Mammals

Characteristics of Mammals

1. **Body covered with hair,** but reduced in some
2. **Integument** with **sweat, scent, sebaceous,** and **mammary glands**
3. Skull with **two occipital condyles** and **secondary bony palate;** middle ear with **three ossicles** (malleus, incus, stapes); **seven cervical vertebrae** (except some xenarthrans [edentates] and the manatee); **pelvic bones fused**
4. Mouth with **diphyodont teeth** (milk, or deciduous, teeth replaced by a permanent set of teeth); teeth heterodont in most (varying in structure and function); lower jaw a **single enlarged bone (dentary)**
5. Movable eyelids and **fleshy external ears (pinnae)**
6. Four limbs (reduced or absent in some) adapted for many forms of locomotion
7. Circulatory system of a four-chambered heart, **persistent left aorta,** and **nonnucleated, biconcave red blood corpuscles**
8. Respiratory system of lungs with alveoli, and voice box (larynx); **secondary palate** (anterior bony palate and posterior continuation of soft tissue, the soft palate) separates air and food passages (Figure 31-3); **muscular diaphragm** for air exchange separates thoracic and abdominal cavities
9. Excretory system of metanephros kidneys and ureters that usually open into a bladder
10. Brain highly developed, especially **neocerebrum;** 12 pairs of cranial nerves
11. Endothermic and homeothermic
12. Separate sexes
13. Internal fertilization; **embryos develop in a uterus** with **placental attachment** (placenta rudimentary in marsupials and absent in monotremes); **fetal membranes (amnion, chorion, allantois)**
14. Young nourished by **milk from mammary glands**

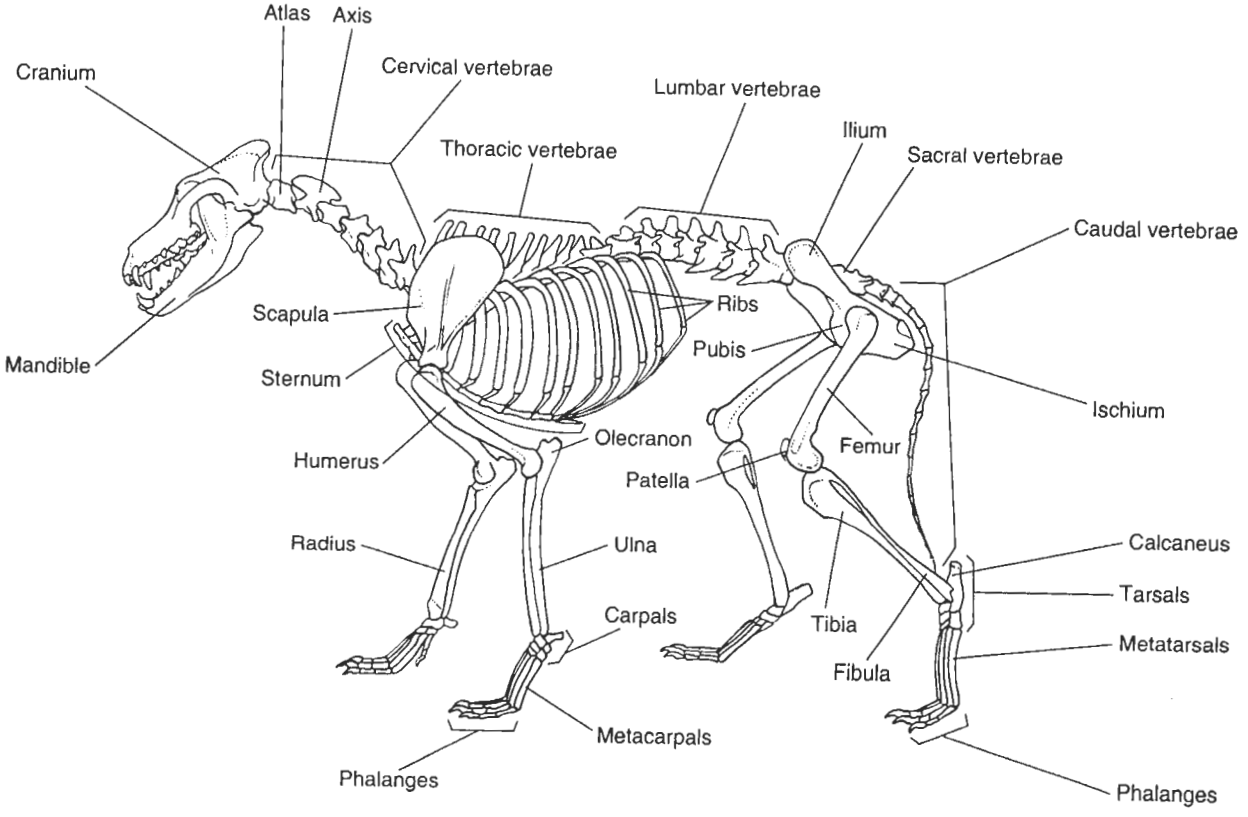


FIGURE 2-14 Skeleton of a mammal, the dire wolf (*Canis dirus*), showing the major elements. *(After Stock, 1949, courtesy of the Natural History Museum of Los Angeles County)*

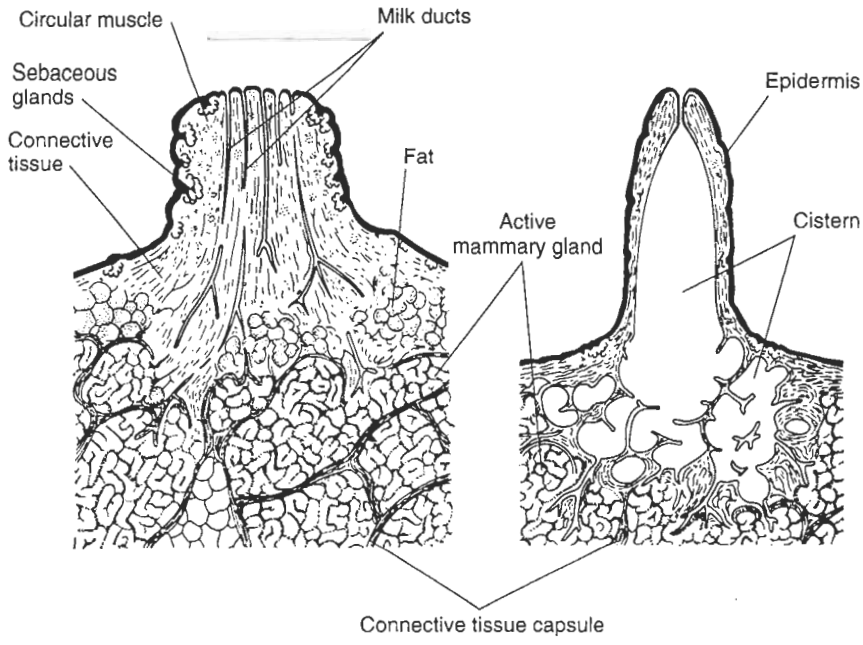


FIGURE 2-1 A section through the nipple and associated tissues of a primate *(left)* and the nipple, or teat, of an artiodactyl *(right). (From Hildebrand, 1974)*

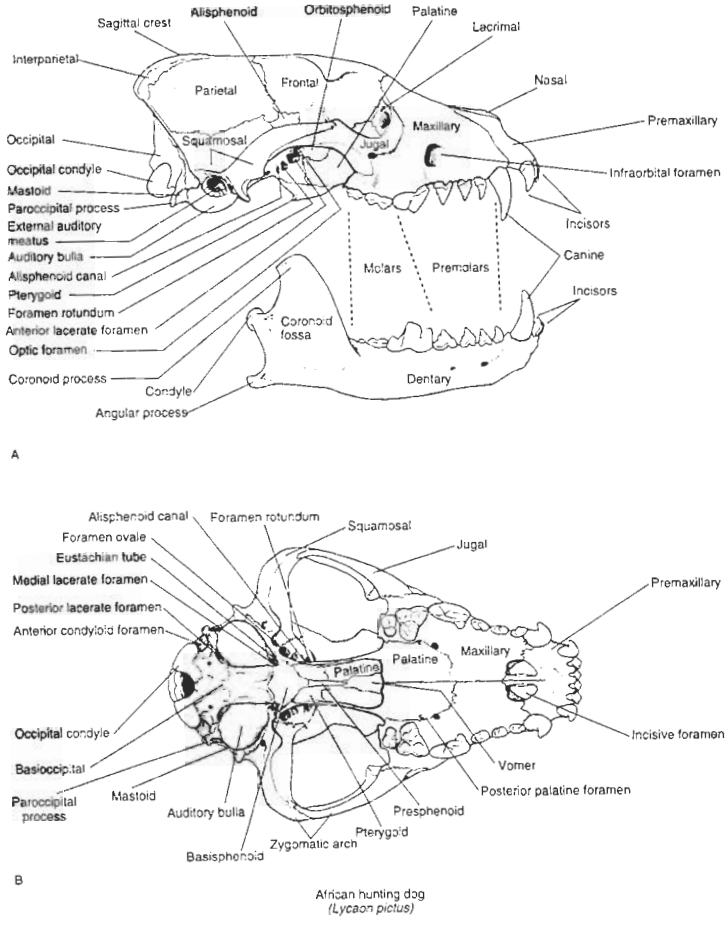


FIGURE 2-16 (A) Side and (B) palatal views of the skull of the African hunting dog (*Lycaon pictus*), showing the bones, foramina, and teeth.

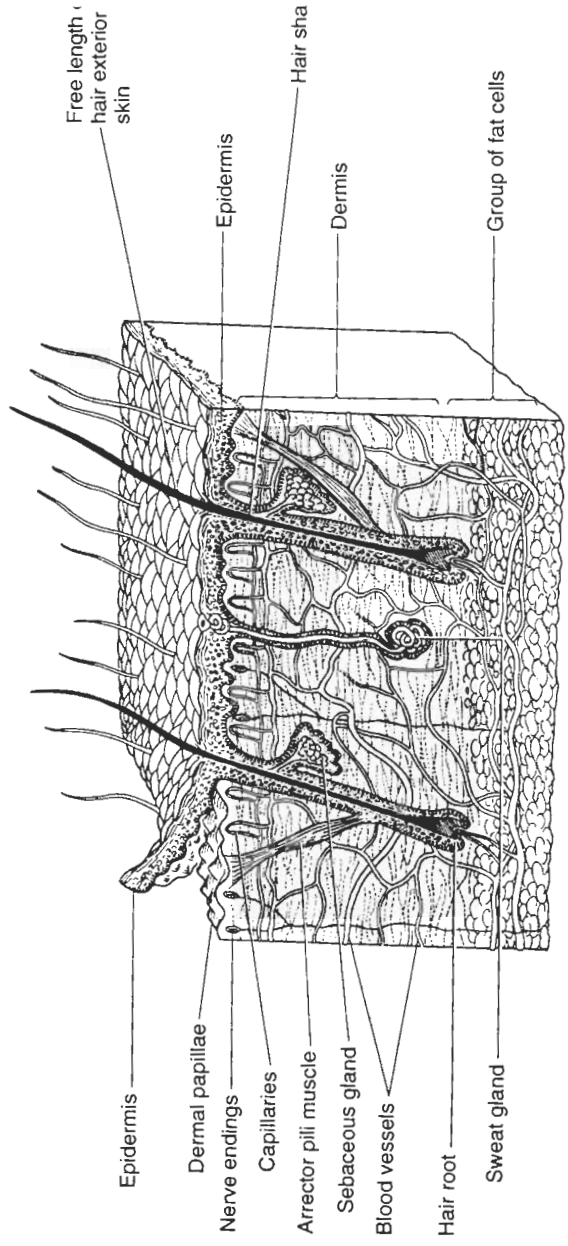


FIGURE 2-2 Generalized section of mammalian skin. The skin on different areas of the body differs in thickness as well as purpose. *(From Romer and Parsons, 1977)*

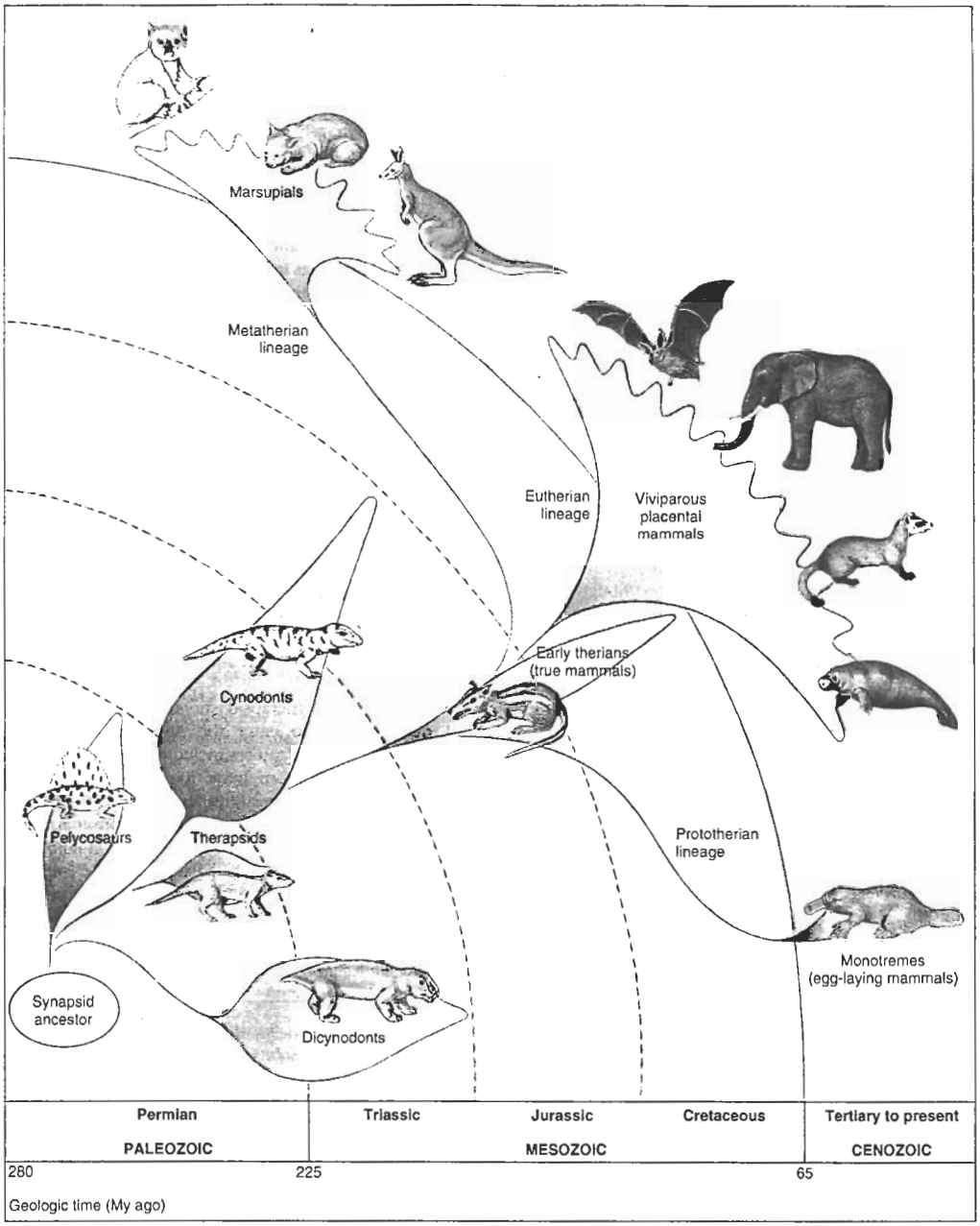
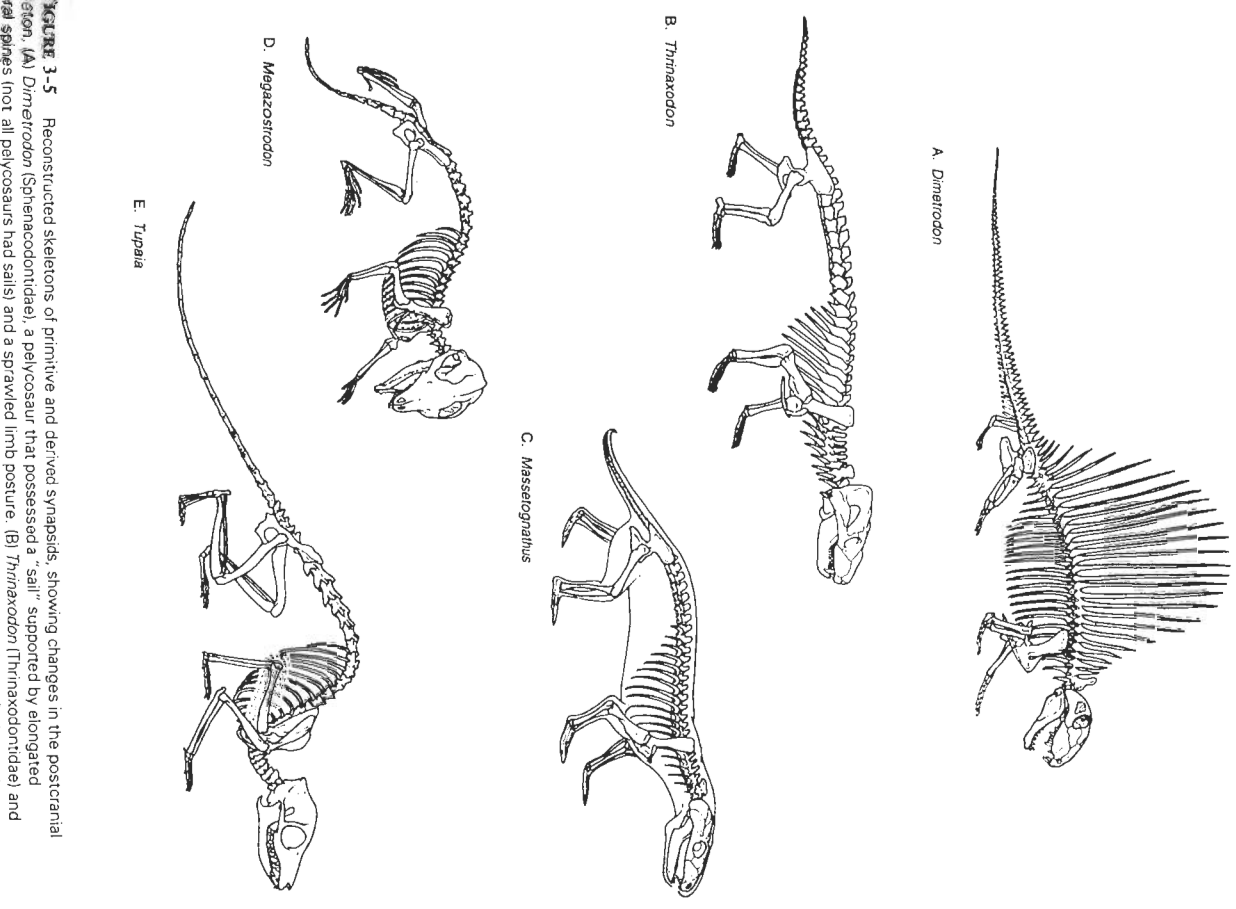


figure 31-1

Evolution of the major groups of synapsids. The synapsid lineage, characterized by lateral temporal openings in the skull, began with the pelycosaurs, early mammal-like amniotes of the Permian. The pelycosaurs radiated extensively and evolved changes in the jaws, teeth, and body form that presaged several mammalian characteristics. These trends continued in their successors, the therapsids, especially in the cynodonts. One lineage of cynodonts gave rise in the Triassic to the therians, the true mammals. Fossil evidence, as currently interpreted, indicates that all three groups of living mammals—monotremes, marsupials, and placentals—are derived from the same lineage. The great radiation of modern placental orders occurred during the Cretaceous and Tertiary periods.



▶ **FIGURE 3-5** Reconstructed skeletons of primitive and derived synapsids, showing changes in the postcranial skeleton. (A) *Dimetrodon* (Sphenacodontidae), a pelycosaur that possessed a "sail" supported by elongated neural spines (not all pelycosaurs had sails) and a sprawled limb posture. (B) *Thrinaxodon* (Thrinaxodontidae) and (C) *Massetognathus* (Traversodontidae), cynodonts showing reduction of the lumbar ribs (due to fusion to the vertebrae) and less sprawling limb posture. (D) *Megazostrodon* (Morganucodontidae), in which the forelimbs are sprawled but the hindlimb posture indicates a mammalian stance (in which the femur swings only fore and aft, not out to the side) and the pelvis has a long, rodlike, anterodorsally oriented ilium and a large obturator foramen. (E) *Tupaia* (Tupaiidae), a modern tree shrew, showing considerable flexure in the axial skeleton (cervico-thoracic and thoraco-lumbar regions) and limbs. (*A from Romer, ©1966, Vertebrate Paleontology, University of Chicago Press; B from Jenkins, 1971; C from Jenkins 1970; D from Jenkins and Parrington, 1976; E from Jenkins, 1974*)

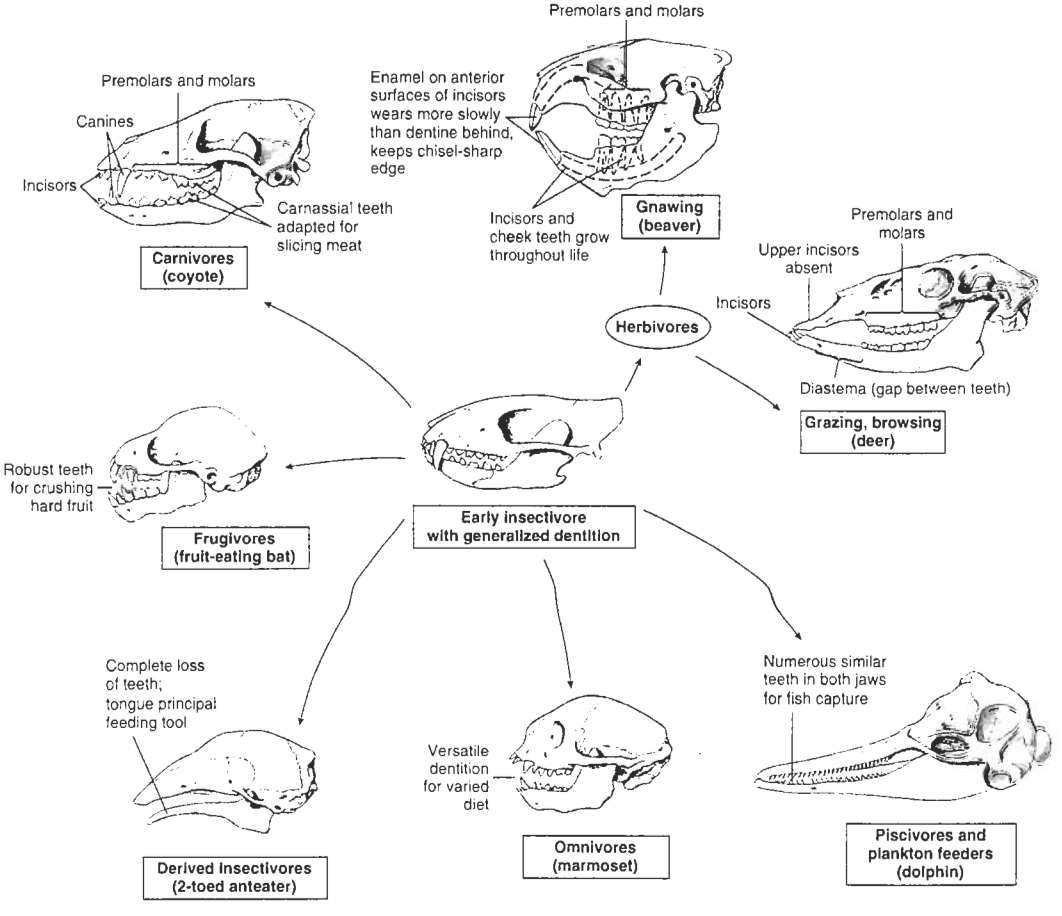


figure 31-9

Feeding specializations of major trophic groups of eutherian mammals. The early eutherians were insectivores; all other types are descended from them.

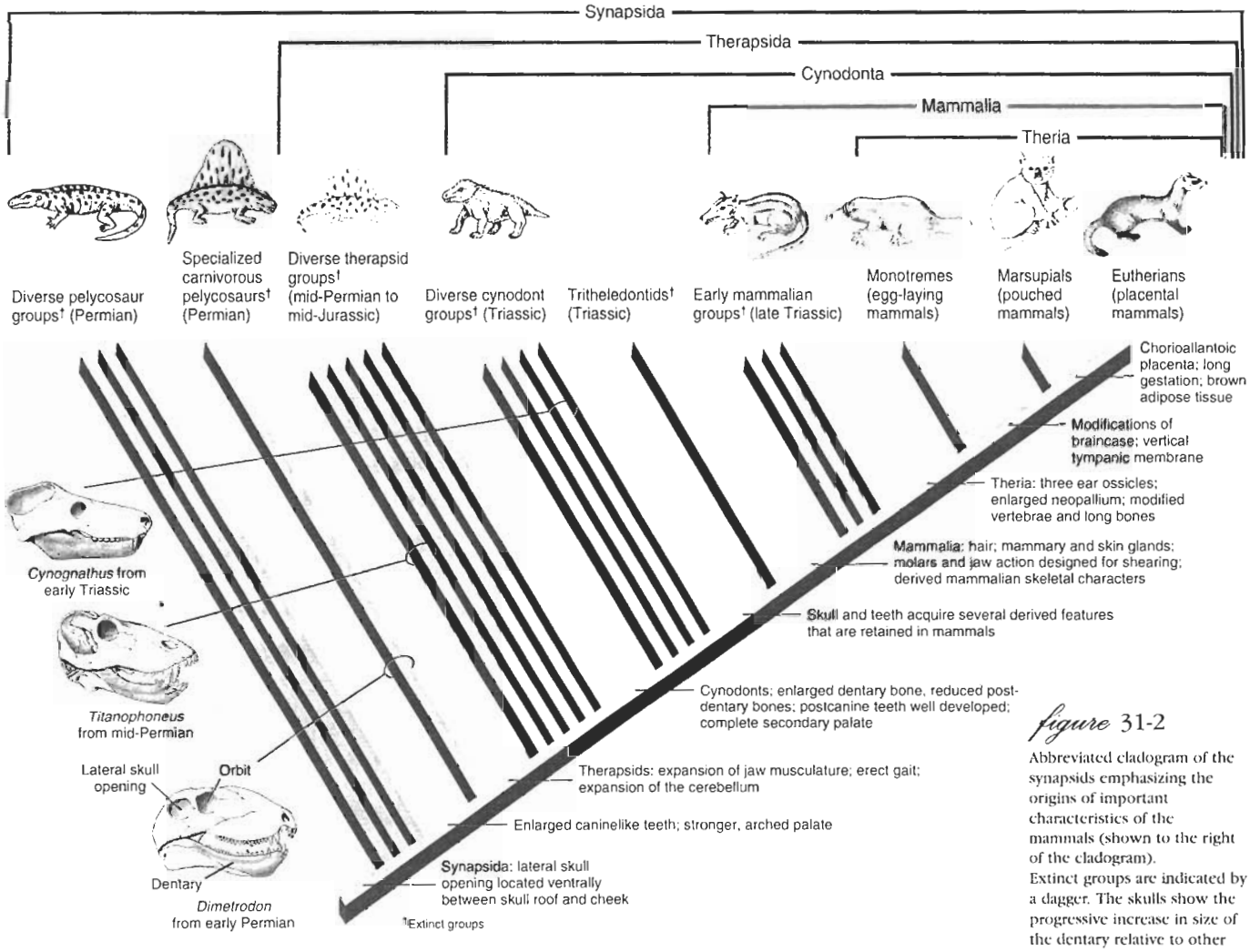


figure 31-2

Abbreviated cladogram of the synapsids emphasizing the origins of important characteristics of the mammals (shown to the right of the cladogram). Extinct groups are indicated by a dagger. The skulls show the progressive increase in size of the dentary relative to other bones in the lower jaw.

Sources: Data from Kemp, T.S. 1982. Mammal-like reptiles and the origin of mammals. *New York, Academic Press; Gauthier, K., A.G. Kluge, and T. Rowe. 1988. Amniote phylogeny and the importance of fossils.* Cladistics *4:105–209; Carroll, R.L. 1988.* Vertebrate paleontology and evolution. *New York, W.H. Freeman; Pough, F.H., J.B. Heiser, and W.N. McFarland. 1989.* Vertebrate life, *ed. 3. New York, Macmillan Co.; and Rowe, T. 1993. Phylogenetic systematics and the early history of mammals. In Szalay, F.S., et al.* Mammal phylogeny, *vol. 1. New York, Springer-Verlag.*

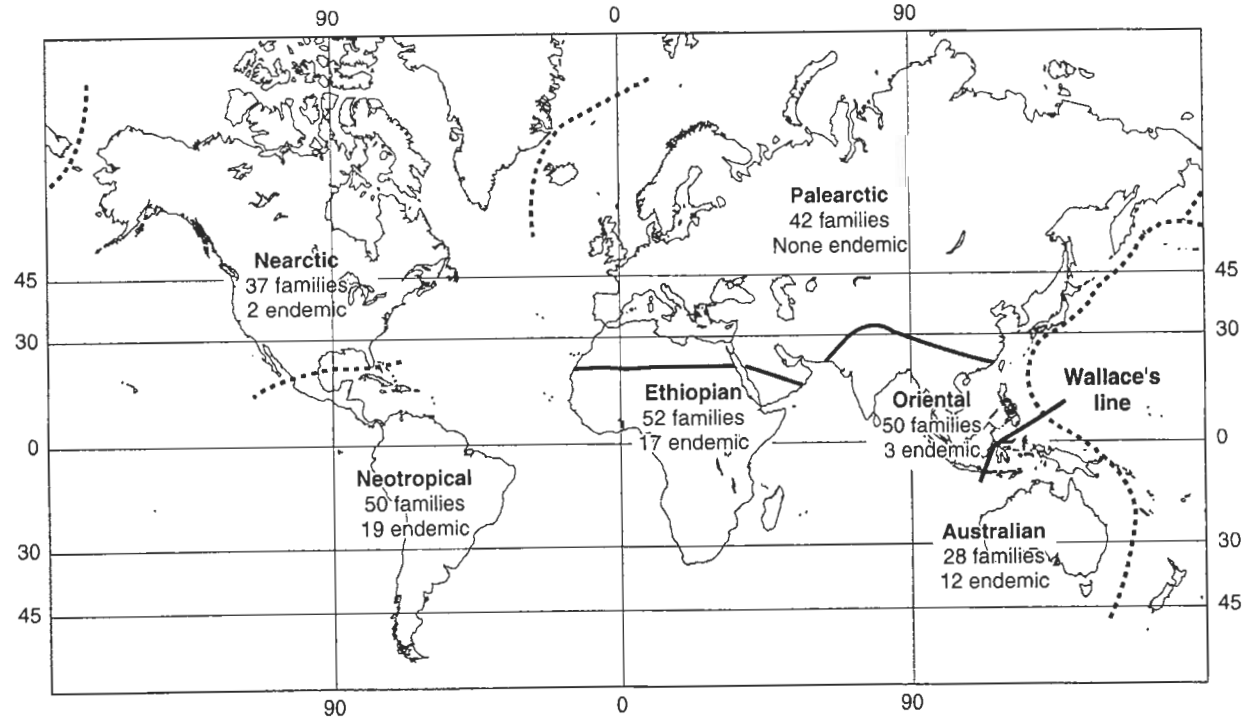


FIGURE 25-2 A map of the world showing the zoogeographic regions discussed in this chapter. The number of modern families of mammals in each region is given, as well as the number of families that are endemic to each.

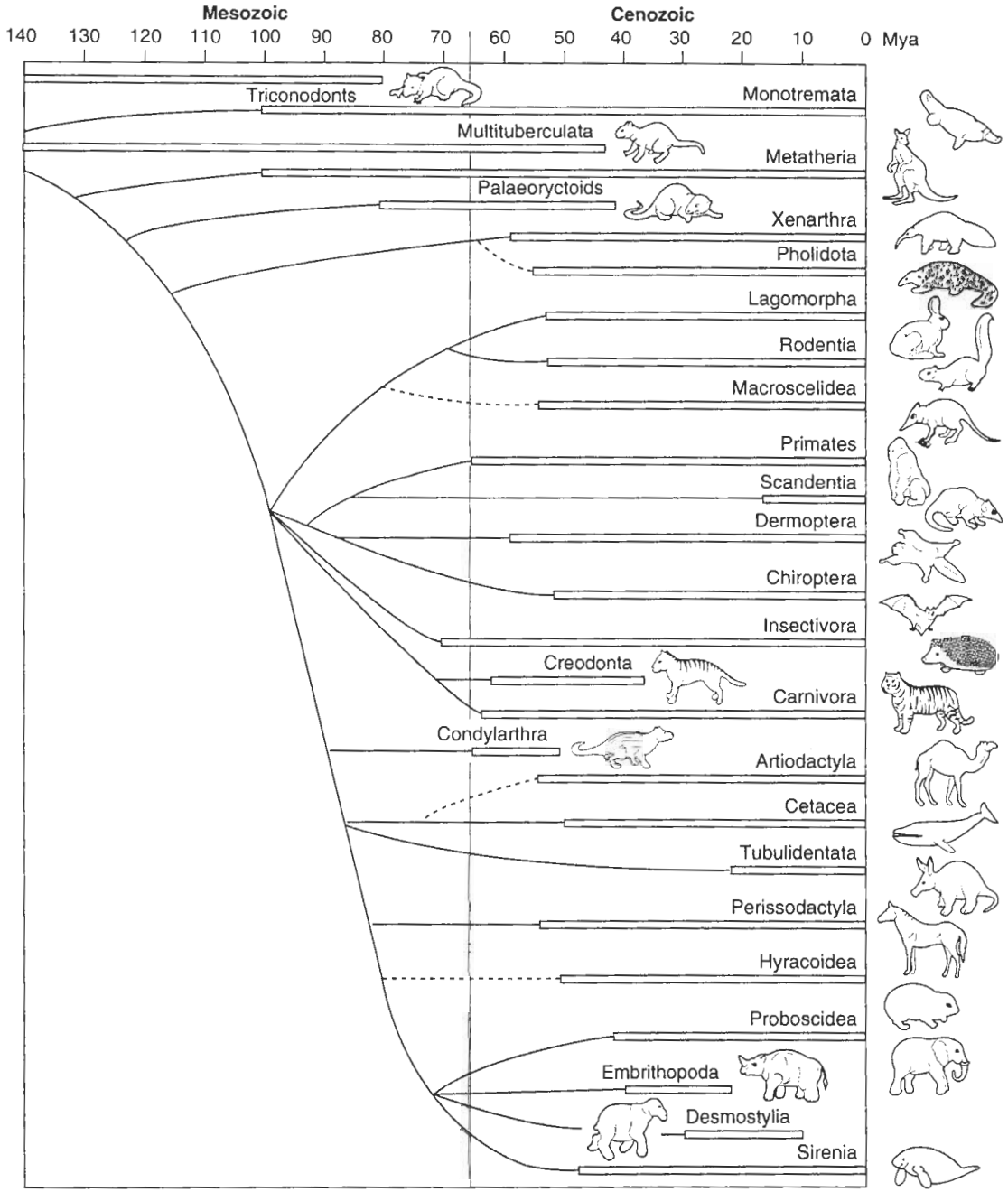
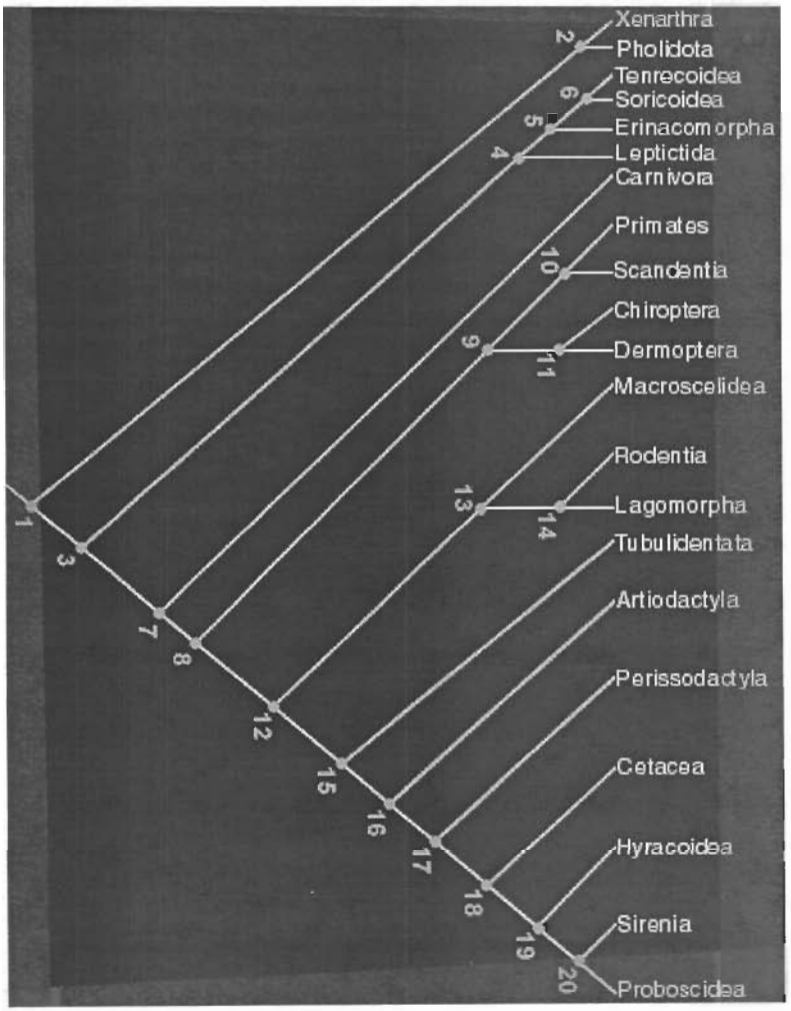


FIGURE 7-2 A phylogenetic tree showing relationships among the major mammalian orders. The solid horizontal bars indicate the known geologic age range of each order based on the fossil record. *Mya* = millions of years ago. *(From Novacek, 1992a)*

WEB SITES

An introduction to eutherian mammals

http://www.ucmp.berkeley.edu:80/mammal/eutheria/placental.html


Xenarthra
Pholidota
Tenrecoidea
Soricoidea
Erinacomorpha
Leptictida
Carnivora
Primates
Scandentia
Chiroptera
Dermoptera
Macroscelidea
Rodentia
Lagomorpha
Tubulidentata
Artiodactyla
Perissodactyla
Cetacea
Hyracoidea
Sirenia
Proboscidea
1
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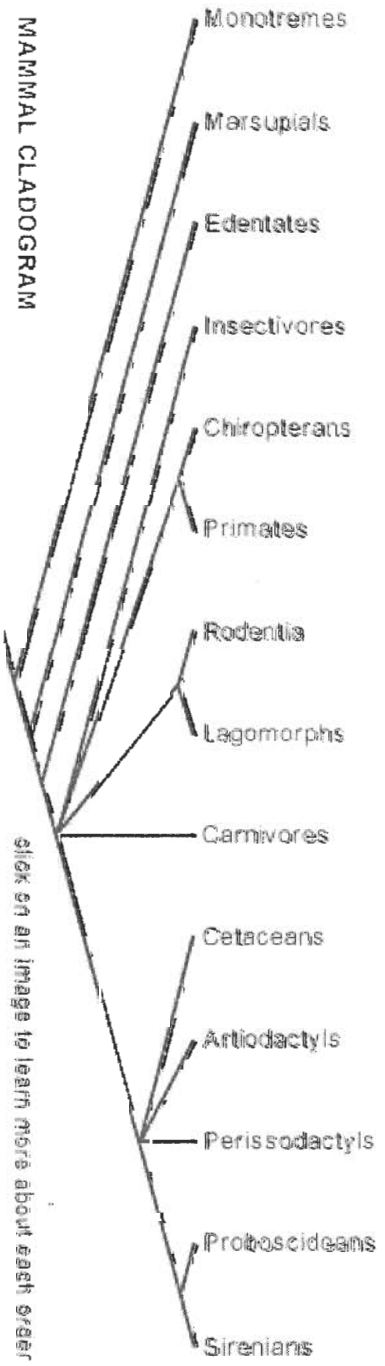
MAMMAL CLADOGRAM
Monotremes
Marsupials
Edentates
Insectivores
Chiropterans
Primates
Rodentia
Lagomorphs
Carnivores
Cetaceans
Artiodactyls
Perissodactyls
Proboscideans
Sirenians
click on an image to learn more about each order

TABLE 4-1 A Classification of Recent Mammals

Classification	Common Name(s)
Subclass Prototheria	
Order Monotremata (3 species)	
Family Tachyglossidae	Echidnas, spiny anteaters
Ornithorhynchidae	Duck-billed platypus
Subclass Theria	
Infraclass Metatheria (Marsupialia)	
Order Didelphimorphia (63 species)	
Family Didelphidae	Opossums
Order Paucituberculata (6 species)	
Family Caenolestidae	Rat opossums
Order Microbiotheria (1 species)	
Family Microbiotheriidae	Monito del monte, llaca
Order Dasyuromorphia (63 species)	
Family Thylacinidae	Thylacine (extinct)
Myrmecobiidae	Numbat
Dasyuridae	Dasyures, quolls, antechinuses, dunnarts, devil
Order Peramelemorphia (21 species)	
Family Peramelidae	Bandicoots
Peroryctidae	Bandicoots
Order Notoryctemorphia (2 species)	
Family Notoryctidae	Marsupial "mole"
Order Diprotodontia (117 species)	
Family Phascolarctidae	Koala
Vombatidae	Wombats
Phalangeridae	Cuscuses, phalangers
Potoroidae	Rat kangaroos, bettongs
Macropodidae	Kangaroos, wallabies
Burramyidae	Pygmy possums
Pseudocheiridae	Ringtailed possums
Petauridae	Gliders, striped possums
Tarsipedidae	Honey possum, noolbenger
Acrobatidae	Feathertail possum, feathertail glider
Infraclass Eutheria (Placentalia)	
Order Xenarthra (29 species)	
Family Bradypodidae	Three-toed tree sloths
Megalonychidae	Two-toed tree sloths
Dasypodidae	Armadillos
Myrmecophagidae	Anteaters
Order Insectivora (429 species)	
Family Solenodontidae	Solenodons, alamiquis
Nesophontidae	West Indian shrews (extinct)
Tenrecidae	Tenrecs
Chrysochloridae	Golden moles
Erinaceidae	Hedgehogs
Soricidae	Shrews
Talpidae	Moles
Order Scandentia (19 species)	
Family Tupaiidae	Tree shrews

TABLE 4-1 *(continued)*

Classification	Common Name(s)
Balaenidae	Right whales
Neobalaenidae	Pygmy right whale
Physeteridae	Sperm whales
Ziphiidae	Beaked whales
Platanistidae	River dolphins
Delphinidae	Ocean dolphins
Monodontidae	Narwhal, beluga
Phocoenidae	Porpoises
Order Sirenia (5 species)	
Family Dugongidae	Dugongs, sea cows
Trichechidae	Manatees
Order Proboscidea (2 species)	
Family Elephantidae	Elephants
Order Perissodactyla (18 species)	
Family Equidae	Horses, asses, zebras
Tapiridae	Tapirs
Rhinocerotidae	Rhinoceroses
Order Hyracoidea (6 species)	
Family Procaviidae	Hyraxes
Order Tubulidentata (1 species)	
Family Orycteropodidae	Aardvark
Order Artiodactyla (220 species)	
Family Suidae	Swine
Tayassuidae	Peccaries, javelinas
Hippopotamidae	Hippopotami
Camelidae	Camels, llamas
Tragulidae	Chevrotains
Giraffidae	Giraffe, okapi
Moschidae	Musk deer
Cervidae	Deer
Antilocapridae	Pronghorns
Bovidae	Antelope, bison, cattle, goats, sheep, etc.
Order Pholidota (7 species)	
Family Manidae	Pangolins, scaly anteaters
Order Rodentia (2024 species)	
Family Aplodontidae	Mountain beaver, sewellel
Sciuridae	Squirrels
Castoridae	Beavers
Geomyidae	Pocket gophers
Heteromyidae	Kangaroo rats, pocket mice
Dipodidae	Jumping mice, jerboas
Muridae	Rats, mice
Anomaluridae	Scaly-tailed flying squirrels
Pedetidae	Springhaas, springhare
Ctenodactylidae	Gundis
Myoxidae	Dormice
Bathyergidae	Mole rats, sand rats
Hystricidae	Old World porcupines
Petromuridae	Rock rat

TABLE 4-1 *(continued)*

Classification	Common Name(s)
Thryonomyidae	Cane rats
Erethizontidae	New World porcupines
Chinchillidae	Chinchillas, vizcachas
Dinomyidae	Pacarana
Caviidae	Cuis, cavies, Guinea pigs
Hydrochoeridae	Capybara
Dasyproctidae	Pacas
Agoutidae	Agoutis
Ctenomyidae	Tuco-tucos
Octodontidae	Degus
Abrocomidae	Chinchilla rats
Echimyidae	Spiny rats
Capromyidae	Hutias
Heptaxodontidae	Hutias (extinct)
Myocastoridae	Nutria, coypu
Order Lagomorpha (80 species)	
Family Ochotonidae	Pikas
Leporidae	Rabbits
Order Macroscelidea (15 species)	
Family Macroscelididae	Elephant-shrews

WEB SITES

"Tree of Life" home page; information about phylogenetic relationships, characteristics, and animal diversity

http://phylogeny.arizona.edu/tree/phylogeny.html

General introduction to mammals and phylogeny of mammals

http://www.ucmp.berkeley.edu/mammal/mammal.html

Searchable electronic version of Wilson and Reeder's 1993 book *Mammal Species of the World*

http://www.nmnh.si.edu/msw/

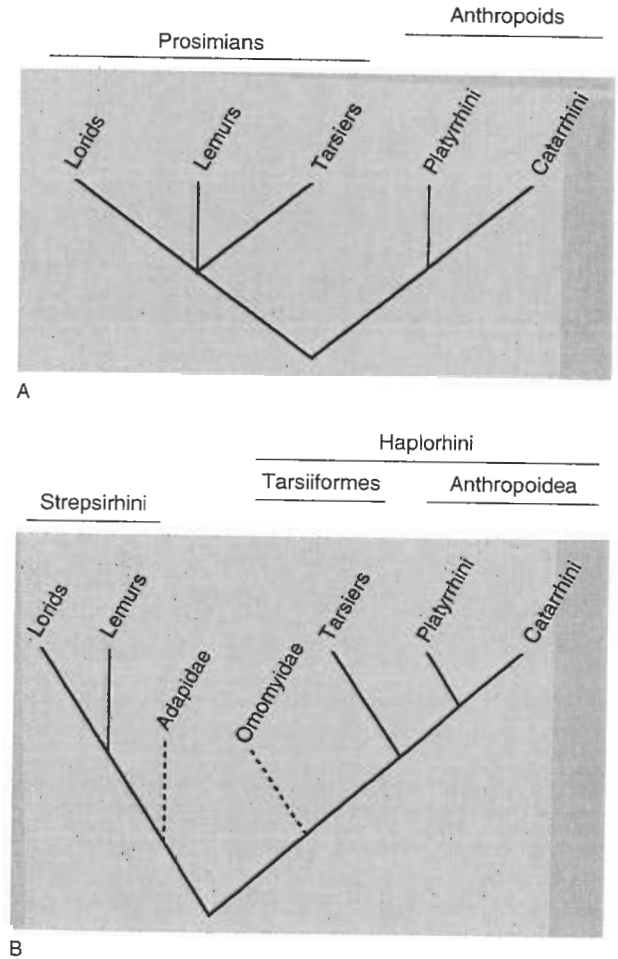

FIGURE 11-3 Two contrasting primate phylogenies: (A) the classical prosimian-anthropoid split, (B) a more recent phylogeny in which the tarsiers are allied with the anthropoids. The two extinct families Adapidae and Omomyidae are represented by dashed lines.