Glencoe Science

Biology

Interactive Classroom

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Mc Graw Hill Glencoe

Chapter 16 Primate Evolution

EXIT

Click on a lesson name to select.

16.1 Primates

Characteristics of Primates

- Manual dexterity
  - Five digits on each hand and foot
  - Flat nails and sensitive areas on the ends of their digits
  - The first digits are opposable.

16.1 Primates

Senses

- Rely more on vision
- Binocular vision results in greater depth perception.
- Color vision
- Decreased sense of smell
- Teeth are reduced in size and usually are unspecialized.

16.1 Primates

Locomotion

- Flexible bodies
- Limber shoulders and hips
- All primates except humans walk on all four limbs.

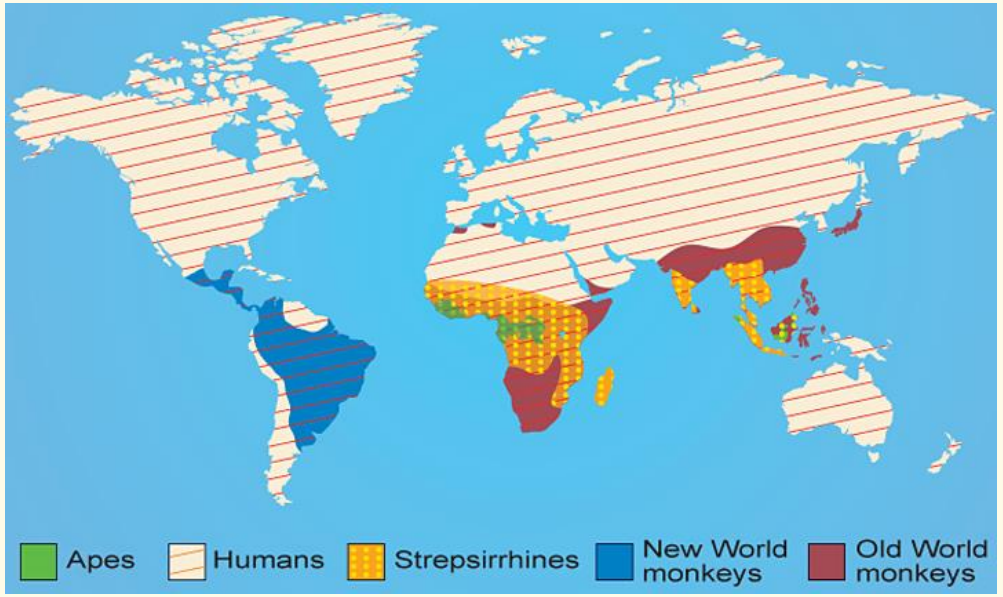
16.1 Primates

Complex Brain and Behaviors

- Have large brains in relation to their body size
- Larger areas devoted to memory and coordinating arm and leg movement
- Problem-solving abilities
- Well-developed social behaviors

16.1 Primates

Reproductive Rate



- Have fewer offspring
- Newborns are dependent on their mothers for an extended period of time.
- Many are endangered.

16.1 Primates

Primate Groups

- Arboreal, or tree-dwelling
- Terrestrial
- The strepsirrhines, or “wet-nosed”
- The haplorhines, or “dry-nosed”

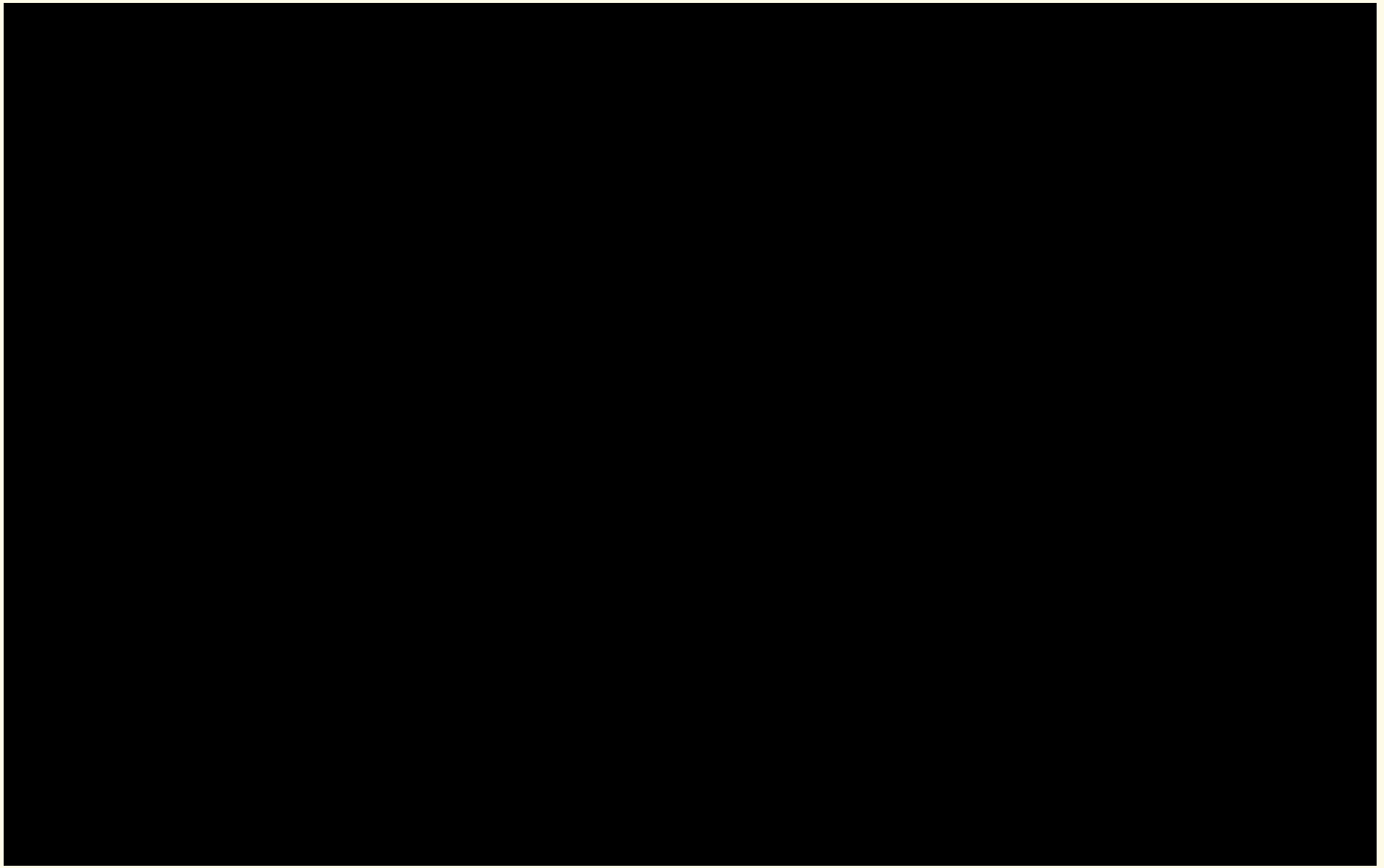
16.1 Primates

Strepsirrhines

- Have large eyes and ears
- Rely predominantly on smell for hunting and social interaction
- Lemurs
- Sifakas
- Indris
- Aye-ayes

Lemur

Concepts In Motion



16.1 Primates

Haplorhines

- Include tarsiers, monkeys, and apes
- The apes include gibbons, orangutans, gorillas, chimpanzees, and humans.
- The anthropoids are split into the New World monkeys and the Old World monkeys.

16.1 Primates

- The New World monkeys are a group of about 60 species of arboreal monkeys.
- They inhabit the tropical forests of Mexico, Central America, and South America.
- Most are diurnal and live together in social bands.
- Distinguished by their prehensile tails 

16.1 Primates

- Old World monkeys live throughout Asia and Africa.
- Diurnal and live in social groups
- Noses tend to be narrower and their bodies are usually larger.
- None have prehensile tails, and some have no tails.
- Most Old World monkeys have opposable digits.

16.1 Primates

- Apes have longer arms than legs, barrel-shaped chests, no tails, and flexible wrists.
- Highly social and have complex vocalizations
- Classified into two subcategories: the lesser apes and the great apes

16.1 Primates

Lesser Apes

- Asian gibbons
- Siamangs
- Generally move from branch to branch using a hand-over-hand swinging motion called brachiation

Gibbon

16.1 Primates

Great Apes

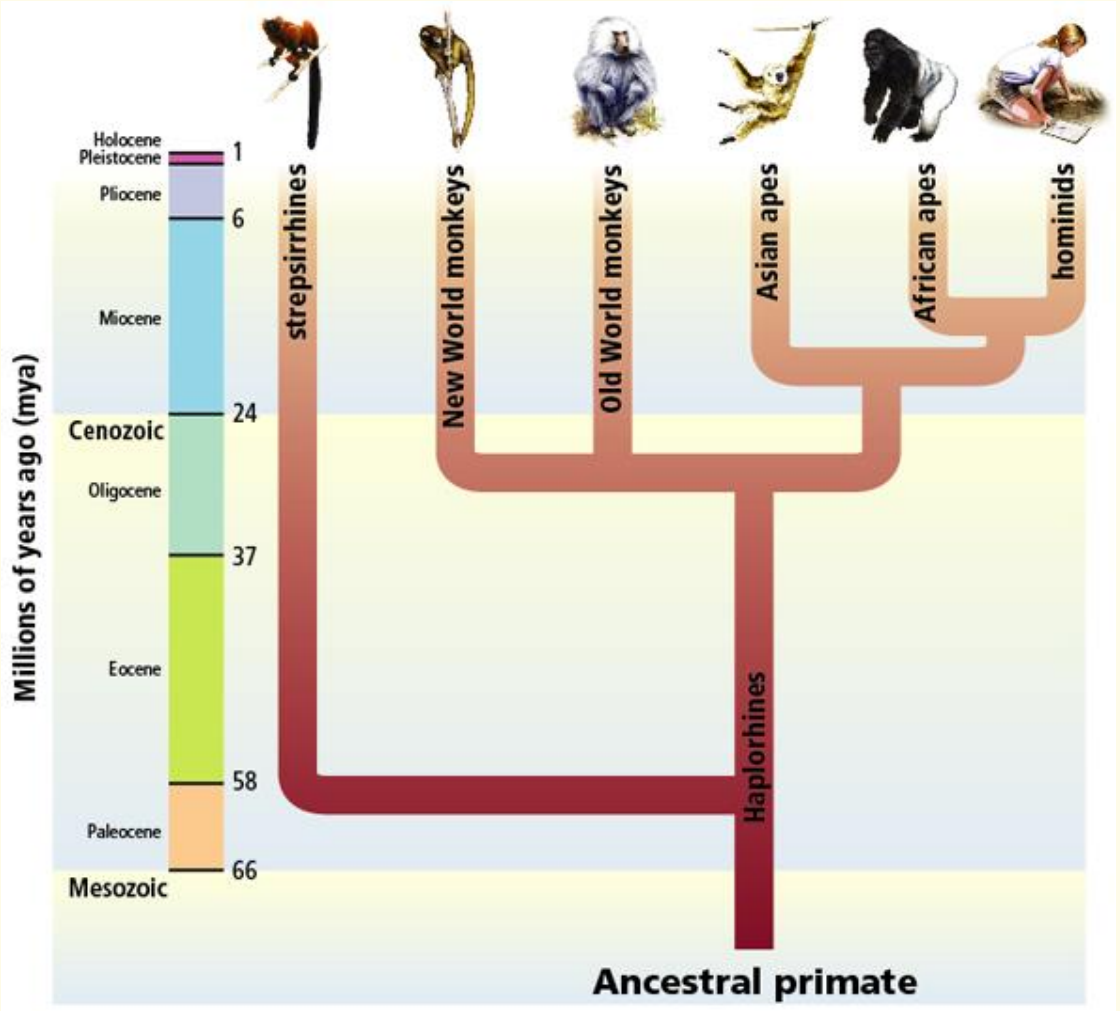
- Orangutans
- Gorillas
- Chimpanzees
- Humans

Female orangutan

Male orangutan

16.1 Primates

Primate Evolution



16.1 Primates

- Primate fossils appear in the fossil record at the beginning of the Eocene, about 60 mya.
- Lemurlike primates were widespread by about 50 mya.
- By the end of the Eocene, 30–35 mya, the anthropoids had diverged and spread widely.

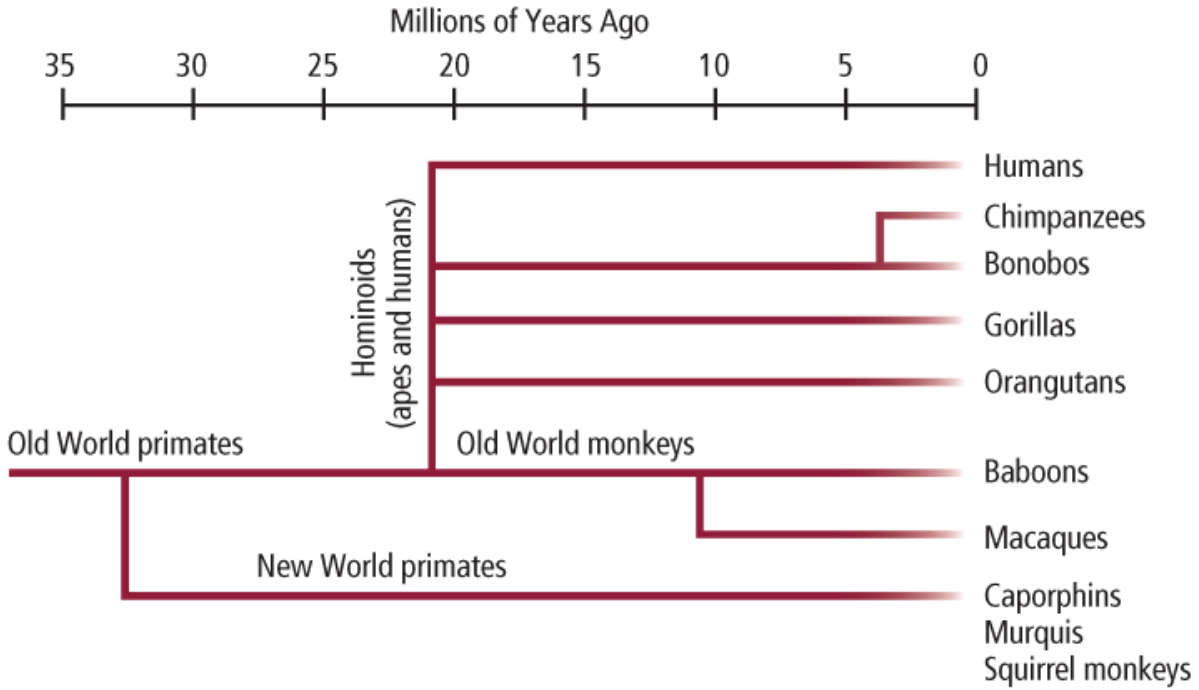
16.1 Primates

- The end of the Eocene also saw the appearance of the monkeys.
- Many scientists hypothesize that New World monkeys evolved from an isolated group of ancestral anthropoids.
- In Africa and Asia, the anthropoids continued to evolve.

16.2 Hominoids to Hominins

Hominoids

- Hominoids include all nonmonkey anthropoids—the living and extinct gibbons, orangutans, chimpanzees, gorillas, and humans.



16.2 Hominoids to Hominins

- Scientists use fossils to determine when ancestral hominoids diverged.
- Scientists also turn to biochemical data to help them in this task.

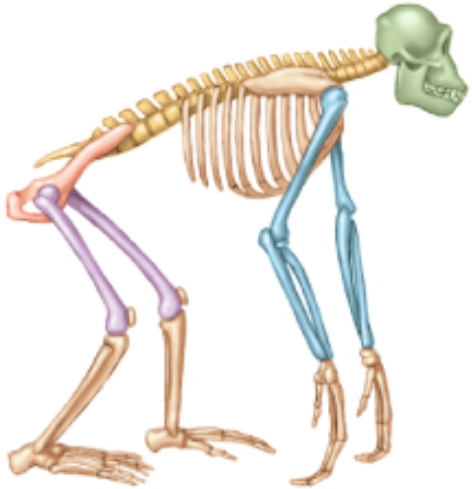
16.2 Hominoids to Hominins

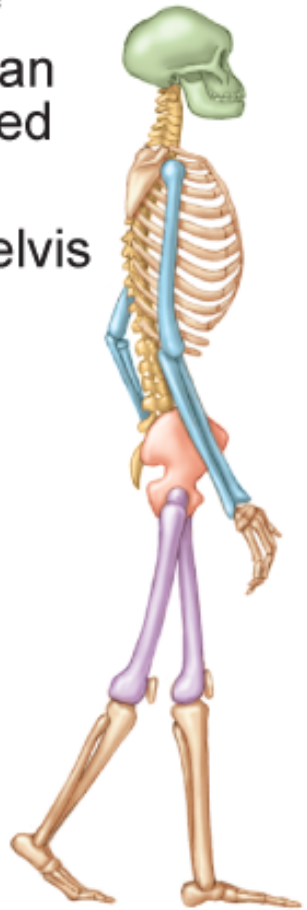
Hominins

- The lineage that most likely led to humans split off from the other African apes sometime between 8 and 5 mya.
- Hominins have bigger brains.
- Thinner and flatter face
- Smaller teeth
- High manual dexterity
- Bipedal 

16.2 Hominoids to Hominins

Chimpanzee	Early hominin
Skull attaches posteriorly	Skull attaches inferiorly
Spine slightly curved	S-shaped spine
Arms longer than legs and used for walking	Arms shorter than legs and not used for walking
Long, narrow pelvis	Bowl-shaped pelvis
Femur angled outward	Femur angled inward





16.2 Hominoids to Hominins

Why bipedalism?

- A changing environment might have played only a minor role.
- Most successful hominins might have been those that evolved on the edge of the forest and savanna.

16.2 Hominoids to Hominins

Hominin Fossils

- Australopithecines lived in the east-central and southern part of Africa between 4.2 and 1 mya.
- Small
- Apelike brains and jaws
- Teeth and limb joints were humanlike.

16.2 Hominoids to Hominins

Taung Baby

- The first australopithecine fossil discovered
- *Australopithecus africanus* likely lived between 3.3 and 2.3 mya.

Lucy

- Lucy is one of the most complete australopithecine fossils ever found.
- She was a member of the species *A. afarensis*, which lived between 4 and 2.9 mya.

16.2 Hominoids to Hominins

Paranthropus

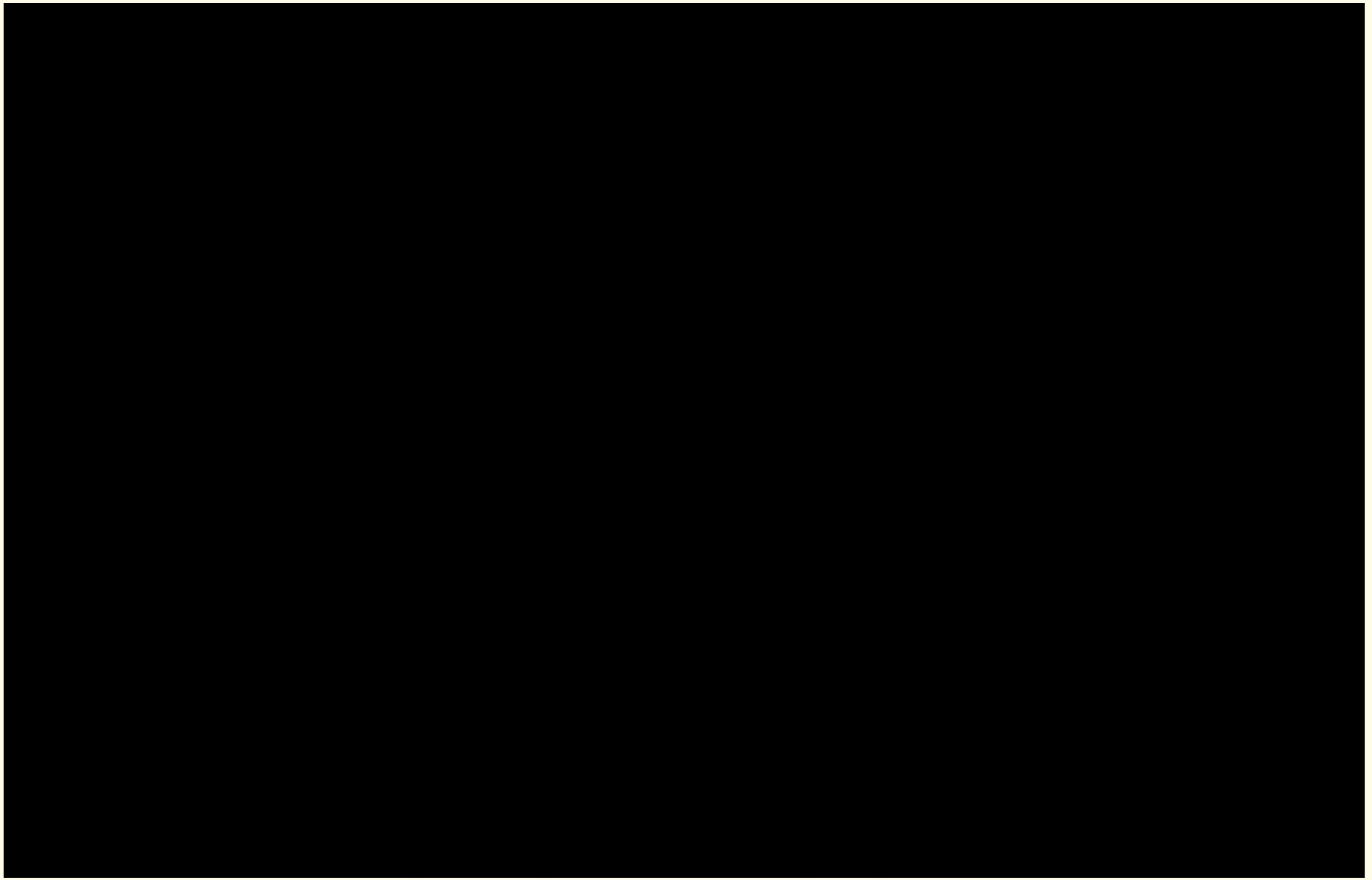
- Thrived between 2 and 1.2 mya
- An offshoot of the human line that lived alongside human ancestors but were not directly related

16.3 Human Ancestry

The Genus *Homo*

- The African environment became considerably cooler between 3 and 2.5 mya.
- *Homo* species had bigger brains, lighter skeletons, flatter faces, and smaller teeth than their australopithecine ancestors.

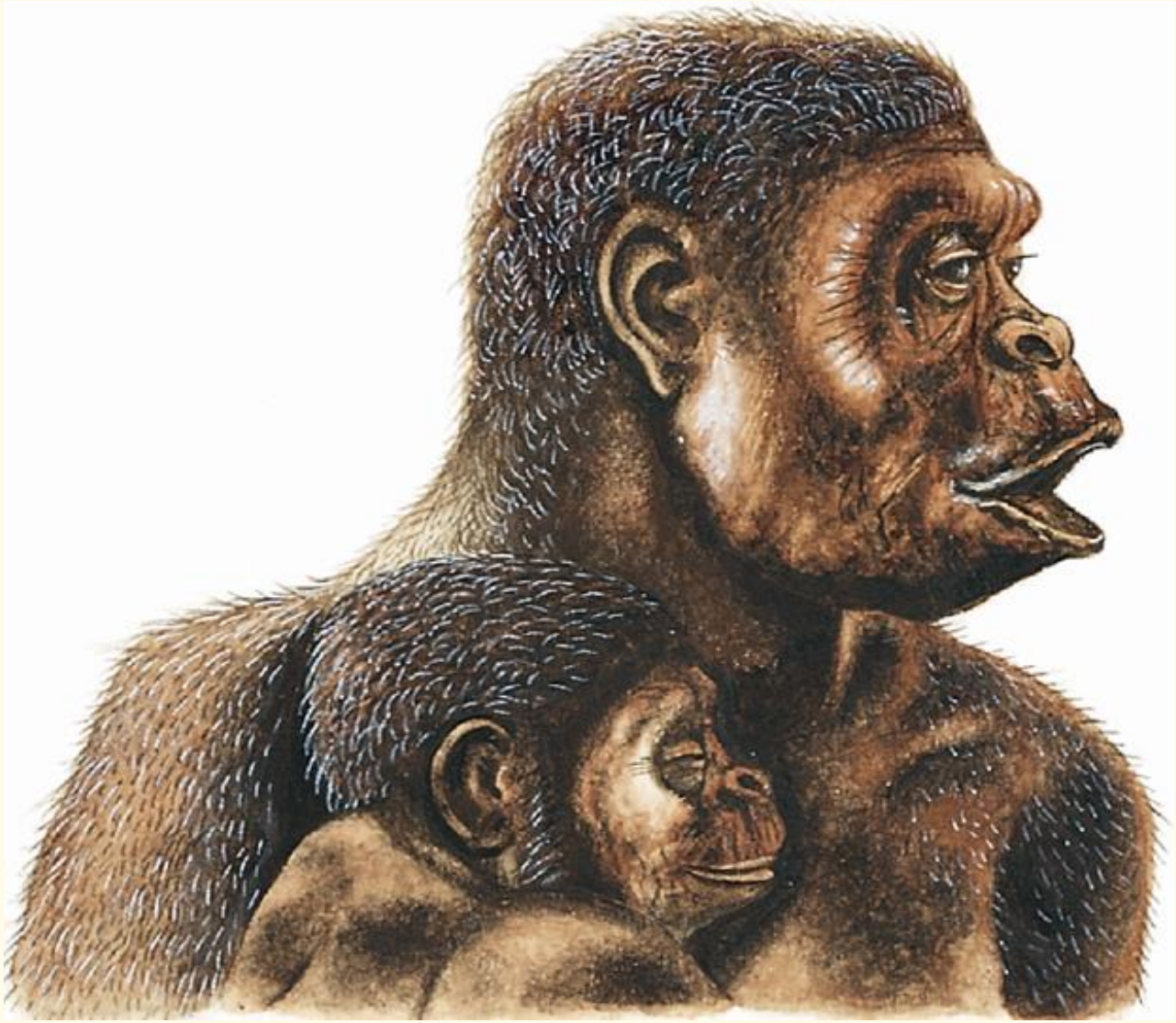
Concepts In Motion



16.3 Human Ancestry

- *Homo habilis* lived in Africa between about 2.4 and 1.4 mya.
- Brain averaged 650 cm^3
- Smaller brow
- Reduced jaw
- Flatter face
- More humanlike teeth
- Small, long-armed, and retained the ability to climb trees

16.3 Human Ancestry

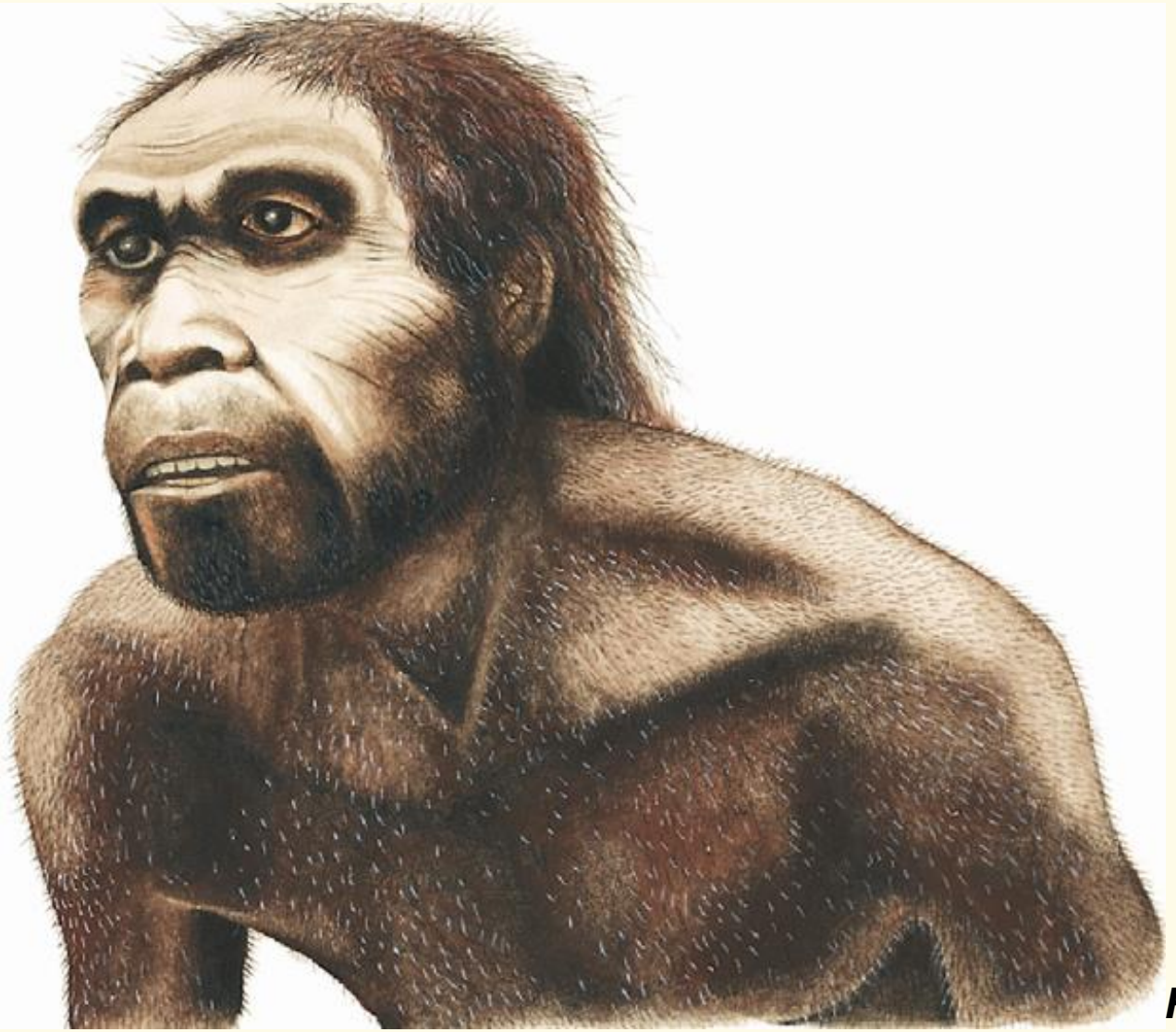


Homo habilis

16.3 Human Ancestry

- *Homo ergaster* emerged within 500,000 years of *H. habilis*.
- Taller
- Lighter
- Longer legs and shorter arms
- Brain averaged 1000 cm^3

16.3 Human Ancestry



Homo ergaster

16.3 Human Ancestry

- *H. ergaster* appears to have been the first African *Homo* species to migrate.
- Eurasian forms of *H. ergaster* are called *Homo erectus*.
- *H. erectus* lived between 1.8 million and 400,000 years ago.

16.3 Human Ancestry

Homo erectus

- Larger than *H. habilis*
- Brain capacity ranged from about 900 cm^3 to about 1100 cm^3
- Longer skull, lower forehead, thicker facial bones, and a prominent browridge

16.3 Human Ancestry

- *Homo floresiensis* lived about 18,000 years ago.
- About 1 m tall
- Brain and body proportions like all the australopithecines.

16.3 Human Ancestry

- *Homo neanderthalensis* evolved exclusively in Europe and Asia about 200,000 years ago.

- Shorter but had more muscle mass
- Larger brains than modern humans
- Thick skulls, bony browridges, and large noses

16.3 Human Ancestry

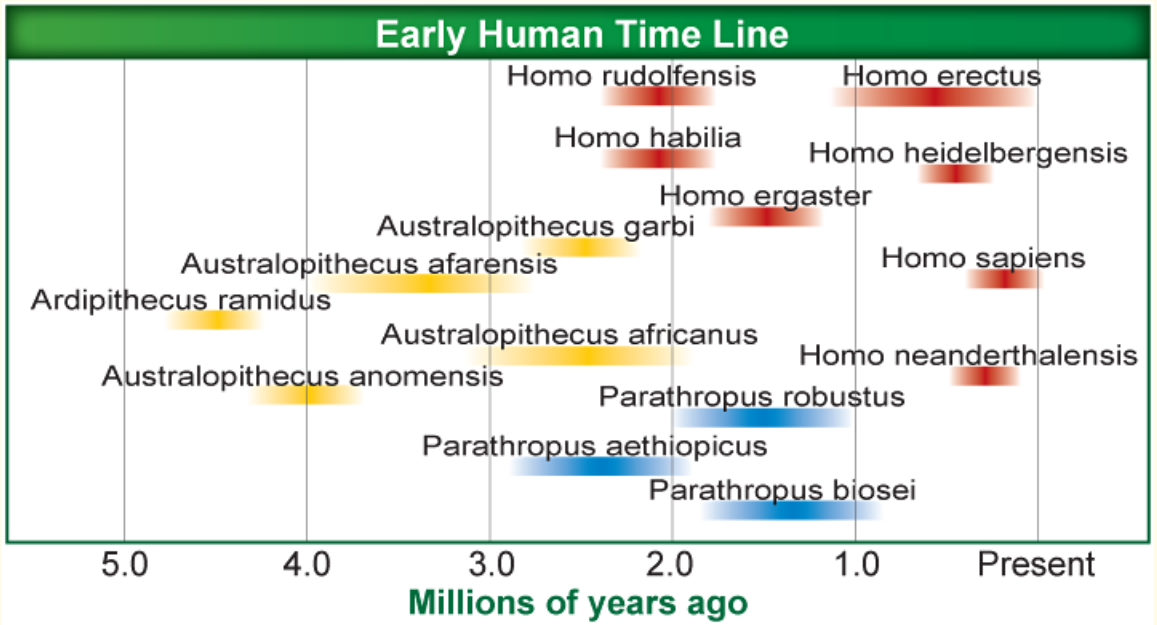
Emergence of Modern Humans

- *Homo sapiens* is characterized by a more slender appearance than all other *Homo* species.
- Thinner skeletons, rounder skulls, and smaller faces with prominent chins
- Their brain capacity averages 1350 cm^3.
- Appeared in the fossil record, in what is now Ethiopia, about 195,000 years ago

16.3 Human Ancestry

Out-of-Africa Hypothesis

- 200,000 years ago, a morphologically diverse genus of hominins were present.
- 30,000 years ago, only modern humans remained.
- Modern humans evolved only once, in Africa, and then migrated.



16.3 Human Ancestry

"Mitochondrial Eve"

- Mitochondrial DNA changes very little over time.
- The population with the most variation should be the population that has had the longest time to accumulate diversity.
- *H. sapiens* emerged in Africa about 200,000 years ago from a hypothetical "Mitochondrial Eve."

16.3 Human Ancestry

Cro-Magnons

Cro-Magnon cave painting

- Early modern humans expressed themselves symbolically and artistically.
- Developed sophisticated tools and weapons
- The first to fish, the first to tailor clothing, and the first to domesticate animals

Chapter Resource Menu

Click on a hyperlink to view the corresponding lesson.

Chapter Diagnostic Questions

CheckPoint

Which is *not* a characteristic of primates?

A. manual dexterity

B. keen eyesight

C. high reproduction rate

D. large brain

Chapter Diagnostic Questions

CheckPoint

Scientists classify primates into subgroups based on what characteristics?

A. tails, bone structure, and brain size

B. noses, eyes, and teeth

C. range, size, and active period

D. teeth, nails, and range

Chapter Diagnostic Questions

CheckPoint

Which is *not* classified as a Great Ape?

A. gorilla

B. gibbon

C. chimpanzee

D. orangutan

16.1 Formative Questions

CheckPoint

What enables primates to have a high level of manual dexterity?

A. an opposable first digit

B. binocular color vision

C. developed hind limbs

D. highly moveable arms

16.1 Formative Questions

CheckPoint

In what group are the anthropoids?

A. lemurs

B. lesser apes

C. haplorines

D. strepsirrhines

16.1 Formative Questions

CheckPoint

Which represents the journey of the ancestors of New World monkeys?

A. Asia → Africa

B. Europe → Asia

C. Madagascar → Africa

D. Africa → South America

16.1 Formative Questions

CheckPoint

What great ape species live in Asia and are the largest arboreal primates?

A. baboons

B. bonobos

C. gorillas

D. orangutans

16.1 Formative Questions

CheckPoint

Which group of apes has only one species that survives today?

A. arboreals

B. hominins

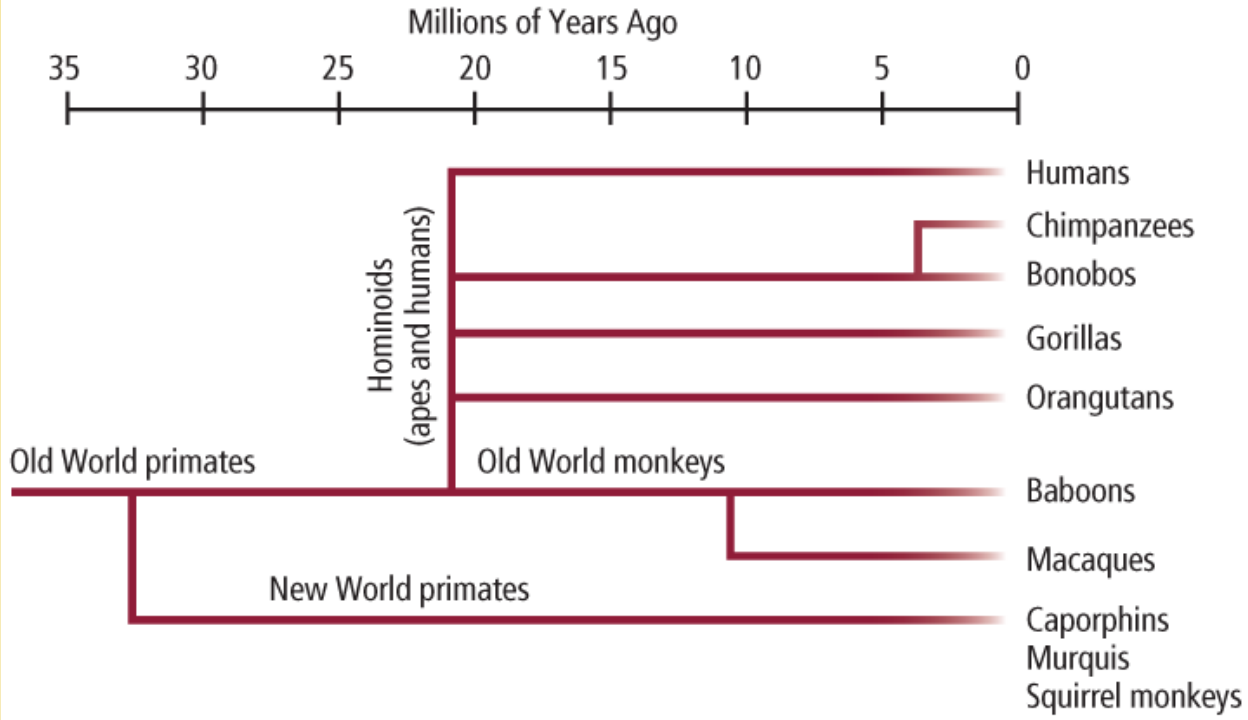
C. hominoids

D. lesser apes

16.2 Formative Questions

CheckPoint

From what type of data was this possible divergence of hominoids constructed?



16.2 Formative Questions

CheckPoint

A. the fossil record

B. DNA comparisons

C. anthropoid analysis

D. morphological features

16.2 Formative Questions

CheckPoint

Which is a distinguishing characteristic of hominins?

A. bipedalism

B. ability to use tools

C. unspecialized teeth

D. complex communication

16.2 Formative Questions

CheckPoint

What advantage does bipedalism have over quadrupedalism?

A. ability to run faster

B. less energy requirements

C. less strain on the hips and back

D. ability to travel over long distances

16.2 Formative Questions

CheckPoint

Which was the first genus of hominins that were truly bipedal?

A. *Altiatlasius*

B. *Australopithecus*

C. *Homo*

D. *Proconsul*

16.3 Formative Questions

CheckPoint

What genus of hominins is believed to have evolved from the australopithecines when the African environment cooled about 2.5 mya?

A. *Andrepithecus*

B. *Homo*

C. *Kenyanthropus*

D. *Parathropus*

16.3 Formative Questions

CheckPoint

What were species in the genus *Homo* the first to do?

A. carry objects

B. control fire

C. live in savannas

D. walk upright

16.3 Formative Questions

CheckPoint

Which *Homo* species still had long arms and seemed to retain the ability to climb trees?

A. *H. erectus*

B. *H. ergaster*

C. *H. fluresiensis*

D. *H. habilis*

16.3 Formative Questions

CheckPoint

Were Neanderthals the ancestors of modern humans?

A. Yes

B. No

C. We don't know.

16.3 Formative Questions

CheckPoint

How does mitochondrial DNA analysis support the Out-of-Africa hypothesis?

A. Mitochondrial DNA changes occur at different rates.

B. Humans today have very different mitochondrial DNA.

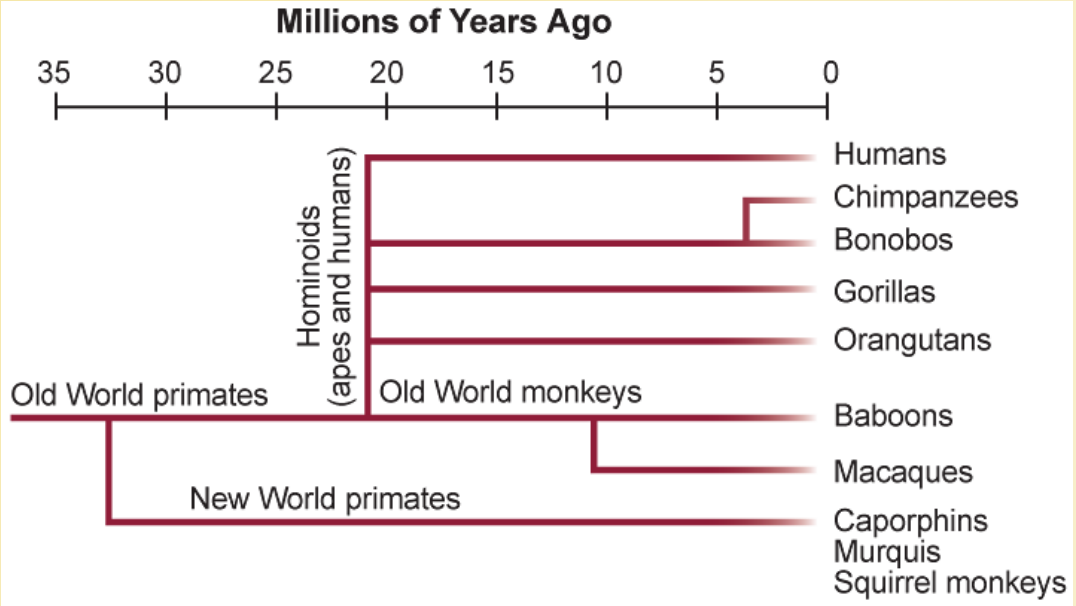
C. Africans have the greatest diversity in their mitochondrial DNA.

D. The mitochondrial DNA of humans throughout the world is identical.

Chapter Assessment Questions

CheckPoint

Use the image to determine the closest living relatives to humans.

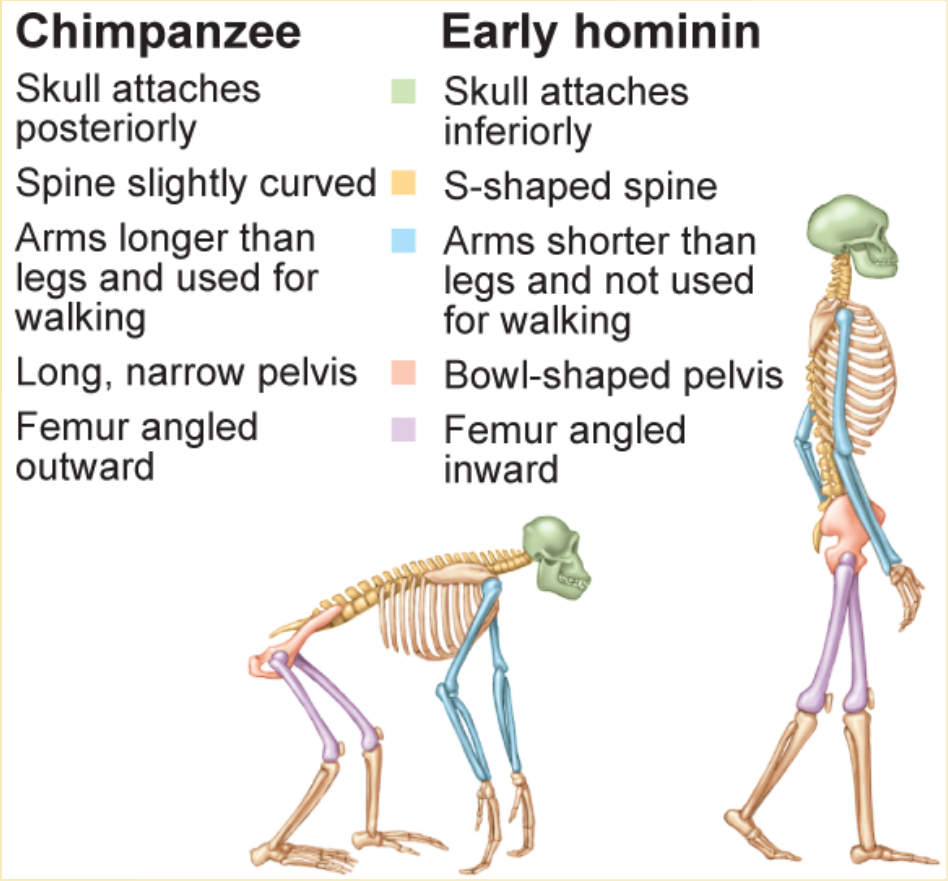


Answer: chimpanzees and bonobos

Chapter Assessment Questions

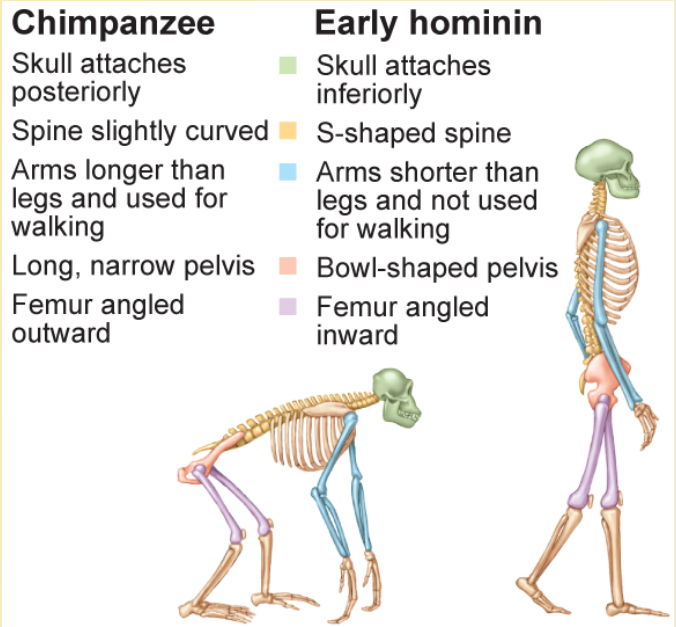
CheckPoint

Describe the foramen magnum and indicate the difference in its location in each skeleton.



Chapter Assessment Questions

CheckPoint



Answer: The foramen magnum is the hole in the skull where the spine extends from the brain. It is in the back of the skull in quadrupedal animals (first image) and at the base of the skull in hominins (second image).

Chapter Assessment Questions

CheckPoint

The discovery of what fossil ended the debate regarding bipedalism and Australopithecus?

A. Taung baby

B. Lucy

C. Java man

D. Proconsul

Standardized Test Practice

CheckPoint

Why do most primates have a decreased sense of smell?

A. They are able to stand upright.

B. They live in tropical regions.

C. They are more active during the day.

D. They have an increased sense of vision.

Standardized Test Practice

CheckPoint

What advantage does binocular vision provide?

A. ability to see at night

B. better color vision

C. capacity to reason

D. greater depth perception

Standardized Test Practice

CheckPoint

What enables primates to learn and develop complex social behaviors?

A. ability to stand and walk upright

B. a large amount of time spent in trees

C. long-term dependency on parents

D. faces that tend to be more flattened

Standardized Test Practice

CheckPoint

What was probably associated with the hunting and/or scavenging lifestyle of *H. ergaster*?

A. fire-making

B. language

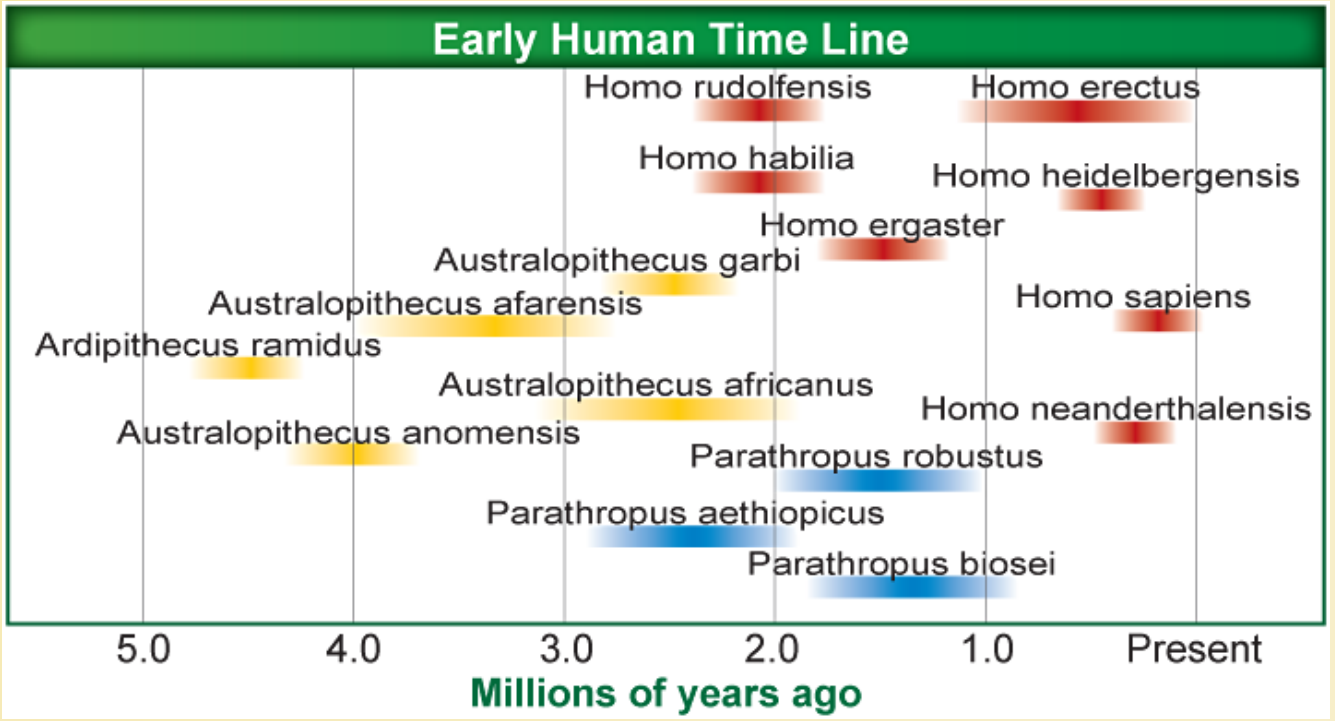
C. migrating

D. symbolic expression

Standardized Test Practice

CheckPoint

What does the early human timeline show about the evolution of hominins?



Standardized Test Practice

CheckPoint

A. Different hominins existed in different parts of the world.

B. Hominins that lived at the same time were very similar.

C. The periods of existence of many early hominins overlapped.

D. There is a direct descent from the early hominins to modern humans.

Standardized Test Practice

CheckPoint

How do most scientists explain the widespread distribution of modern humans on Earth?

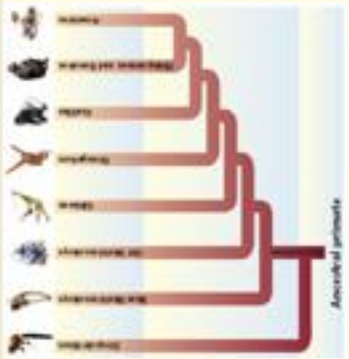
A. They evolved by convergent evolution.

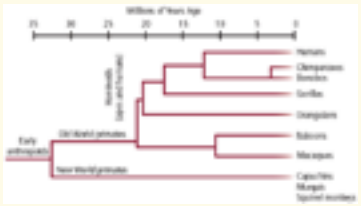
B. They evolved by reproductive isolation.

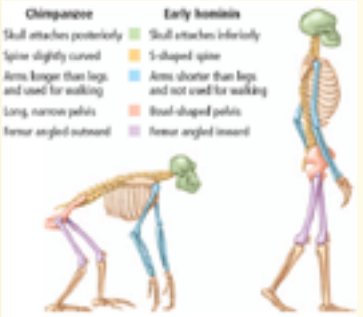
C. They evolved from dispersed populations.

D. They evolved in one place, then migrated.

Glencoe Biology Transparencies







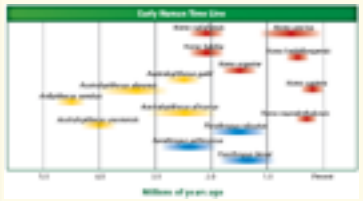
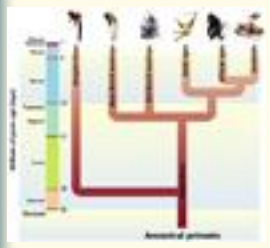
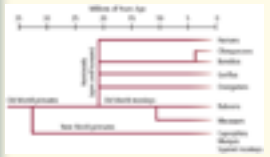
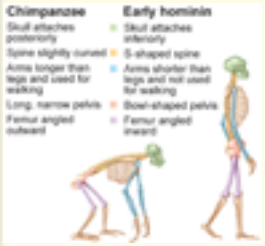
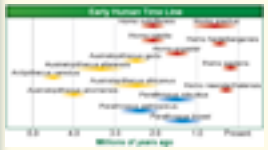


Image Bank






Chimpanzee
Skull attaches posteriorly
Spine slightly curved
Arms longer than legs and used for walking
Long, narrow pelvis
Femur angled outward
Early hominin
Skull attaches inferiorly
S-shaped spine
Arms shorter than legs and not used for walking
Bowl-shaped pelvis
Femur angled inward



Vocabulary

Section 1

- opposable first digit
- binocular vision
- diurnal
- nocturnal
- arboreal
- anthropoid
- prehensile tail
- hominin

Vocabulary

Section 2

- hominoid
- bipedal
- australopithecine

Vocabulary

Section 3

- *Homo*
- Neanderthal
- Cro-Magnon

Animation

Concepts In Motion

- Visualizing Primates