

Phylum Chordata (Figs. 4.32 and 4.33)

Chordates range in time from Cambrian to Quaternary and possess a spinal cord or notochord at some time during their lifetimes.

Subphylum Vertebrata

Vertebrates possess a spinal cord enclosed by vertebrae. Vertebrates possess an internal skeleton of bone or cartilage and well-developed nervous, circulatory, digestive, and muscular systems. The most commonly preserved portions of the internal skeleton are the bones and teeth of the animal. The teeth and bones are composed of apatite, which is a variety of calcium phosphate.

Class Agnatha

This class includes modern jawless vertebrates such as lamprey and hagfish. Fossil ostracoderms were jawless fish with platy armor. Class Agnatha ranges from Cambrian to Recent, but ostracoderms became extinct in the Devonian.

Class Placodermi

Placoderms were primitive jawed fish with platy armored skin. This class ranges from late Silurian to Carboniferous.

Class Chondrichthyes

Cartilaginous fishes include modern sharks, rays, and skates. Since the skeleton is composed of nonmineralized material, usually only the teeth and spines are fossilized. Chondrichthyes range from Silurian to Recent.

Class Osteichthyes

This class includes the bony fish. Major groups are (1) extinct forms called acanthodians; (2) ray-finned fish, including most modern gamefish and food fish; and (3) lobe-finned fish, which have bone structure in their fins that is similar to the limbs of other vertebrates. Lobe-finned fish called crossopterygians are considered ancestral to amphibians. The range of this class is Silurian to Recent.

Class Amphibia

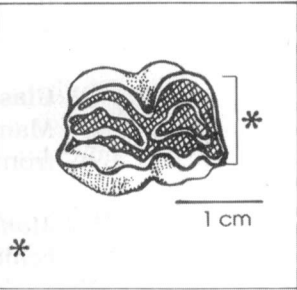
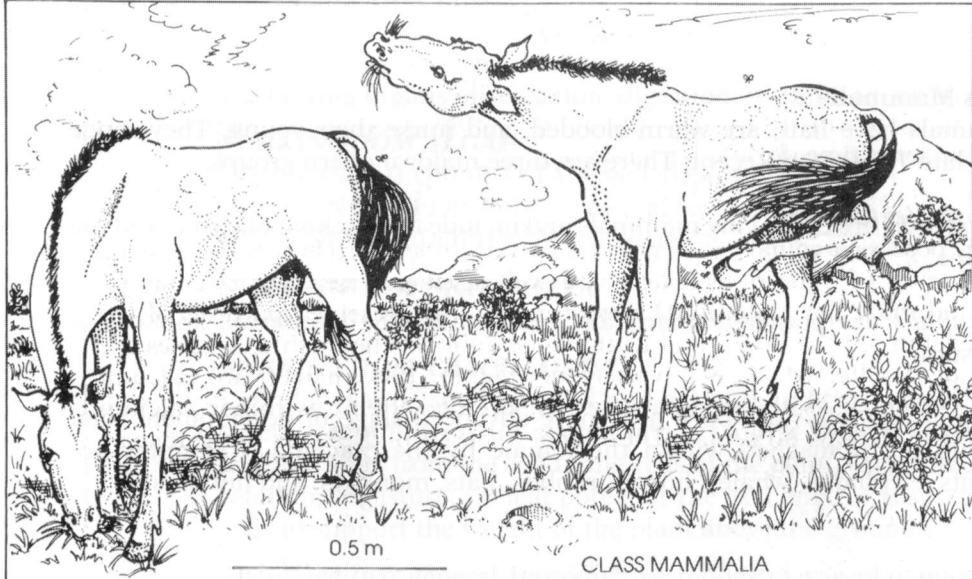
The amphibians were the first vertebrates to live on land, although they need moisture in which to lay eggs. Juveniles are aquatic with gills; adults possess lungs. Labyrinthodont amphibians were common Paleozoic fossils. Modern representatives are frogs and salamanders. Amphibians range from Devonian to Recent.

Class Reptilia

Reptiles were the first vertebrates to conduct their lives fully on land, although many returned to aquatic environments. The key to this ability was the self-contained, amniotic egg. Modern representatives of Reptilia include turtles, crocodiles, snakes, and lizards. Fossil members include dinosaurs, flying reptiles, marine reptiles, phytosaurs, therapsids and many others. Reptiles range from upper Carboniferous to Recent.

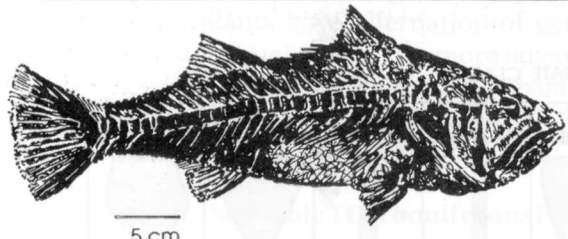
Class Aves

Birds are warm-blooded, egg-laying vertebrates with an external covering of feathers. The earliest fossil bird, *Archaeopteryx*, is from the Jurassic. *Hesperornis* was a Cretaceous diving bird. Birds are very rare as fossils. Some



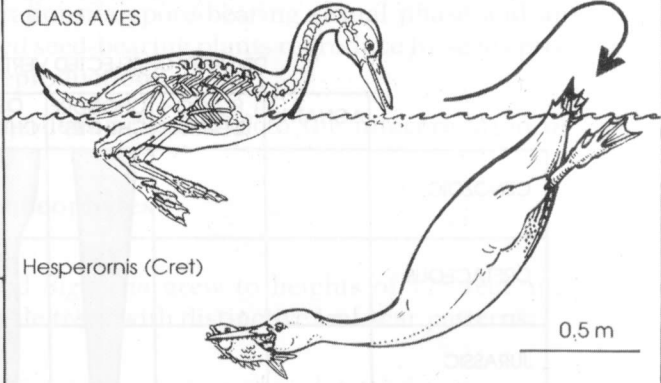
Merychippus (Mio)
Ancestor of modern horse, Equus.

CLASS MAMMALIA



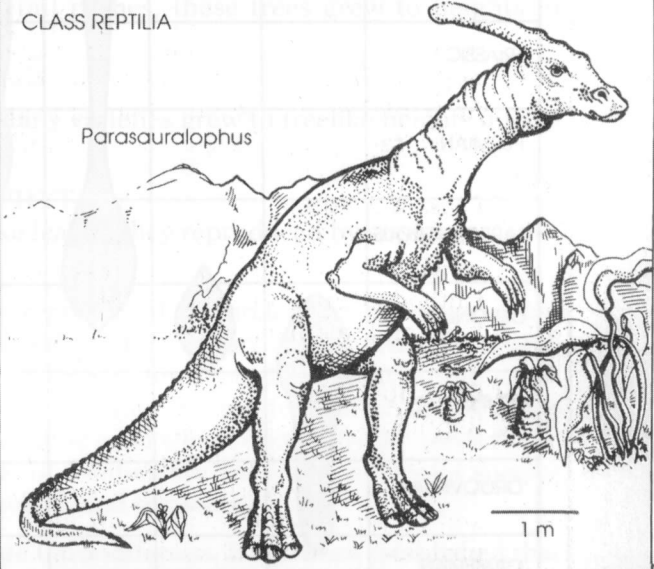
CLASS OSTEICHTHYES

CLASS AVES

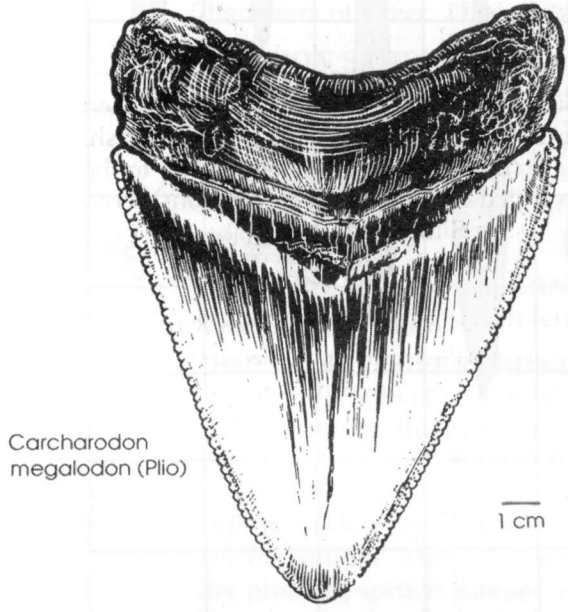


Hesperornis (Cret)

CLASS REPTILIA



Parasauralophus



Carcharodon megalodon (Plio)

CLASS CHONDRICHTHYES

PHYLUM CHORDATA

SUBPHYLUM VERTEBRATA

Figure 4.32 Phylum Chordata, subphylum Vertebrata

paleontologists consider birds to be descendants of small theropod dinosaurs. This class ranges from Jurassic to Recent.

Class Mammalia

Mammals have hair, are warm-blooded, and nurse their young. They range from late Triassic to Recent. There are three major modern groups:

Monotremes are egg-laying mammals and include the duckbill platypus and the echidna.

Marsupials are pouched mammals and include the kangaroo, koala, and opossum.

Placental mammals are born at a more advanced stage of development than marsupials, nourished within the female by the placenta. Examples are rodents, elephants, whales, horses, rabbits, bats, monkeys, and humans.

DIVERSITY OF SELECTED VERTEBRATE CLASSES

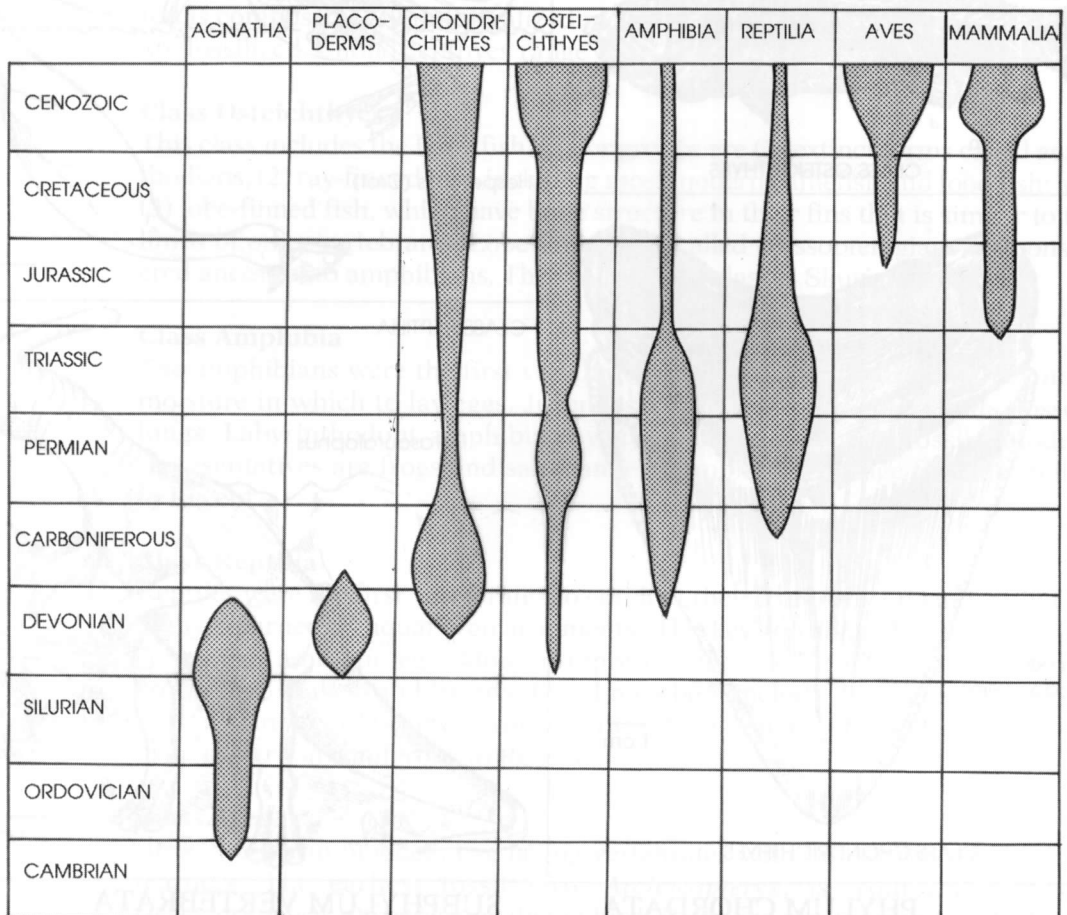


Figure 4.33 Diversity of selected vertebrate classes