Primate and Human Evolution

What Are Primates?

- Primate order: Arboreal ancestors.
- Trends in primate evolution:
  - Changes in skeletons.
  - Change in mode of locomotion.
  - Increase in brain size.
  - Shift towards smaller, fewer, and more specialized teeth.
  - Development of stereoscopic vision.
  - Grasping hand with opposable thumb evolved.

What Are Primates?

- Not all evolutionary trends occurred in every primate group.
- Trends also did not evolve at the same rate in every group.
- Two primate suborders:
  - Prosimii: lemurs, lorises, tarsiers, and tree shrews.
  - Anthropoidea: monkeys, apes, and humans.

What Are Primates?

TABLE 19.1 Classification of the Primates

Order Primates: Lemurs, lorises, tarsiers, tree shrews, monkeys, apes, humans

- Suborder Prosimii: Lemurs, lorises, tarsiers, tree shrews
- Suborder Anthropoidea: Monkeys, apes, humans
  - Superfamily Cercopithecoidea: Macaque, baboon, proboscis monkey (Old World monkeys)
  - Superfamily Ceboidea: Howler, spider, and squirrel monkeys (New World monkeys)
  - Superfamily Hominoidea: Apes, humans
    - Family Pongidae: Chimpanzees, orangutans, gorillas
    - Family Hylobatidae: Gibbons, siamangs
    - Family Hominidae: Humans

Table 19.1, p. 389

What Are Primates?

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(a) Tarsier.

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(b) Baboon.

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(c) Spider monkey.

Tom McHugh/Photo Researchers, Inc.

(d) Chimpanzee.

Fig. 19.1, p. 390

Prosimians

- Small and arboreal primates.
- Five digits on each hand.
- Claws or nails on feet.

(a) Tarsier.

Fig. 19.1 a, p. 390

Prosimians

- Typically omnivorous.
- Large eyes for night vision.
- Oldest primate lineage.

Fig. 19.2, p. 390

Prosimians

- Fossil record goes back to Paleocene.
- They were abundant in North America and Eurasia during the Eocene.
- As continents moved northward in Cenozoic and mid-latitude climates cooled, the prosimian population decreased.

Prosimians

- By Oligocene, few prosimians in north continents.
- Prosimians migrated to warmer climates in Africa and Asia.
- Today, prosimians are only found in tropical areas of Asia, India, Africa, and Madagascar.

Anthropoids

- Anthropoids are divided into three superfamilies:
  - Cercopithecoidea (Old World monkeys).
    - Macaque, baboon, and proboscis monkey.
  - Ceboidea (New World monkeys).
    - Howler, spider, and squirrel monkeys.
  - Hominoidea (apes and humans).
    - Chimpanzees, orangutans, gorillas, gibbons, siamangs, and humans and our extinct ancestors.

Anthropoids

- Old World monkeys.
  - Close-set downward nostrils, grasping hands, and nonprehensile tail.
  - Probably evolved during the Oligocene.

(b) Baboon.

Fig. 19.1 b, p. 390

Anthropoids

- New World monkeys.
  - Prehensile tail, flattish face, and widely separated nostrils.
  - Evolved from African monkeys, Early Oligocene.

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(c) Spider monkey.

Fig. 19.1 c, p. 390

Anthropoids

- Hominoidea (apes and humans).
  - Three families:
    - Great apes (family Pongidae): chimpanzees, orangutans, and gorillas.
    - Lesser apes (family Hylobatidae): gibbons and siamangs.
    - Hominids (family Hominidae): humans and our extinct ancestors.
  - Hominoids diverged from Old World monkeys before the Miocene.
  - Hominoids evolved in Africa.

Anthropoids

- Hominoidea (apes and humans).
  - Once climates cooled and became drier after the Late Eocene, rain forests were replaced by mixed forests, savannas, and open grasslands.
    - Prosimians and monkeys became rare.
    - Hominoids diversified and adapted to the new environments.

Anthropoids

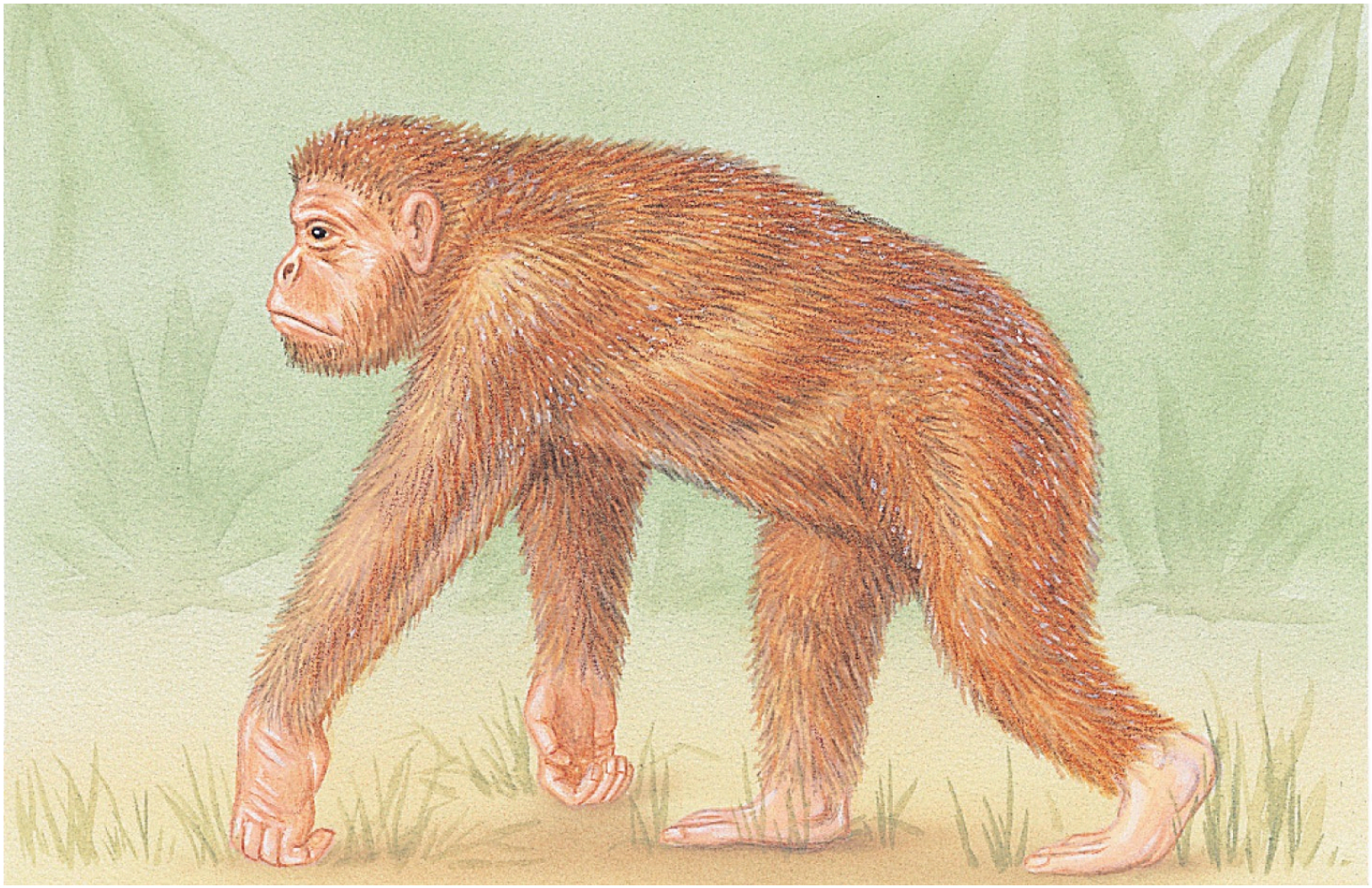


Fig. 19.4, p. 391

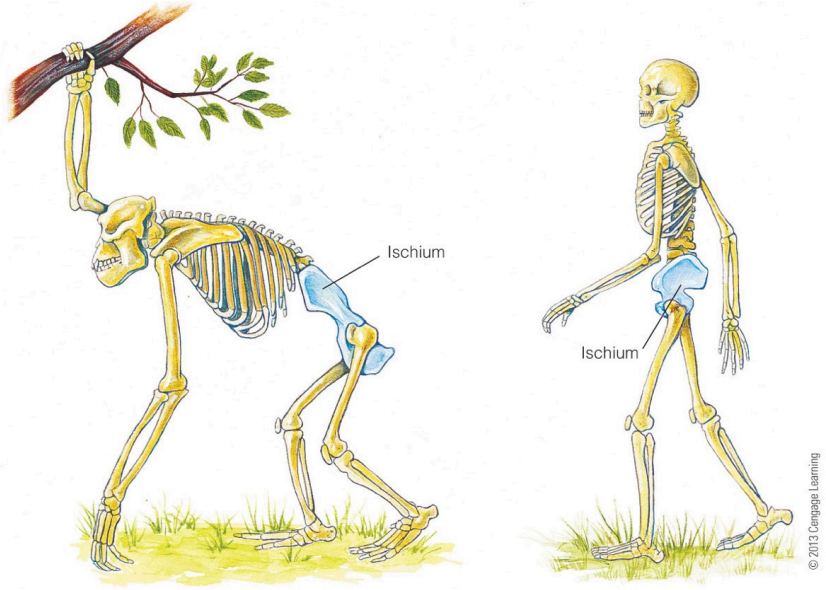
Anthropoids

- Hominoidea (apes and humans).
  - Two ape-like groups evolved in the Miocene that gave rise to modern hominoids.
    - Dryopithecines - Evolved in Africa and spread into Eurasia. Diversified during Miocene and Pliocene. Included *Proconsul*.
    - Sivapithecids - Evolved in Africa and spread throughout Eurasia. May have evolved into orangutans. Included *Gigantopithecus*.
  - DNA and fossil evidence indicate that dryopithecines, African apes, and hominids are closely related.

Hominids

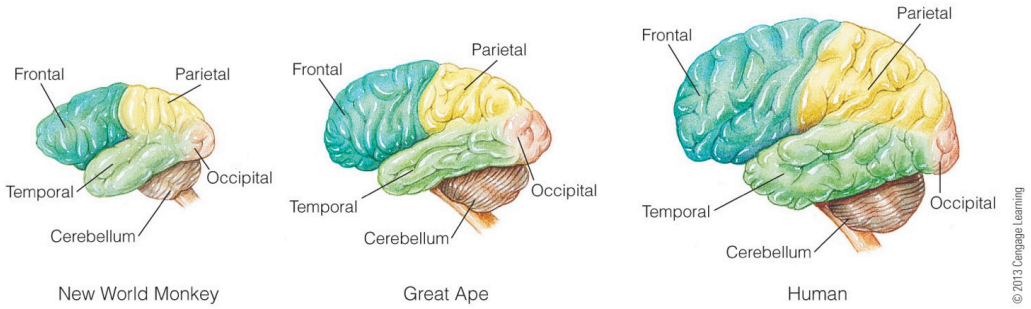
- Fossil record on hominids extends back almost 7 million years.
- Hominids have upright posture and are bipedal.
- Large and internally organized brain.
- Reduced canine teeth.
- Omnivorous diets.
- Increased manual dexterity.
- Use of sophisticated tools.

Hominids



Gorilla Human

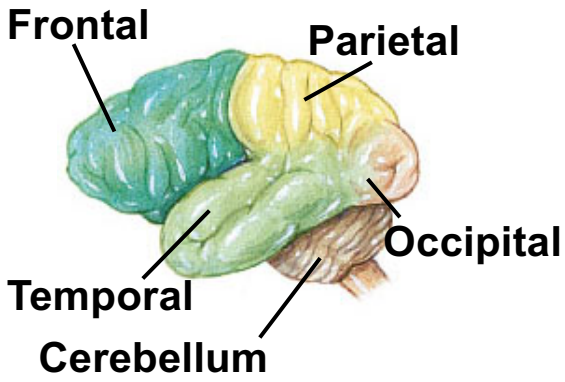
(a) In gorillas, the ischium bone is long, and the entire pelvis is tilted toward the horizontal. In humans, the ischium bone is much shorter, and the pelvis is vertical.



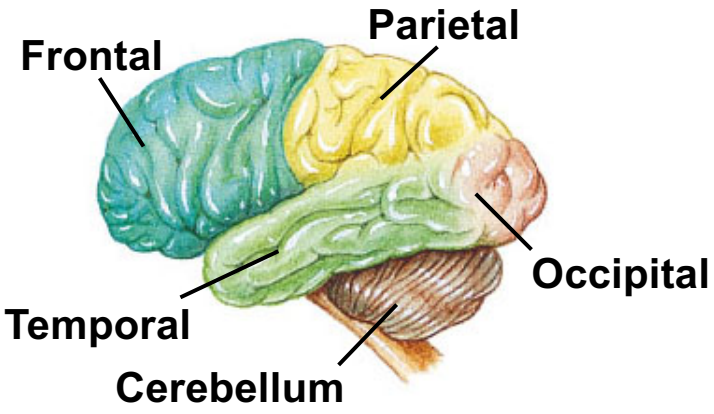
New World Monkey Great Ape Human

(b) An increase in brain size and organization is apparent in comparing the brains of a New World monkey (Superfamily Ceboidea), a great ape (Superfamily Hominoidea; Family Pongidae), and a present-day human (Superfamily Hominoidea; Family Hominidae).

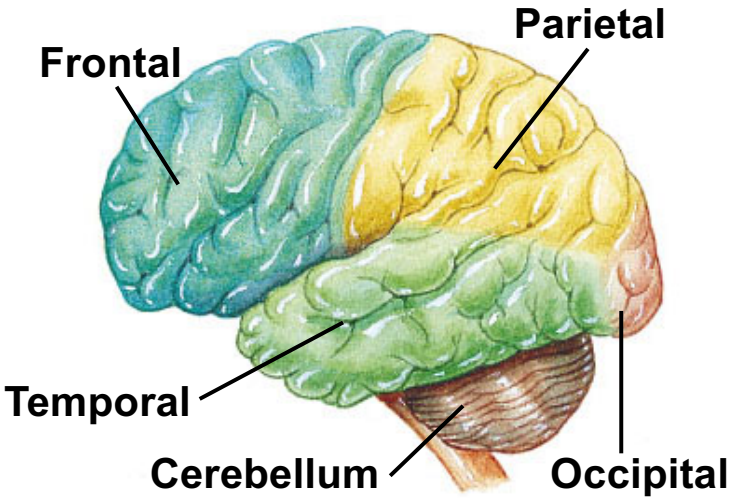
Fig. 19.5, p. 393



New World Monkey



Great Ape



Human

Stepped Art

Figure 19-5b p393

Hominids

- Many hominid features may be due to climatic changes that began in the Miocene.
  - Vast savannas replaced tropical rain forests in Africa.
  - As savannas and grasslands expanded, hominids made the transition.
- Details on hominid evolution are debated because of the lack of fossil evidence.

Hominids

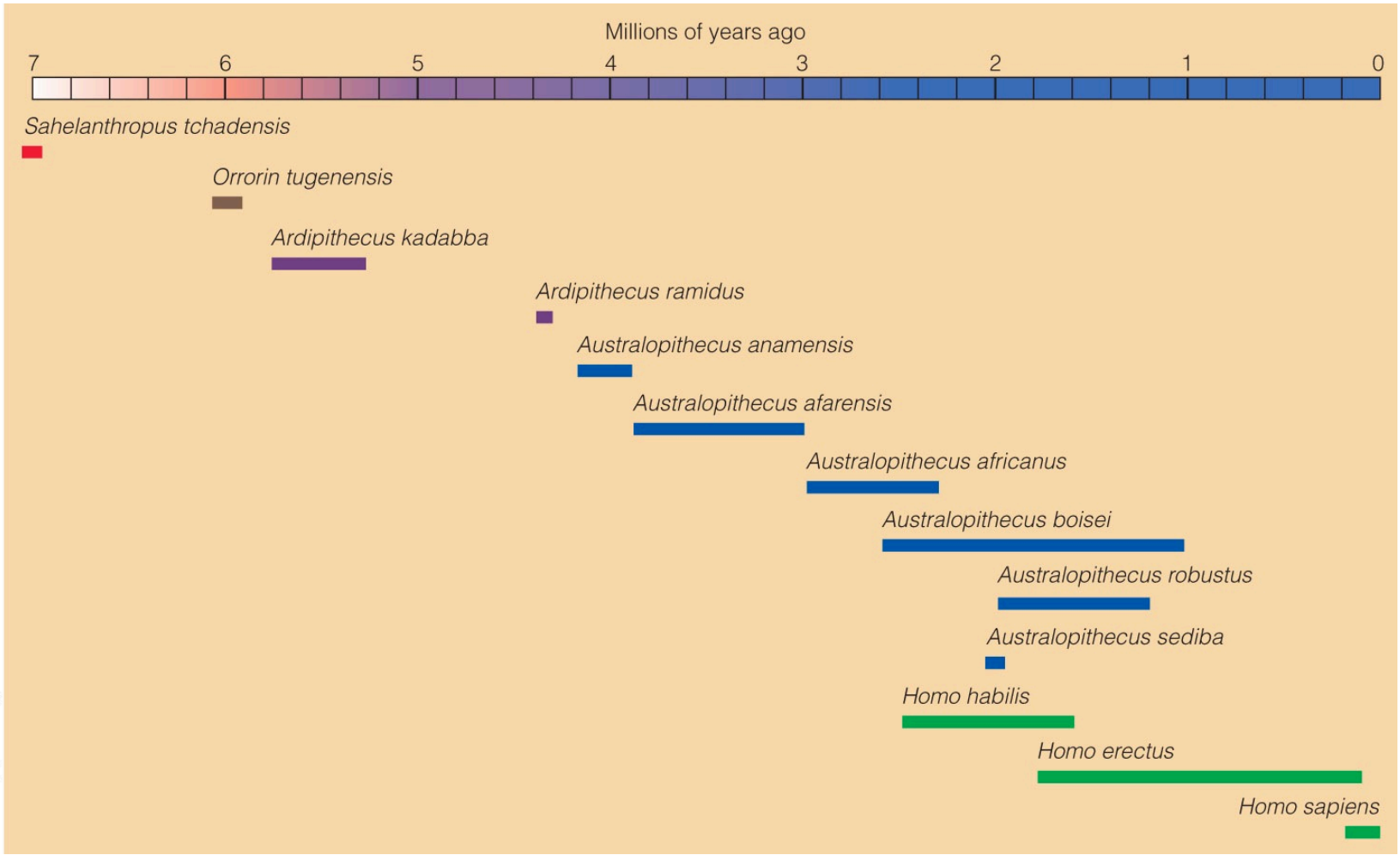


Fig. 19.6, p. 394

Hominids

- *Sahelanthropus tchadensis* - oldest known hominid.
  - Lived about 7 mya.
  - Chimpanzees and human ancestors diverged about 5 mya.

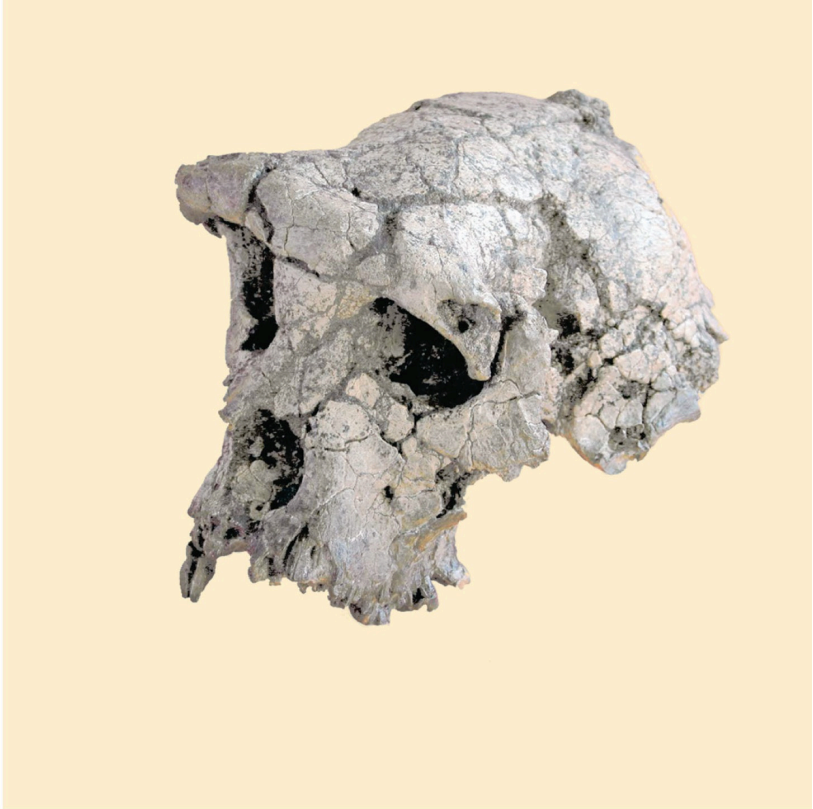


Fig. 19.7, p. 394

Hominids

- *Sahelanthropus tchadensis* - oldest known hominid.
  - Small brain case and teeth (except canines) are chimp-like.
  - Nose and prominent brow ridges seen in human genus *Homo*.
- *Orrorin tugenensis.*
  - Lived about 6 mya.
  - Debate over whether it's a hominid.

Hominids

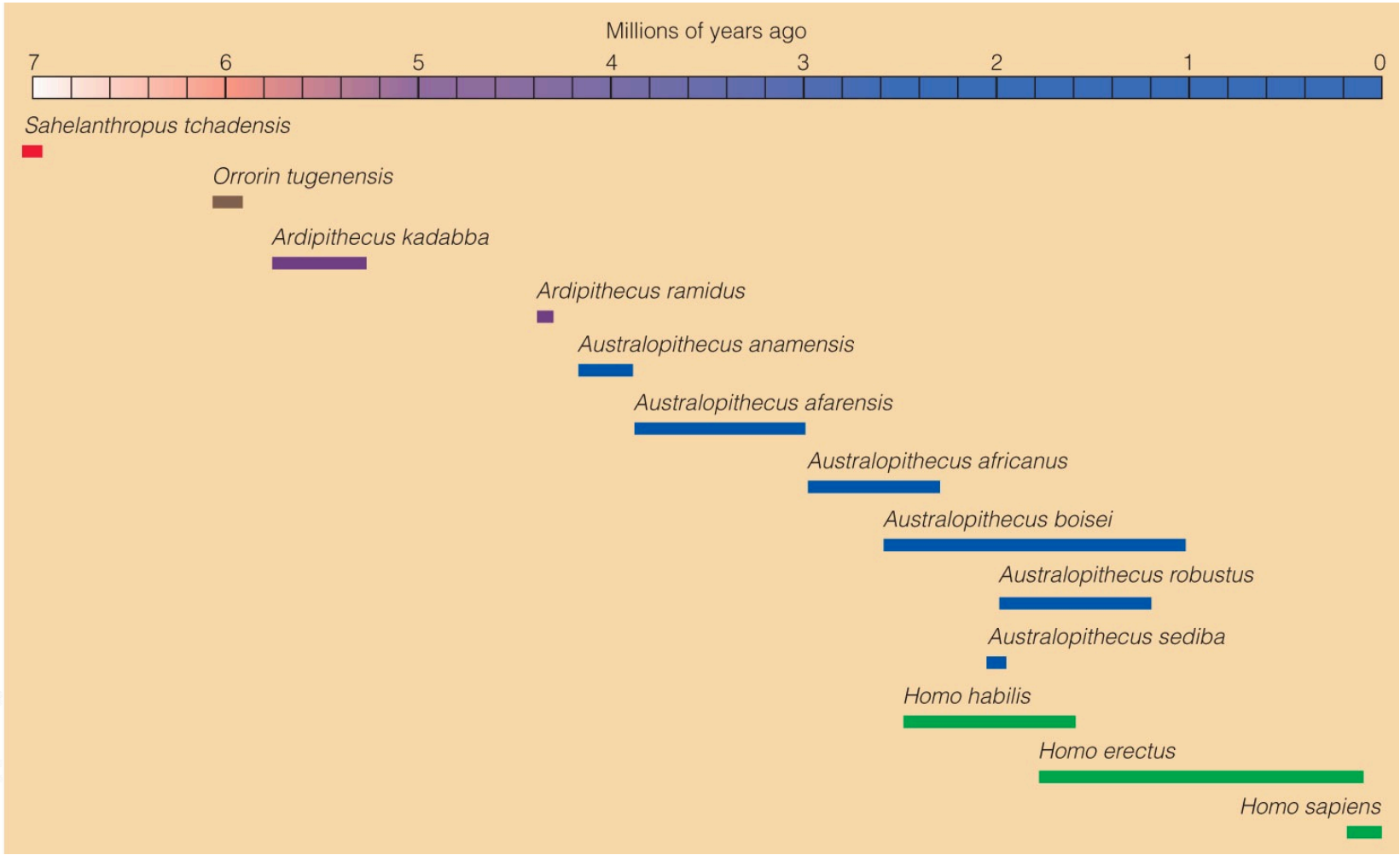


Fig. 19.6, p. 394

Hominids

- *Ardipithecus.*
  - *A. kadabba*. Eastern Africa: 5.2 - 5.8 mya.
  - 2nd species: *A. ramidus*: about 4.4 mya.
    - Dexterous hand for grasping.
    - Foot with opposable big toe, but lacked flexibility of an ape's foot.
    - Based on feet and hands, probably walked upright, but could climb and maneuver in trees.

Hominids

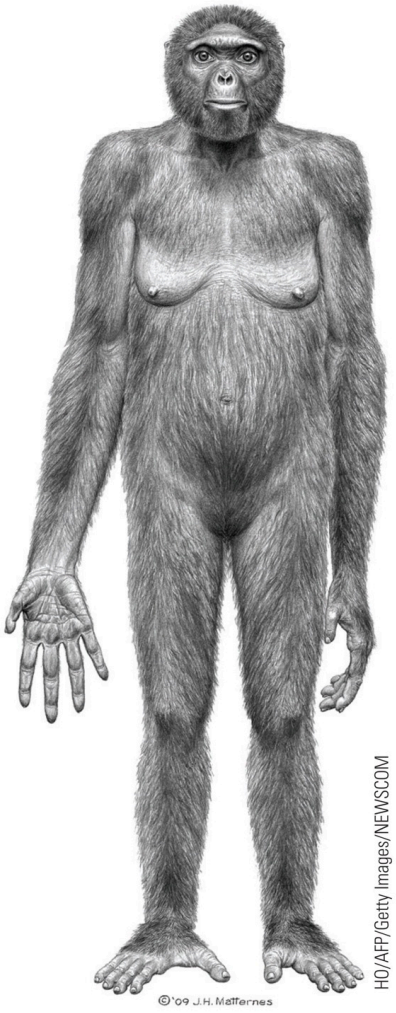
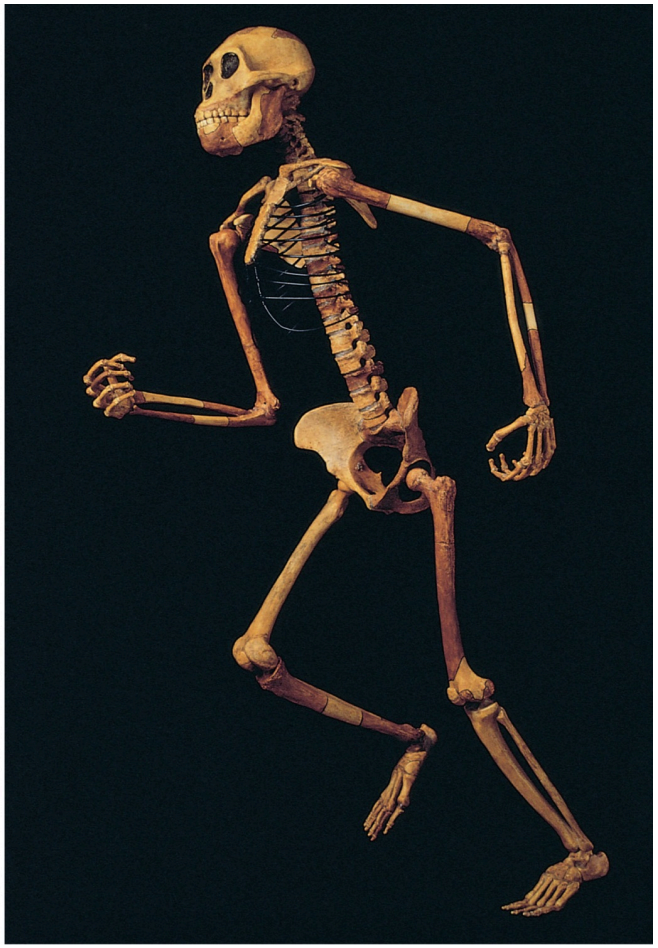


Fig. 19.8, p. 394

Hominids

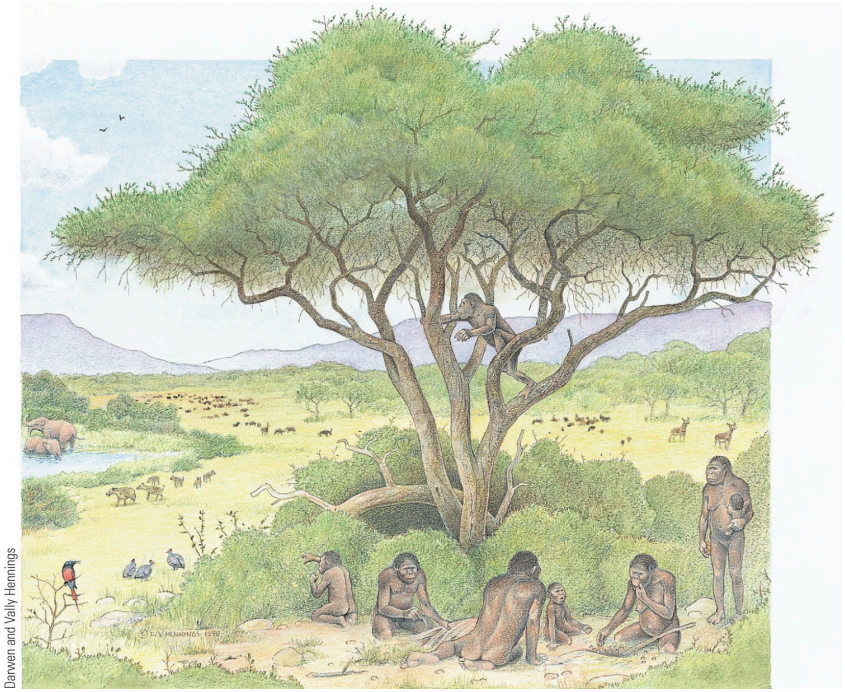
- Australopithecines.
  - Refers to all members of the genus *Australopithecus*.
  - Five species recognized:
    - *A. anamensis.*
    - *A. afarensis.*
    - *A. africanus.*
    - *A. robustus.*
    - *A. boisei.*

Hominids



David L. Brill

Fig. 19.9, p. 396



Darwen and Valiy Hennings

Fig. 19.10, p. 396

Hominids

Replica courtesy of Carolina Biological Supply. Photo by Sue Monroe

Fig. 19.12, p. 397

Hominids

- Oldest Hominid Footprints
  - In volcanic ash in Tanzania, Africa, dated 3.4-3.8 mya.
  - Indicates that hominids were walking upright before they made stone tools.

Fig. 19.11, p. 397

Hominids

- Australopithecines.
  - *A. afarensis* very similar to *A. africanus,* but both were different from *A. robustus* and *A. boisei.*
  - *A. robustus.*
    - Lived 1.2-2.0 mya.
    - Flat face, bony crest on crown of skull, strong jaw muscles, vegetarian.
  - *A. boisei.*
    - Lived about 1.0-2.6 mya.
    - Robust like *A. robustus.*

Hominids

Replica courtesy of Carolina Biological Supply. Photo by Sue Monroe

Fig. 19.13, p. 398

Hominids

- The Human Lineage.
  - Genus *Homo*.
  - Earliest member *Homo habilis.*
    - Lived 1.6-2.5 mya in Tanzania, Kenya, Ethiopia, and South Africa.
    - *H. habilis* evolved from *A. afarensis* and *A. africanus.*
    - *H. habilis* coexisted with *A. africanus* for about 200,000 years.
    - Had larger brain, but smaller teeth than australopithecine ancestors.

Hominids

Fig. 19.14, p. 398

Hominids

- The Human Lineage.
  - *Homo habilis* and *Homo erectus* coexisted for about 500,000 years.
  - Either *H. erectus* evolved from *H. habilis* about 1.6-1.8 mya or they evolved from a common ancestor and represent separate branches of *Homo*.
  - *H. erectus* lived until about 100,000 years ago.
  - *H. erectus* moved outside of Africa during the Pleistocene.

Hominids

- The Human Lineage
  - *Homo erectus* includes "Peking Man" of China and "Java Man" of Indonesia.
  - Specimens also found in Europe and India.

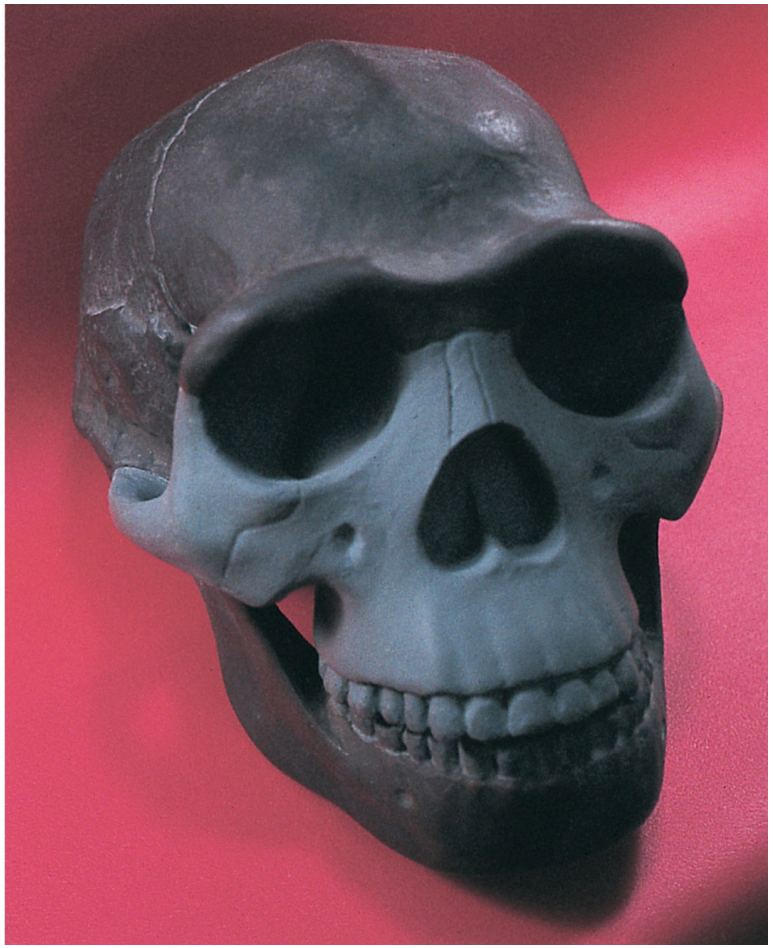


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Fig. 19.15, p. 398

Hominids

- The Human Lineage.
  - *Homo erectus*:
    - Much larger brain size than *H. habilis*, but still much less than modern humans.
    - Prominent brow ridges and teeth slightly larger than modern humans.
    - Similar in size to modern humans.
    - A tool maker, used fire, and lived in caves.

Hominids

Fig. 19.16, p. 399

Hominids

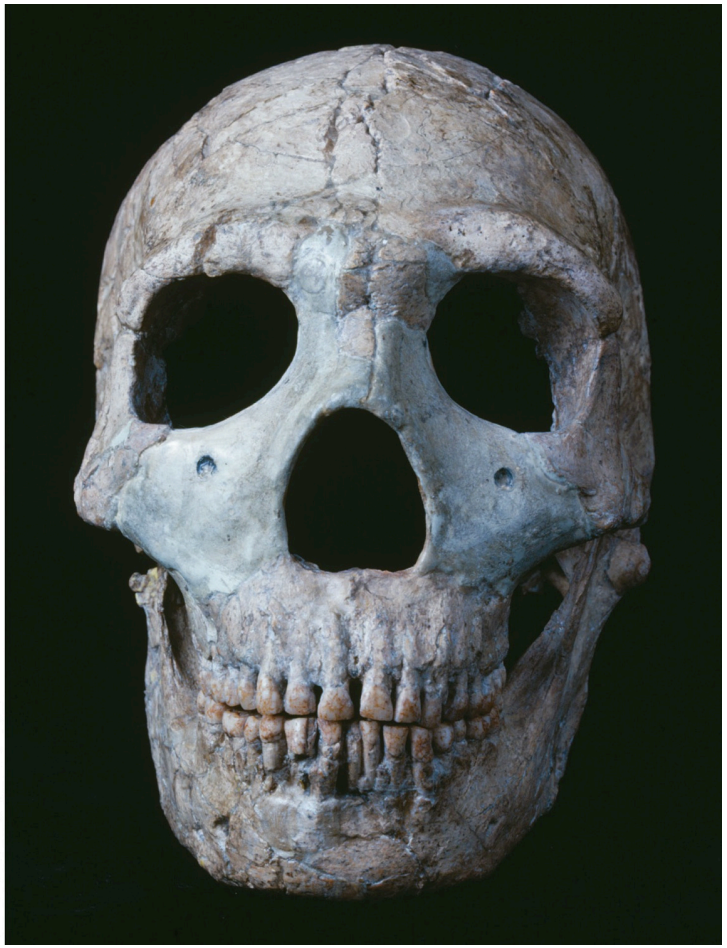
- The Human Lineage.
  - *H. sapiens* evolved from *H. erectus*, but details are still debated.
  - Two hypotheses of human origins:
    - "Out of Africa": All humans descended from one woman in Africa. Her descendants initially migrated into Eurasia about 100,000 years ago.
    - "Multiregional": Humans did not have an isolated origin in Africa, but developed from separate populations throughout Eurasia. Occasional interbreeding between populations maintained the species.

Hominids

- The Human Lineage.
  - Neanderthals.
    - Lived in Europe and Near East about 30,000 to 200,000 years ago.
    - May be a subspecies of humans (*Homo sapiens neanderthalensis*) or a separate species (*Homo neanderthalensis*).
    - First specimens found in Neander Valley of Germany in 1856.
    - Neanderthal brains were slightly larger than humans and different shaped.

Hominids

- The Human Lineage.
  - Neanderthals.
    - Neanderthal skulls have heavy brow ridges, projecting mouth, and weak, receding chin.



Ira Block/National Geographic/Getty Images

Fig. 19.17, p. 400

Hominids

- The Human Lineage.
  - Neanderthals.
    - Neanderthal bodies were more massive and muscular than human bodies.
    - They had shorter limbs.
    - Adapted for cold climates.
    - DNA from fossils indicate that at least some Neanderthals had red hair and light skin. Gene is different than the one that creates red hair in modern humans.

Hominids

Painting by Ronald Bowen/Robert Harding Picture Library

Fig. 19.18, p. 400

Hominids

- The Human Lineage.
  - Neanderthals.
    - They lived in caves and rock shelters.
    - They used stone tools and weapons.
    - They took care of their injured.
    - Buried their dead with tools and food.
  - About 30,000 years ago, humans closely resembling modern Europeans moved into the region inhabited by Neanderthals and completely replaced them.

Hominids

- The Human Lineage.
  - Cro-Magnons replaced Neanderthals and lived from about 35,000 to 10,000 years ago.
  - Evolution from Cro-Magnons to modern humans was cultural rather than biological.
  - Cro-Magnons lived in caves and rock shelters, and formed living groups of various sizes.

Hominids

- The Human Lineage.
  - Cro-Magnons developed art and technology.

Fig. 19.19, p. 401

Hominids

- The Human Lineage.
- Cro-Magnons were skilled nomadic hunters, following herds in seasonal migrations. Their weapons might have included the bow and arrow.

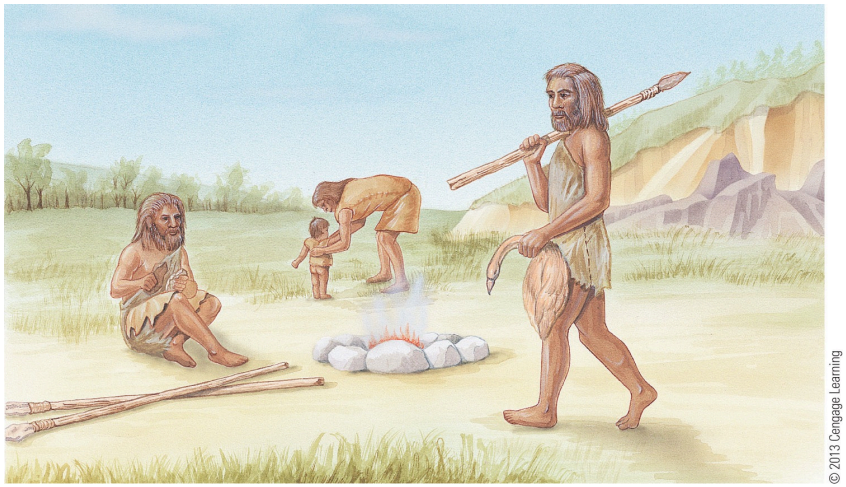


Fig. 19.20, p. 401