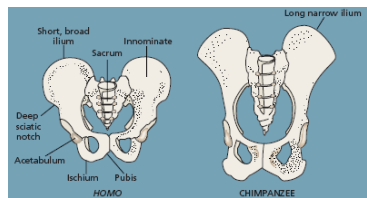


Table 8.1 Dates and Geographic Distribution of Major Hominoid, Hominid, and Hominin Fossil Groups

Fossil Group	Dates, m.y.a.	Known Distribution
Hominoid		
<i>Pan troglodytes</i>	13	Spain
Hominid		
Common ancestor of hominids	81	East Africa
"Tasman"	7-6	China
<i>Orrorin tugenensis</i>	6	Kenya
Hominins		
<i>Ardipithecus kadabba</i>	5.8-5.5	Ethiopia
<i>Ardipithecus ramidus</i>	4.4	Ethiopia
<i>Kenyanthropus platyops</i>	3.5	Kenya
<i>Australopithecines</i>		
<i>A. anamensis</i>	4.2	Kenya
<i>A. africanus</i>	3.8-3.0	East Africa (Boetli, Hodo)
<i>A. garhi</i>	2.5	Ethiopia
<i>Robustus</i>	2.6-1.2	East and South Africa
<i>A. robustus</i> (aka <i>Paranthropus</i>)	2.08-1.08	South Africa
<i>A. boisei</i>	2.68-1.0	East Africa
Graciles		
<i>A. africanus</i>	3.0-2.0	South Africa
<i>Homo</i>		
<i>H. habilis/H. rudolfensis</i>	2.48-1.78	East Africa
<i>H. ergaster/H. erectus</i>	1.78-0.38	Africa, Asia, Europe
<i>Homo sapiens</i>	0.3-present	Worldwide
Archaic <i>H. sapiens</i>	0.3-0.28 (300,000-28,000)	Africa, Asia, Europe
Neanderthals	0.13-0.28 (130,000-28,000)	Europe, Middle East, North Africa
Anatomically Modern Humans (AMH)	0.158-present (150,000-present)	Worldwide (after 20,000 a.p.)

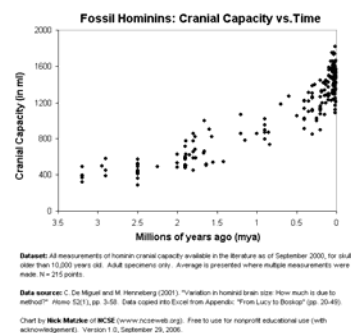
Figure 8.4 A Comparison of Human and Chimpanzee Pelvises



The human pelvis has been modified to meet the demands of upright bipedalism. The blades, (*ilia*, singular, *ilium*) of the human pelvis are shorter and broader than those of the ape. The *sacrum*, which anchors the side bones, is wider. The *australopithecine* pelvis is far more similar to that of *Homo* than to that of the chimpanzee, as we would expect in an upright biped.

Brain Size

- Earliest hominins had brains not much bigger than modern apes
- Later hominins had progressively larger brains
- Early hominins
 - Primitive brains
 - Derived postcrania



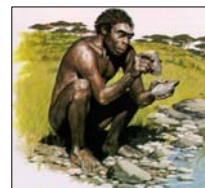
Childhood Dependency

- Hominins have longer period of childhood dependency for body and brain growth
- May have been a byproduct of evolution of bipedalism
 - Bipedal pelvis requires baby with small head



Tool Use

- Capacity for tool use and culture is a primitive trait shared by humans and some other hominoids
- Trend toward more complex tools in hominins
 - Earliest stone tools 2.5 mya

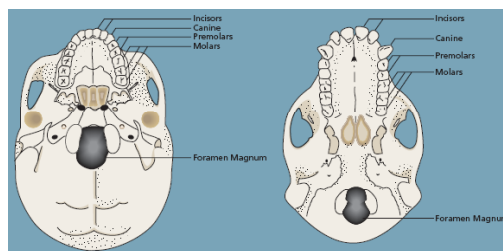


Dental Changes

- Early hominins have primitive large back teeth and thick enamel
 - Later hominins do not
- Canines reduced from hominoid ancestors
- One later hominin had extremely large teeth, but this was a unique adaptation not shared hominins ancestral to modern humans

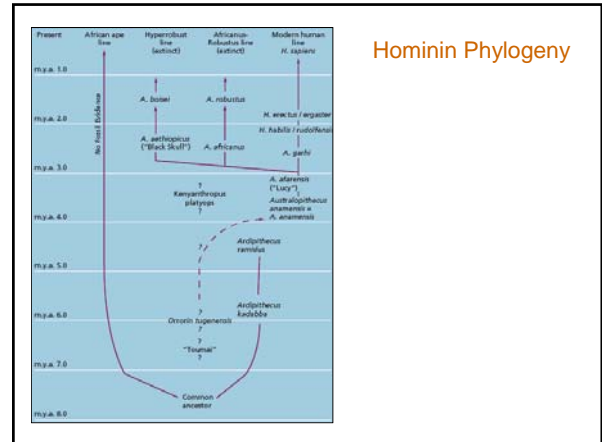


Figure 8.5 A Comparison of the Skull and Dentition (Upper Jaw) of Homo and the Chimpanzees



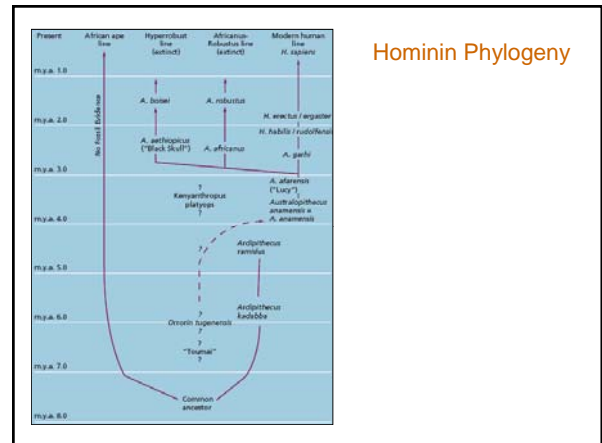
Ardipithecus

- Lived during late Miocene, between 5.8 and 5.5 million years ago
- Eventually evolved into *australopithecines*
 - Distinction between *australopithecines* and later hominins made on genus level
 - Kadabba* finds consisted of 11 specimens that were apelike in size, anatomy, and habitat



Kenyanthropus

- Complicating picture is discovery, which Maeve Leakey named *Kenyanthropus platyops*
 - Shows at least two hominin lineages existed as far back as 3.5 million years ago
 - Kenyanthropus* has flattened face and small molars
 - Lucy may not be a direct human ancestor



Australopithecus Species

- A. anamensis* (4.2 to 3.9 m.y.a.)
- A. afarensis* (3.8? to 3.0 m.y.a.)
- A. africanus* (3.0? to 2.0? m.y.a.)
- A. garhi* (2.5 m.y.a)
- A. robustus* (2.0? to 1.0? m.y.a.)
- A. boisei* (2.6? to 1.2 m.y.a.)

Discovery of Taung Baby

- First australopithecine discovered by Raymond Dart in 1925
- Specimen was a juvenile referred to as the "Taung Baby"
- Developed the "Killer Ape" theory
 - Found **osteodontokeratic** tools
 - Claimed they were for early warfare

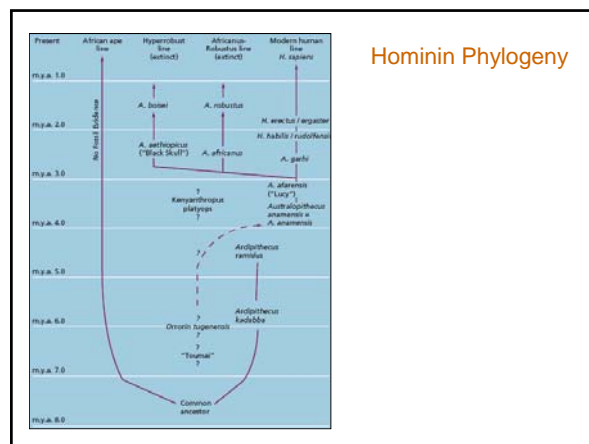


Australopithecus anamensis

- Fossils reported first by Leakey and Walker date to 4.2 – 3.9 m.y.a.
- Molars have thick enamel and apelike canines are large
- Weighed about 110 pounds (50 kg)
- Bipedal
- May be ancestral to *A. afarensis*



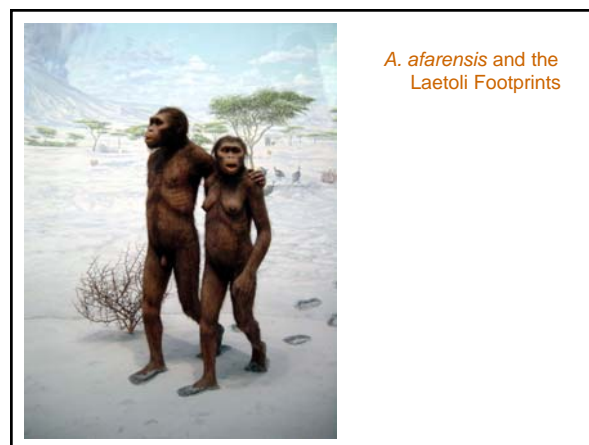
Anamensis was an apelike hominin



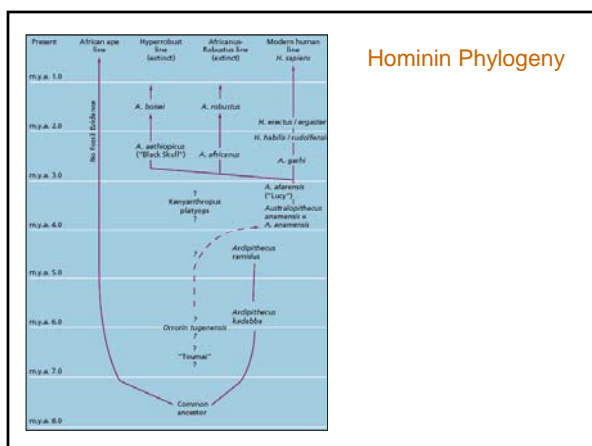
Hominin Phylogeny

Australopithecus afarensis

- *A. afarensis* lived between 3.8 and 3.0 m.y.a.
- Similar in many ways to chimps and gorillas
- Indicates common ancestry with African apes must be recent
- Very small brain case
- Below neck, unquestionably human
- Striding bipedalism



A. afarensis and the Laetoli Footprints



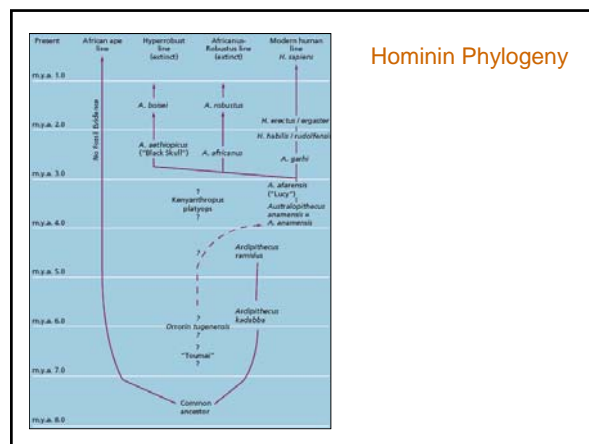
Hominin Phylogeny

Table 8.2 Facts about the *Australopithecines* Compared with Chimps and *Homo*

Species	Dates (m.y.a.)	Known Distribution	Important Sites	Body Weight (Mid-Sex)	Brain Size (Mid-Sex) (cm ³)
Anatomically modern humans (AMHs)	150,000 to present			132 lb/60 kg	1,350
<i>Pan troglodytes</i> (chimpanzees)	Modern			93 lb/42 kg	390
<i>A. boisei</i>	2.69 to 1.2	E. Africa	Olduvai, East Turkana	96 lb/39 kg	490
<i>A. robustus</i>	2.09 to 1.09	S. Africa	Kromdraai, Swartkrans	91 lb/37 kg	540
<i>A. africanus</i>	3 to 2.0	S. Africa	Taung, Sterkfontein, Makapansgat	79 lb/36 kg	490
<i>A. afarensis</i>	3.8 to 3.0	E. Africa	Hadar, Laetoli	77 lb/35 kg	430
<i>A. anamensis</i>	4.2 to 3.9	Kenya	Kanapoi, Allio Boy	Insufficient data	No published skulls
<i>Ardipithecus</i>	5.8 to 4.4	Ethiopia	Aramis	Insufficient data	No published skulls

Gracile & Robust Australopithecines I

- Two groups of South African australopithecines (3 – 1 m.y.a.)
 - Gracile smaller and lighter
 - Some argue graciles lived before robust (3 – 2 m.y.a.)
 - Others contend graciles and robusts overlapped
 - Others view them as opposite ends of a continuum



Hominin Phylogeny

Gracile & Robust Australopithecines II

- Trend toward enlarged back teeth, chewing muscles, and facial buttressing, already noticeable in *A. afarensis*, continues in South African australopithecines
 - Might have hunted small and slow-moving game
 - Diet mainly vegetarian



Teeth of robust Australopithecine

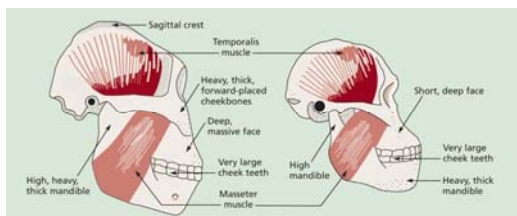
Gracile & Robust Australopithecines III

- Contrasts with *Homo* in that front teeth are less marked
 - In Robust *australopithecines*, chewing muscles strong enough to produce sagittal crest
 - Brain size increased only slightly between *A. afarensis* (430 cm³), *A. africanus* (490 cm³), and *A. robustus* (540 cm³)
- Robusts probably did not use tools to large extent



Early Homo

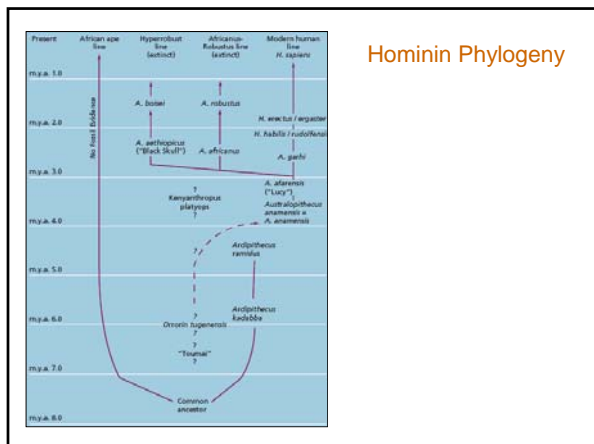
Figure 8.6 Skulls of Robust (left) and Gracile (Right) Australopithecines Showing Chewing Muscles



Flaring cheek arches and, in some robusts, a sagittal crest supported this massive musculature. The early hominin diet – coarse, gritty vegetation of the Savanna – demanded such structures. These features were most pronounced in *A. boisei*.

The Australopithecines and Early Homo

- Ancestors of *Homo* split off and became reproductively isolated from later *australopithecines* between 3 and 2 m.y.a.
 - Homo erectus* had larger brain and re-proportioned skull
 - H. erectus* hunted and gathered, made sophisticated tools, and eventually displaced its sole surviving cousin species, *A. boisei*
 - Johanson and White propose that *A. afarensis* effectively produced two populations



Australopithecines and Early Homo

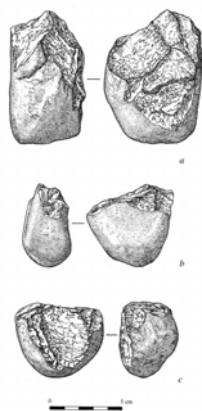
- 1985 discovery of the black skull (dated 2.6 m.y.a.), apparently an early *A. robustus*, made for more possible models of the divergence between *Homo* and *Australopithecus*
- Surprising mixture of australopithecine features, particularly given its relatively early date



The "Black Skull"

Oldowan Tools

- Oldest tools from Olduvai are widely used between 1.5 and 2 m.y.a.
 - Stone tools consist of cores and flakes
 - Core-piece of rock from which flakes are removed
 - Chopper-tool made by flaking the edge of such a core on one side
 - Oldowan pebble tools represent world's oldest formally recognized stone tools



A. Garhi and Early Stone Tools

- In 1999, a new hominid species, *A. garhi*, found in Ethiopia associated with stone tools and the remains of butchered animals
 - Added new species to human family tree
 - Demonstrated the thigh bone elongated one million years before the forearm shortened to create current human proportions
 - Showed early stone tools designed at getting meat and marrow from big game

