

Outline 12: Evolution of Mammals

Classifying Mammals

- Paleontologists recognize at least 5 major groups of mammals. Only 3 are still living:
- Monotremes: lay eggs
- Marsupials: poorly developed at birth
- Eutherians or Placentals: well developed at birth

Defining Mammals

- Warm blooded
- Fur
- Milk glands
- Can lay eggs or have some form of live birth.

Recognizing Fossil Mammals

- Our definition of mammals doesn't work with fossil bones.
- How do we recognize the first mammals?
- Reptiles have 3 bones in lower jaw.
- Mammals have 1 bone in lower jaw
- Mammal teeth are specialized.

Mammal Teeth

- Teeth make excellent fossils.
- Reptile ancestors had simple, cone-shaped teeth they regularly replaced.
- Mammal teeth are specialized into incisors, canines, pre-molars and molars.
- Mammals have only two sets of teeth during their lifetime.

The First Mammals

- Mammals evolved from the Therapsid reptiles (mammal-like reptiles) during the Triassic, about 210 MY ago.
- The change was gradual. Hard to pinpoint the first mammal.

The First Mammals

- Reptiles have 3 bones in their jaw: dentary, articular, and quadrate.
- Articular and quadrate bones of reptile jaw became the hammer and anvil bones of the mammalian inner ear.
- Marsupials are born with a reptilian jaw, which quickly changes before they eat solid food.

The First Mammals

- Reptile nasal passages open into mouth cavity. Can't breathe and chew at the same time.
- Mammals developed a secondary palate to allow breathing and chewing at the same time.

Milk Glands: to be a Mammal

- How did milk glands evolve?
- Can't know for sure, but they are probably related to sweat glands.
- Monotremes lack nipples, milk oozes from several milk ducts in the skin.

Live Birth

- Typical of most mammals.
- Not unique to mammals. Also found in reptiles, amphibians, and fish.
- Accomplished by retaining the egg in a euterus.

Monotremes

- First appear in the Cretaceous.
- Only 2 species alive today, both found only in Australia:
- Duck-billed platypus
- Spiny anteater, or echidna

Marsupials

- First appear in the Cretaceous.
- The most abundant mammal of the Cretaceous.

- Fetus lacks a placenta, has a less effective nutritive membrane.
- Short gestation, long lactation period.

Placentals

- First appear in the Cretaceous.
- The most abundant mammal of the Cenozoic.
- Fetus has a placenta, an effective nutritive membrane.
- Long gestation, relatively shorter lactation period.

The Inferiority of Mammals

- Dinosaurs dominated mammals for 145 MY during the Jurassic and Cretaceous.
- Mammals came to dominate earth only after the extinction of the dinosaurs.

Evolutionary Radiation of the Placental Mammals

- All placentals seem to have evolved from insectivorous Late Cretaceous mammals.
- Shrews and moles eat insects in the ground.
- Bats eat insects in the air.
- Primitive primates eat insects in trees.

Early Cenozoic Placentals

- Creodonts - primitive carnivores
- Condylarths - mixed bag of herbivores and carnivores
- Edentates - anteaters, armadillos, sloths
- Primates

Middle Cenozoic Placentals: New Groups

- Bats
- Carnivores: cats, dogs, pinnipeds
- Ungulates: even-toed, odd-toed, proboscideans, sirenians
- Rodents

- Rabbits
- Cetaceans

Ungulates

- Odd-toed: horses, rhinos, brontotheres
- Even-toed: all other hoofed mammals; pigs, camels, sheep, deer, cattle, etc.
- Cooler, drier climates of the Cenozoic led to the evolutionary expansion of ungulates. Grasslands replaced many forested areas.

North American-South American Interchange

- Isthmus of Panama formed 5 MY ago.
- Mammals moved in both directions.
- Many South American primitive mammals, including many marsupials, became extinct.
- North America got armadillos, porcupines, and possums.
- South America got camels (llamas), lions (pumas), and jaguars (among others).

Giant Pleistocene Mammals

- Mammoths
- Mastodons
- Saber-tooth cats
- Giant lions
- Giant bears
- Giant beavers
- Giant bison
- Ground sloths
- Irish Elk
- Woolly rhinos

Extinction of Giant Pleistocene Mammals

- Not caused by climate change. They survived 2 MY of glacial-interglacial cycles.
- Extensive evidence that hunting by humans caused these extinctions.