

Chapter 20: Mammals

Phylum: Chordata

Subphylum: Vertebrata

Class: **Mammalia** (~4800 spp.)

Subclass: 2

Order: 17



most highly differentiated group in animal kingdom

Mammals

• Key mammalian characteristics

– hair

- heat loss/thermal insulation
- camouflage/concealment
- sensory structures/sensitive vibrissae
- defense weapon
- protection
- waterproofing/ buoyancy
- signaling

Key Mammalian Characteristics

- mammary glands

~ 50% of energy in milk comes from fat

provides nourishment to newborn

-nervous system

more advanced than in other animal groups

enlargement of cerebrum (cerebral cortex)

Key Mammalian Characteristics

- endothermy

– crucial adaptation that allowed activity at any time of day to colonize severe environments

- placenta

– specialized organ allowing food, H₂O & O₂ to pass from mother to child

- teeth

– heterodont dentition



Key Mammalian Characteristics

-glands

- protection
- defense
- cooling
- scent for sexual attraction

Key Mammalian Characteristics

- digestion of plants

- cellulose major source of food for herbivores
 - mammals do not have necessary digestive enzymes to break apart cellulose
 - some have evolved **four-chambered stomachs**
 - some contain **mutualistic bacteria** in a cecum

Key Mammalian Characteristics

- hooves & horns

- hooves specialized pads of keratin*
- horns: core of bone surrounded by keratin sheath

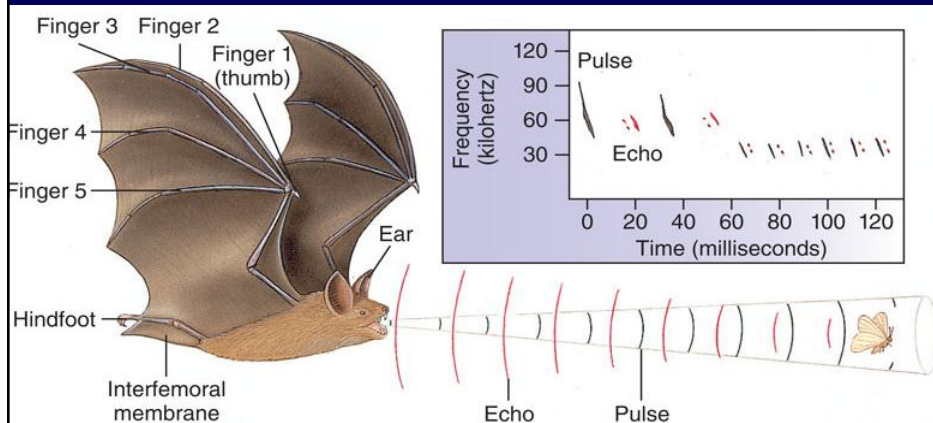
*extremely strong protein

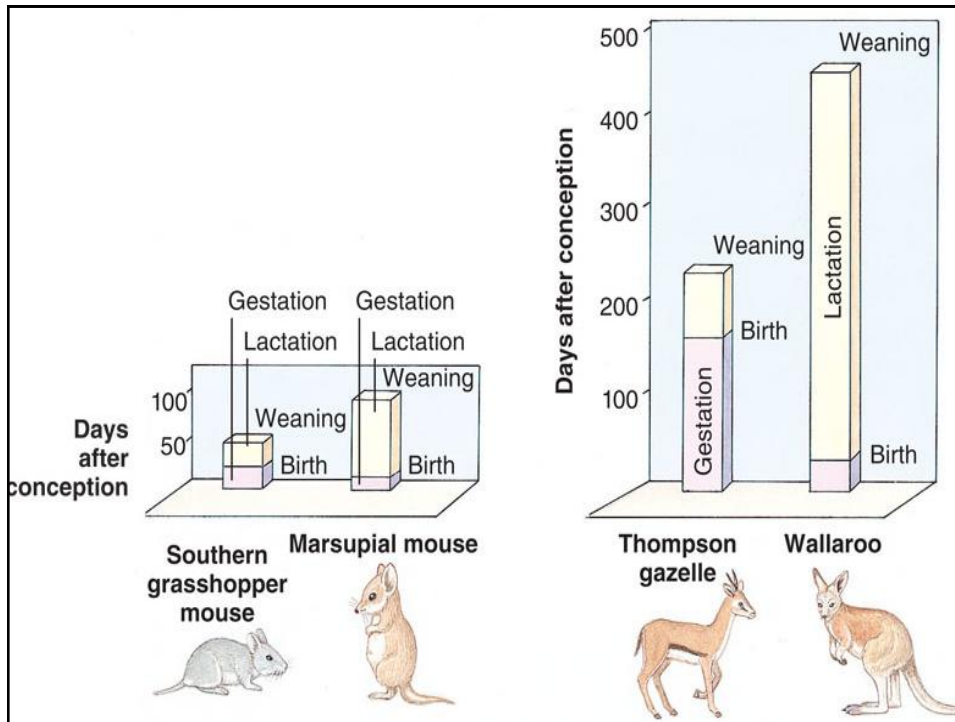


- flight

- Bats: wing of leathery membrane of skin stretched over bones of four fingers
 - second largest order of mammals
 - echolocation

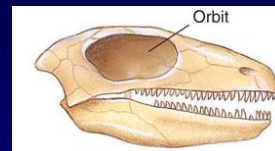
Echolocation



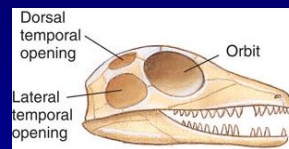


Amniote Skull

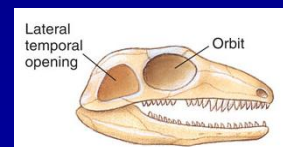
1. **Anapsids**: no openings
turtles & their ancestors



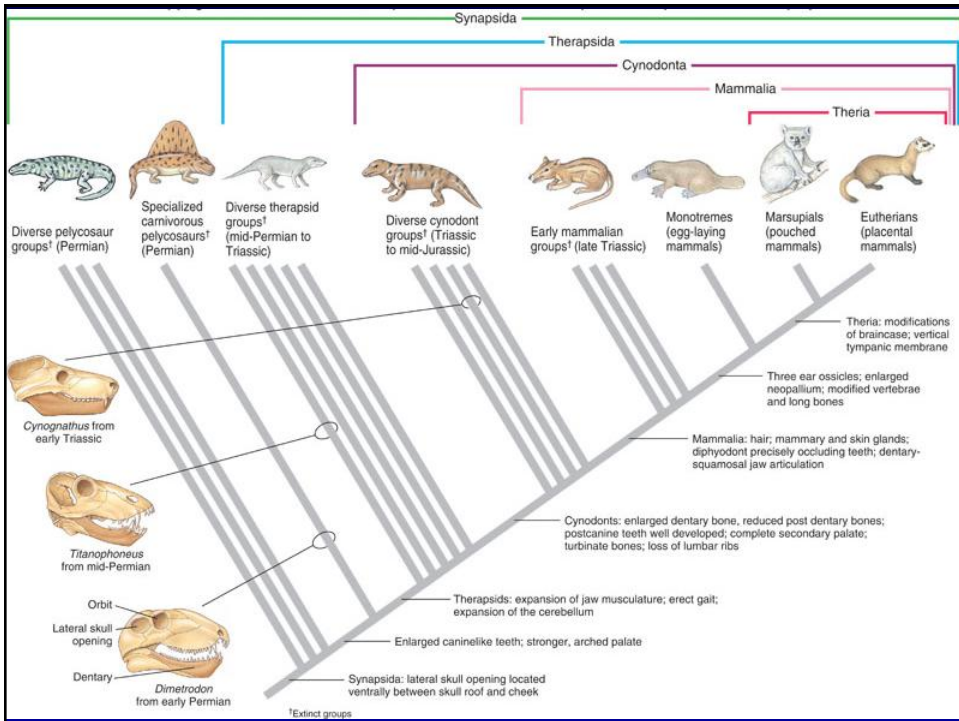
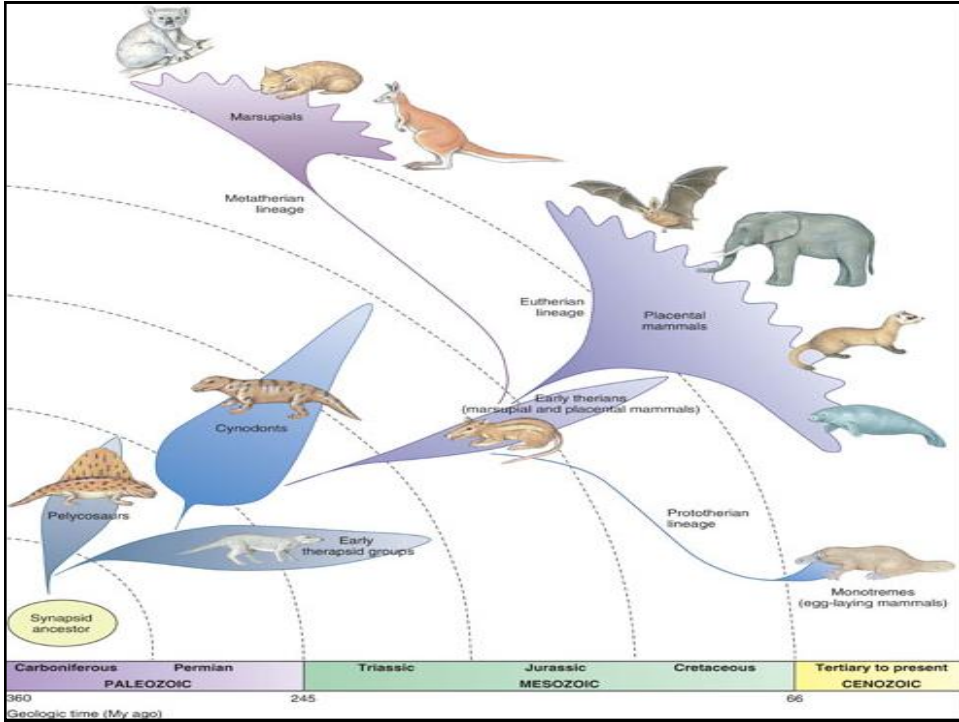
2. **Diapsids**: two pairs of openings
dinosaurs, lizards, etc.,

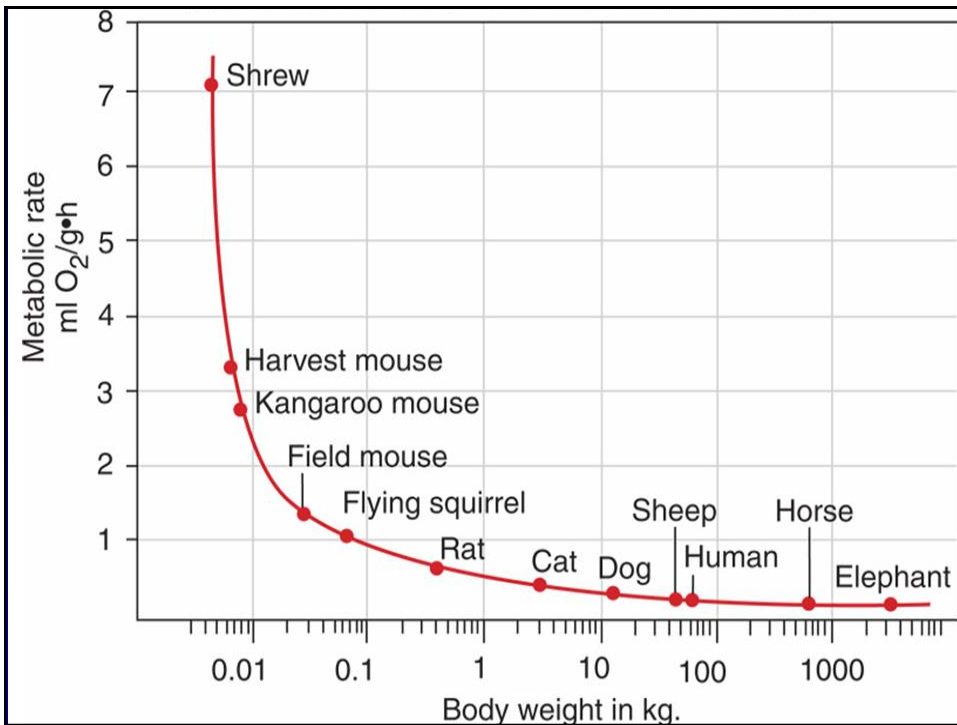
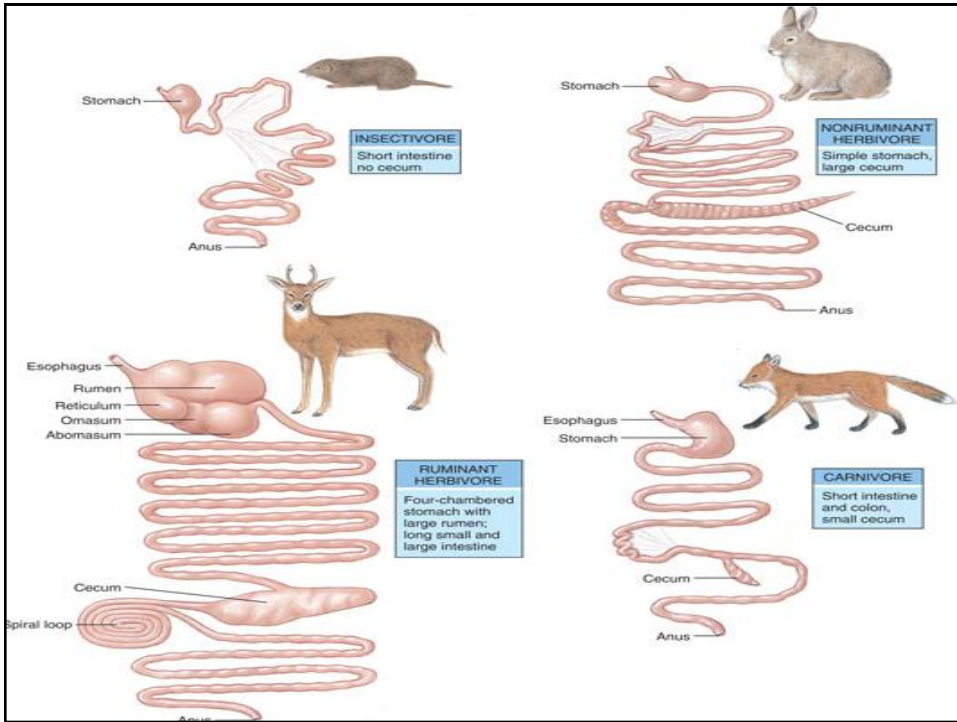


3. **Synsids**: pair of openings
mammals



first amniotes to radiate widely
into terrestrial habitats

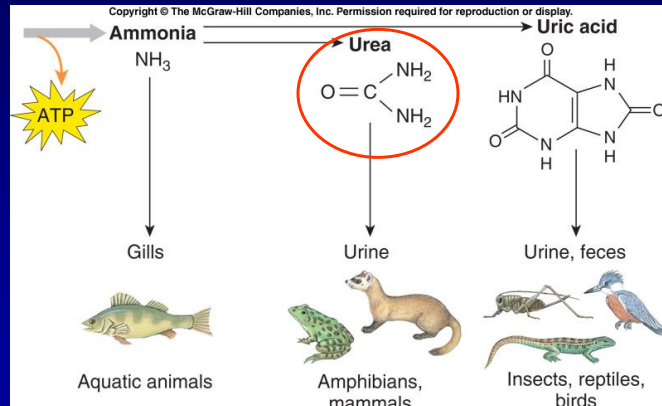




Water Conservation

1. all amniotes have **metanephric kidneys** drained by ureter
2. mammalian kidney **with very long loop of Henle** allow water absorption
3. nitrogenous waste excretion: **urea** rather than uric acid or ammonia

Nitrogen Endproducts



Orders of Mammals

- **Origin of mammals**
 - first mammals arose about 220 mya
 - tiny shrewlike creatures with large eye sockets - nocturnal?
- **Early divergence**
 - Subclass Prototheria
 - duckbill platypus
 - Subclass Theria
 - marsupials & placental mammals

History of Mammals

- Orders of mammals
 - **monotremes:** egg-laying mammals (**oviparity**)
 - lay shelled eggs
 - **marsupials: (viviparity)** pouched mammals
 - finish development in external pouch
 - **placental mammals:** placenta nourishes embryo through entire development



Evolution Among Primates

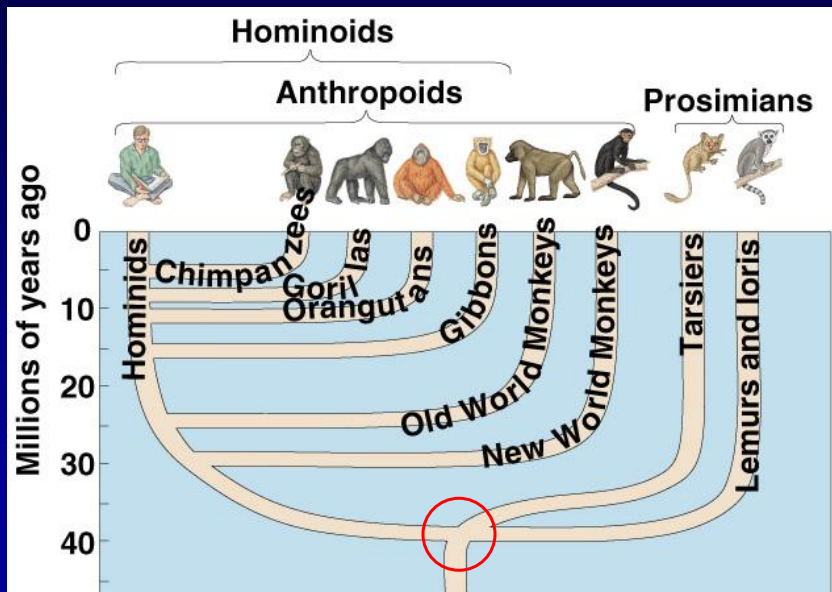
- Primates
 - 2 distinct features → success in arboreal environment:
 - grasping fingers & toes
 - binocular vision
- Evolution of prosimians
 - earliest primates split into prosimians & anthropoids ~40 mya
 - “before monkeys”

Anthropoids

- Higher primates - includes apes, monkeys & humans
 - one of most contentious issues in primate biology is identity of first anthropoid
- Direct descendents:
 - New World monkeys
 - Old World monkeys

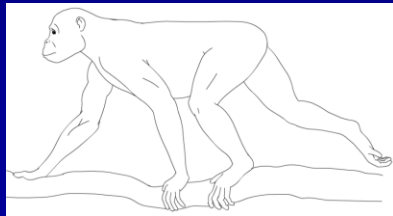


Primate Evolutionary Tree



Anthropoids

- **Hominoids** (apes & human) evolved from anthropoid ancestors
- First hominoid
 - current attention centered around Miocene ape (27-17 mya)
 - ***Proconsul***: many characteristics of Old World monkeys, apelike hands, feet & pelvis but no tail

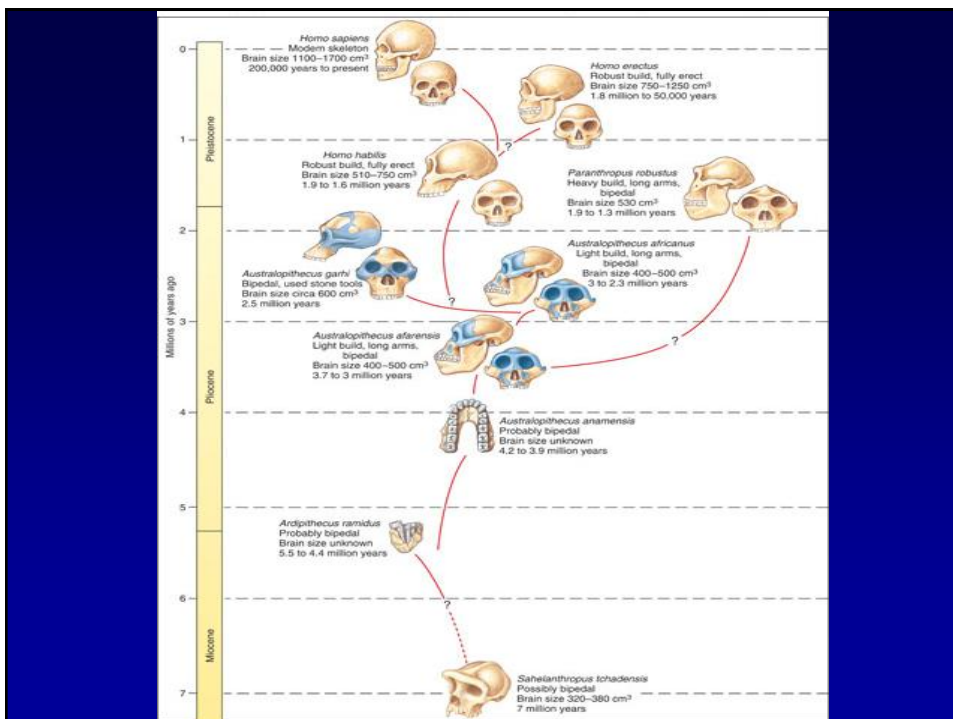


Comparing Apes to Hominoids

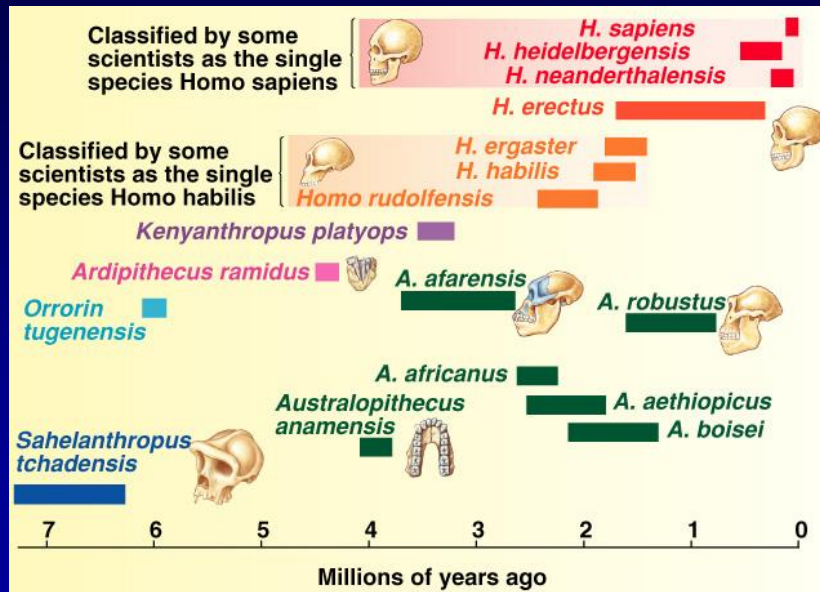
- Common ancestor of apes & hominids thought to have been arboreal climber
 - hominids became **bipedal**
 - apes evolved knuckle-walking
- Multiple anatomy differences related to bipedal locomotion

Evolutionary Tree With Many Branches

- Two major groups of hominids:
 - **Homo**
 - **Australopithecus**
 - older
 - smaller brain



Hominid Evolutionary Tree



Australopithecines

- About 1 meter tall
- Hominid dentition
- Bipedal
 - seems to have evolved as our ancestors left dense forests for grasslands & open woodlands
 - reason why bipedalism evolved still controversial
 - preceded large brains

Differing View of Hominid Tree

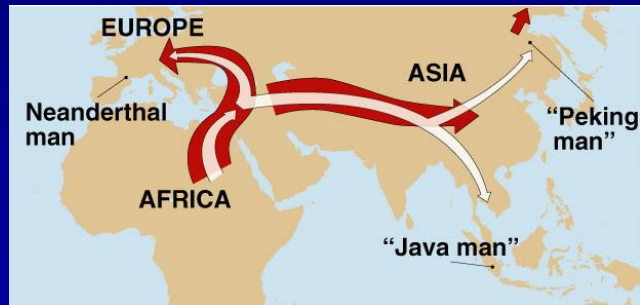
- **Lumpers**
 - focus on commonalities between fossils
- **Splitters**
 - focus on differences between fossils

Genus *Homo*

- First humans evolved from australopithecine ancestors ~2 mya
 - ***Homo habilis***
 - ***Homo rudolfensis***
 - ***Homo ergaster***
- Still active debate whether *Homo* should be lumped into *habilis*, or split into three species

Homo erectus

- *H. erectus*
 - larger than *H. habilis*
 - larger brain
 - walked erect
- Prominent brow ridges & a rounder jaw
- **Came out of Africa**



Homo erectus

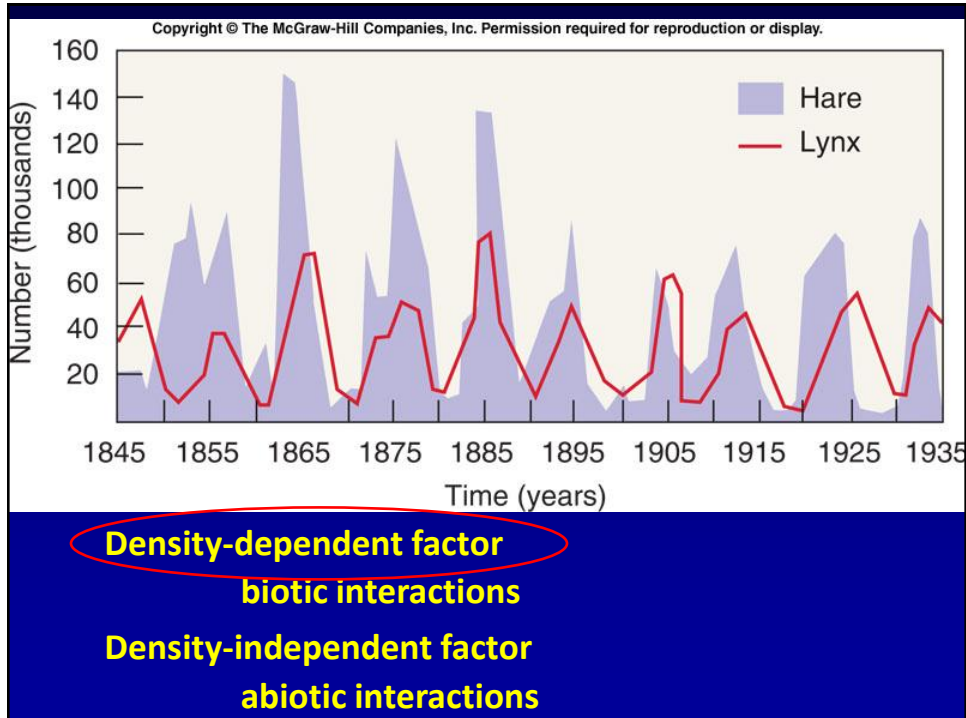
- Modern human 1st appeared in Africa ~ 600,000 yrs ago
 - three species of modern humans:
 - *H. heidelbergensis*
 - *H. neanderthalensis*
 - *H. sapiens*

Homo sapiens

- *H. sapiens* only surviving hominid
 - best fossils between 90,000 -100,000 years old
 - Cro-Magnons replaced Neanderthals ~40,000 years ago
 - Humans of modern appearance eventually spread across Siberia to North America ~ 13,000 years ago

Homo sapiens

- Distinguishing characteristics
 - tool use
 - conceptual thought a hallmark
 - symbolic language to shape & transmit accumulated experiences



Glands

I. Sweat glands

A. eccrine:

- 1) secrete watery fluid evaporate cooling
- 2) hairless regions e.g. foot pads
- 3) horses/primates scattered all over body
- 4) reduced/absent in rabbits, rodents,, whales

B. Apocrine

- 1) secrete whitish/yellow milky fluid-dry on skin—form film
- 2) open into hair follicle where hair existed
- 3) humans armpits, breasts, scrotum, external auditory canals
- 4) with human puberty & correlated with reproductive cycle

II. Scent: communication, marking, territorial

III. Sebaceous: secretion of oily/waxy sebum to lubricate skin/hair

IV. Mammary: milk secretion

Lucy: *Australopithecus afarensis*



Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

Figure 28.07





lemur



tarsier



lorise

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



A

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



B

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

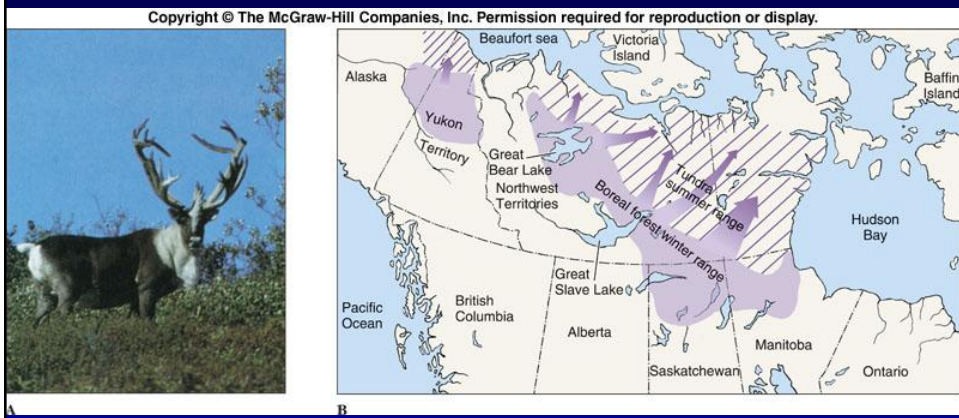


Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

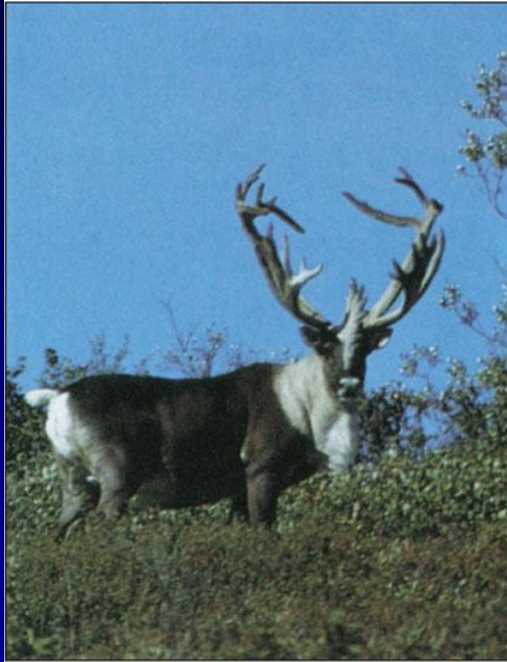




Figure 28.17



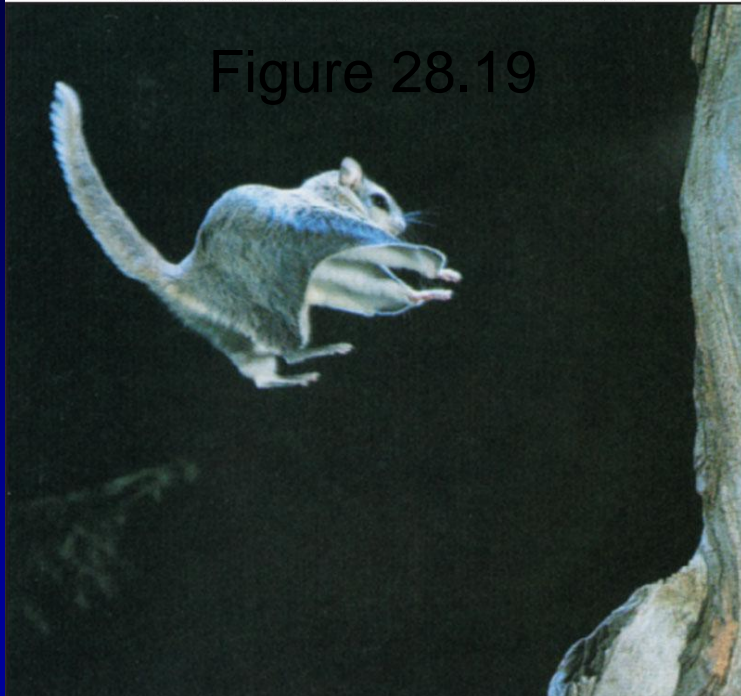
Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



A

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

Figure 28.19



Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

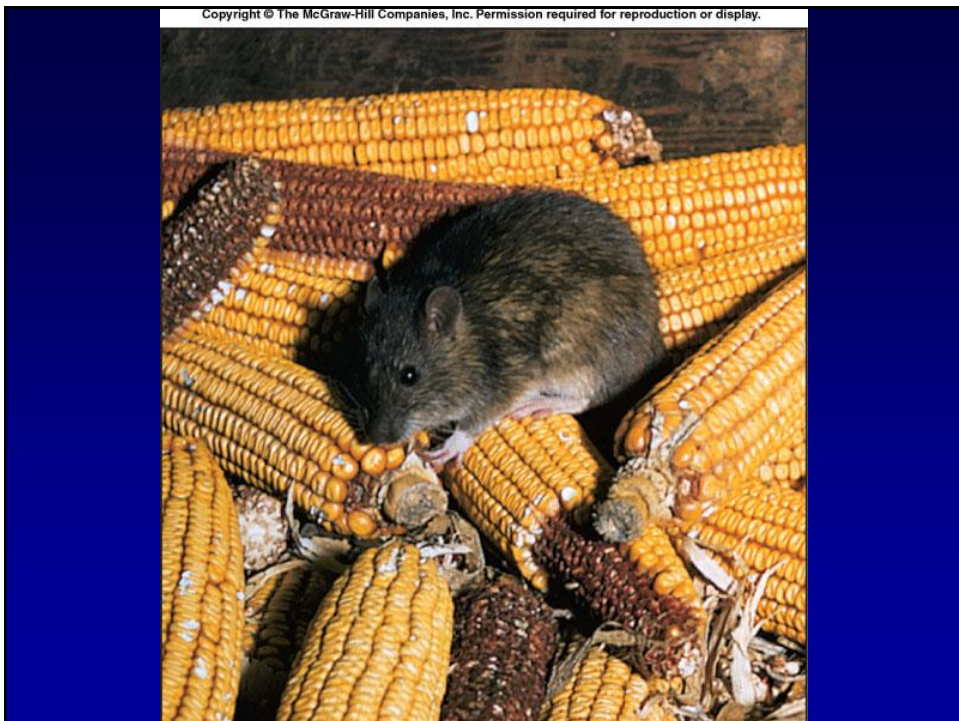
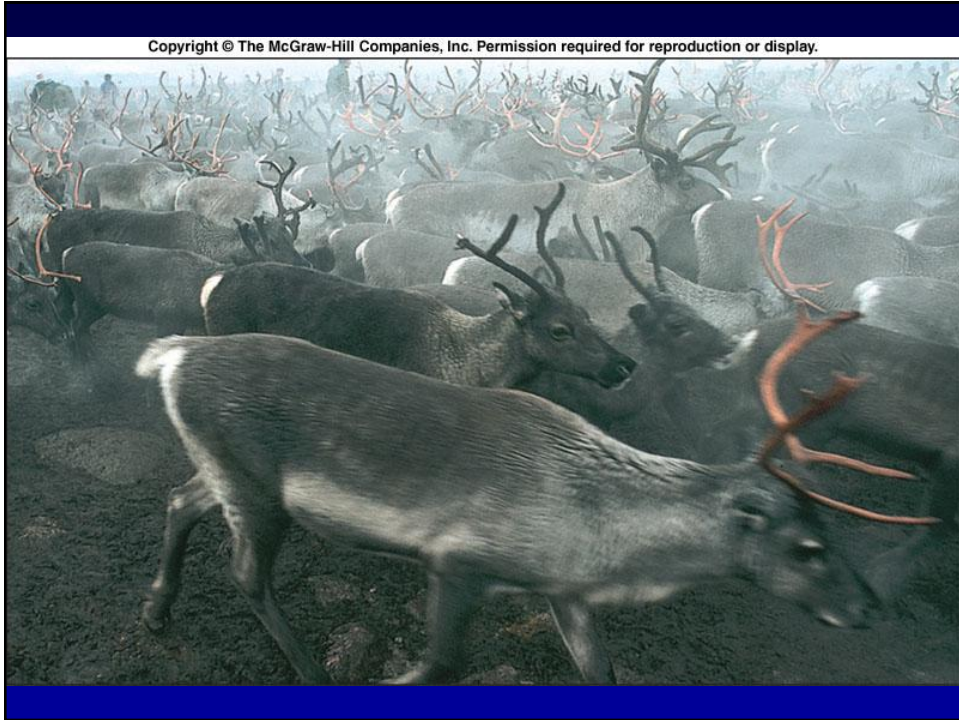


Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



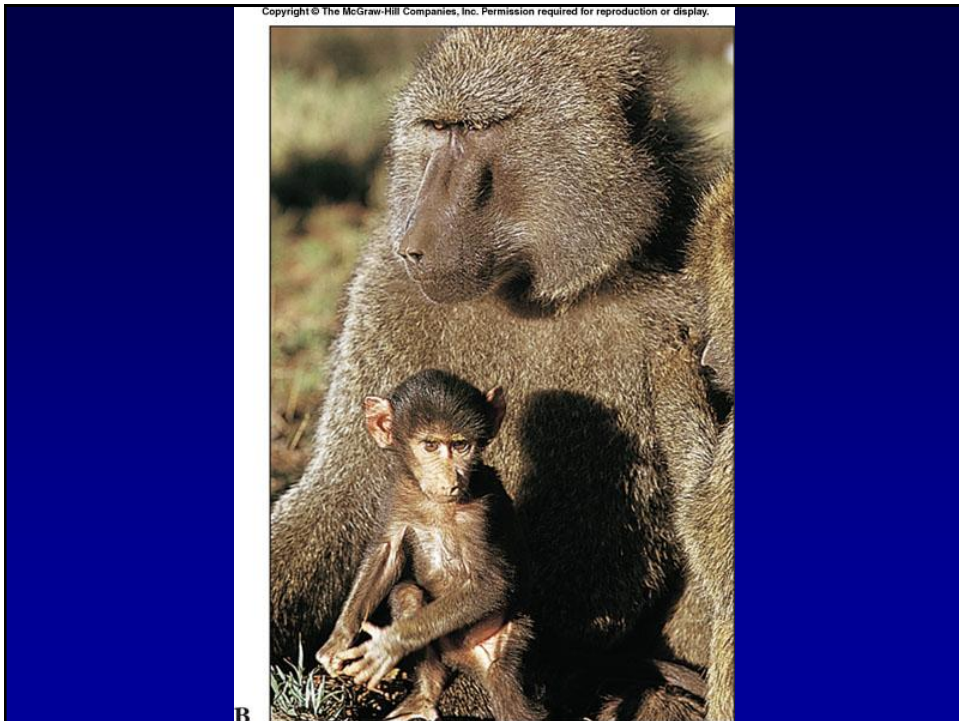
Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.





Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.





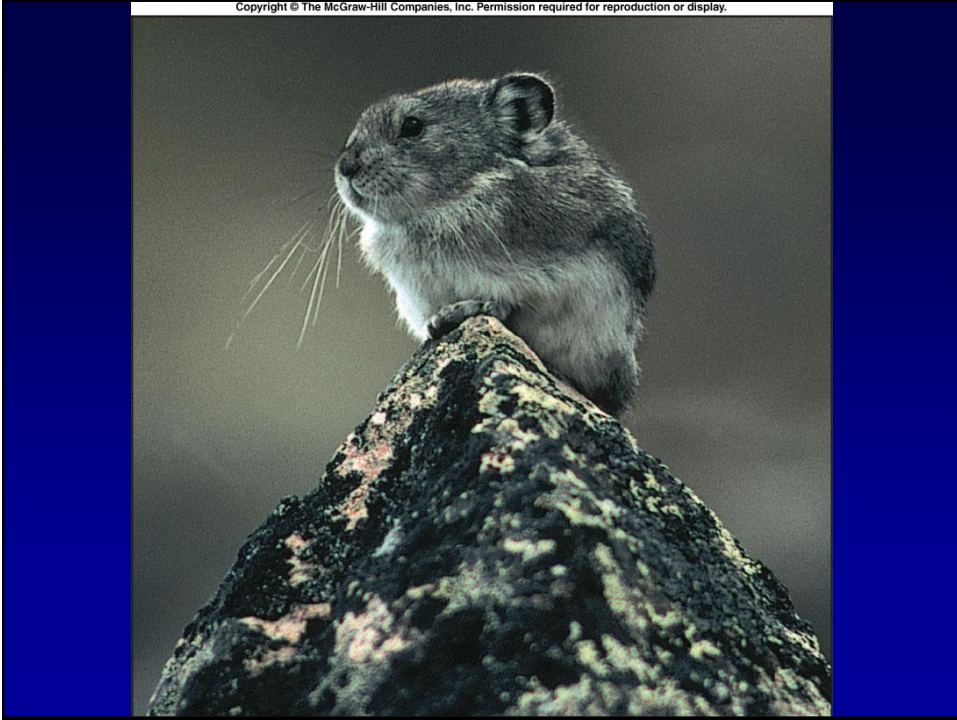
Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

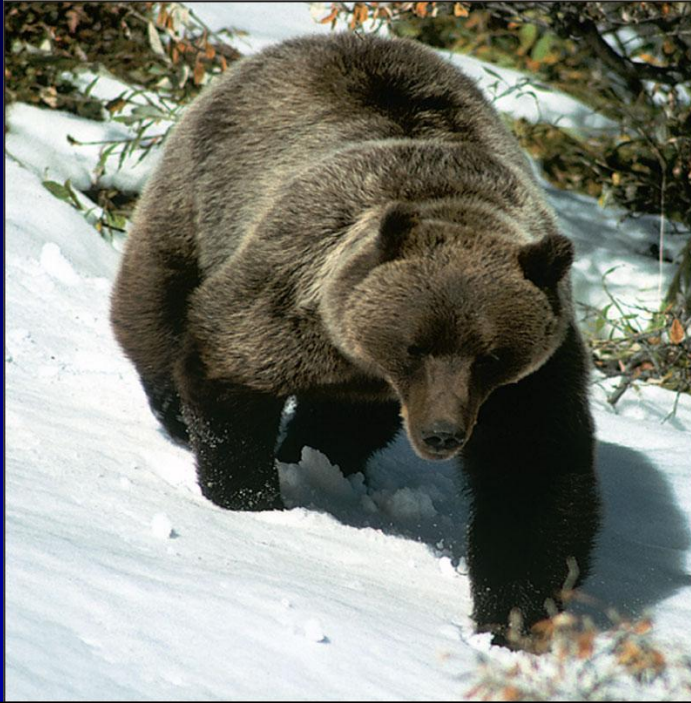


Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

Figure 28.38

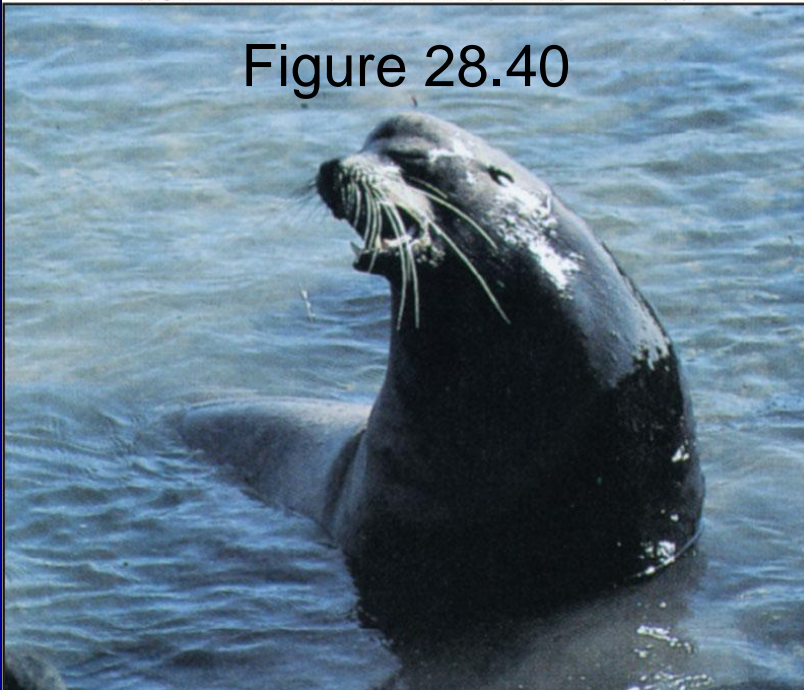


Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

Figure 28.40



Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

