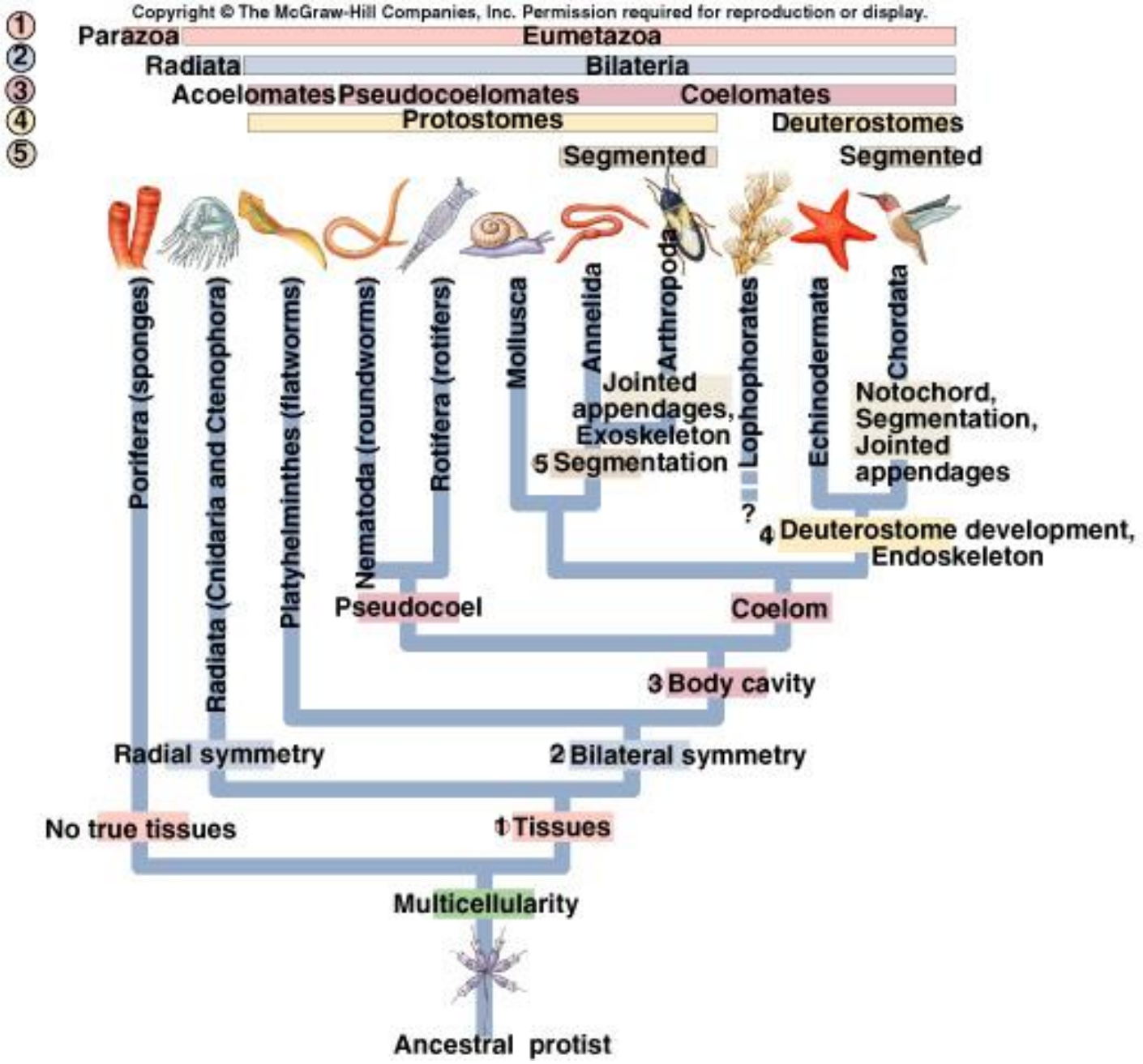
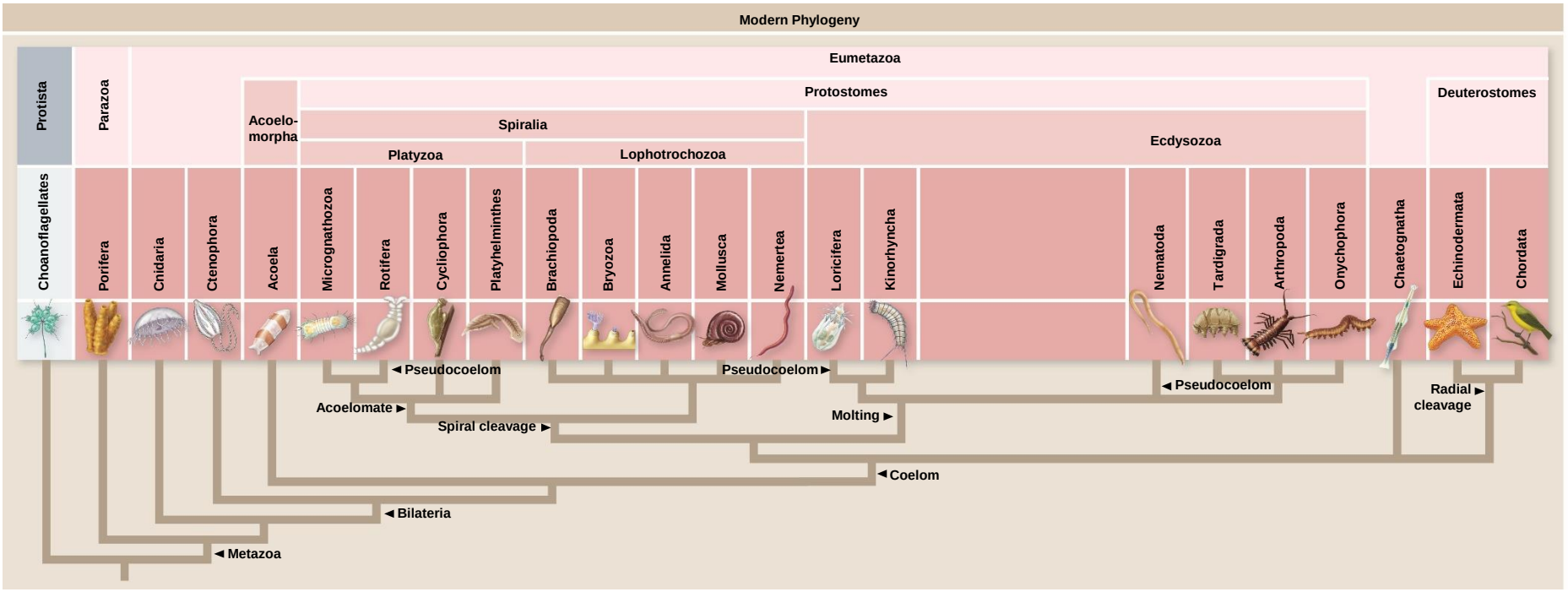
Kingdom Animalia

- Eukaryotic, heterotrophic, multicellular, no cell walls
- ingestive nutrition

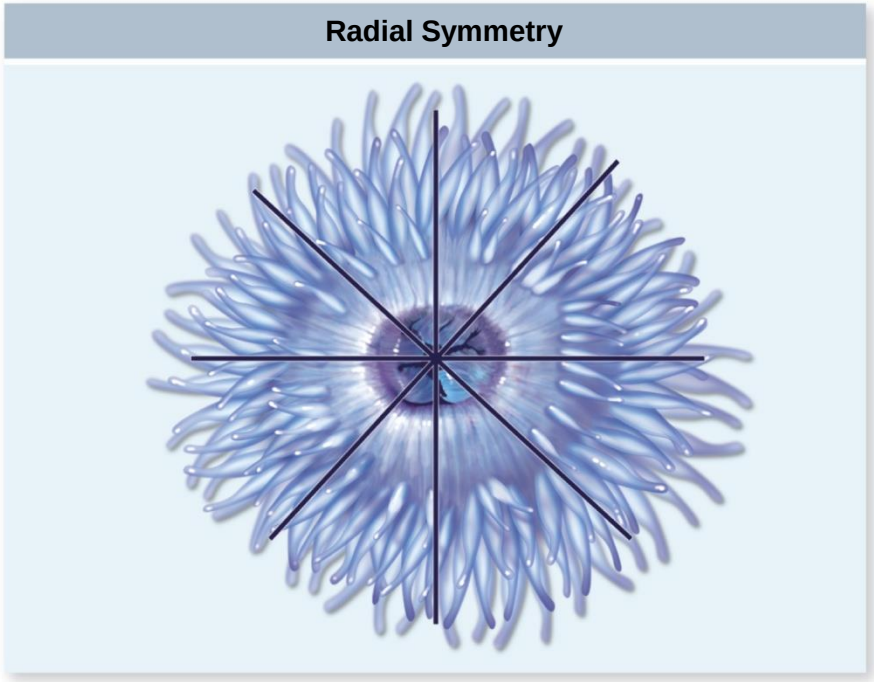




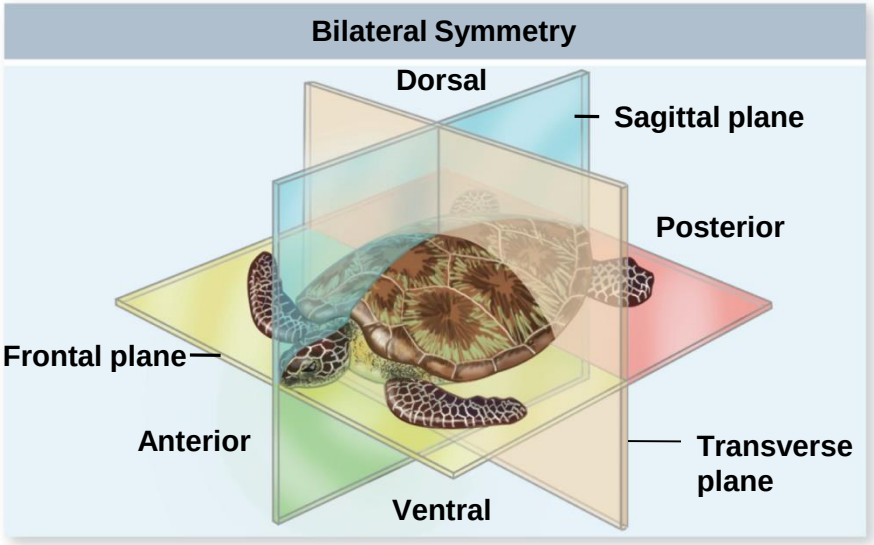
Kingdom Animalia

- Define the major branches of the phylogeny by the evolution of the following traits:
  - Presence of tissues (Parazoa or Eumetazoa)
  - Symmetry
  - Body cavity
  - Embryonic development
  - segmentation

Radial vs Bilateral Symmetry



a.



b.

Fig. 33.2

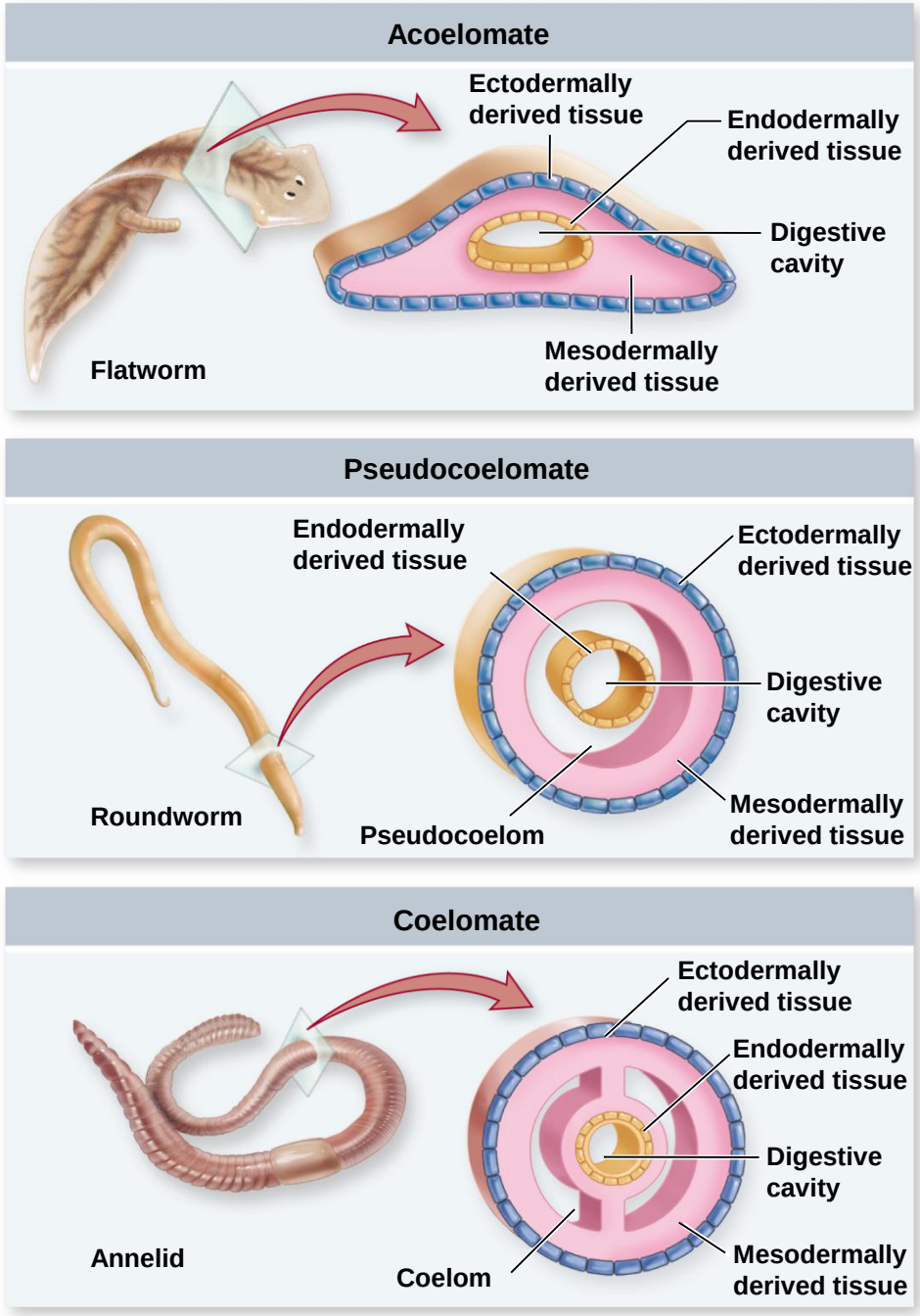


Fig. 33.3

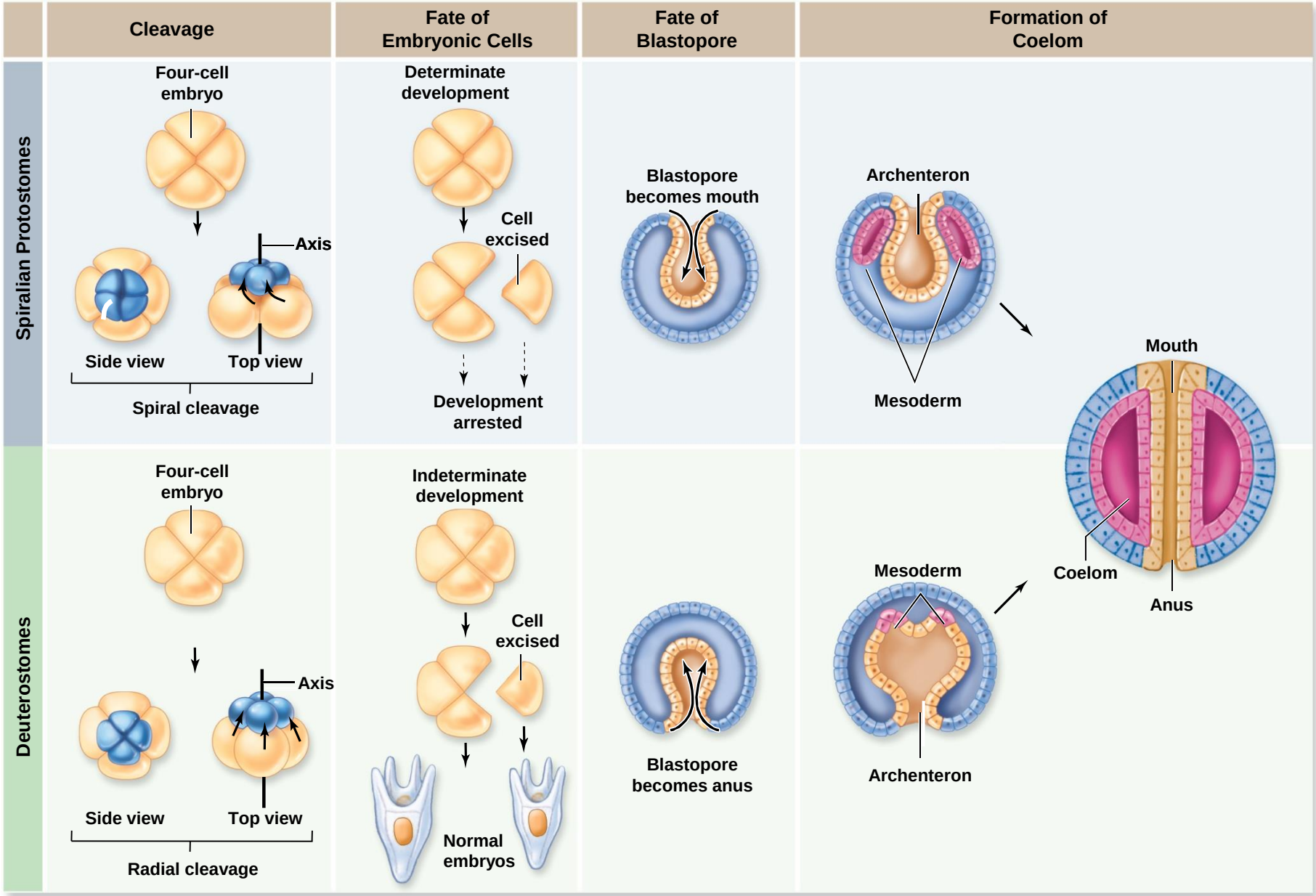


Figure 31.7 Segmentation

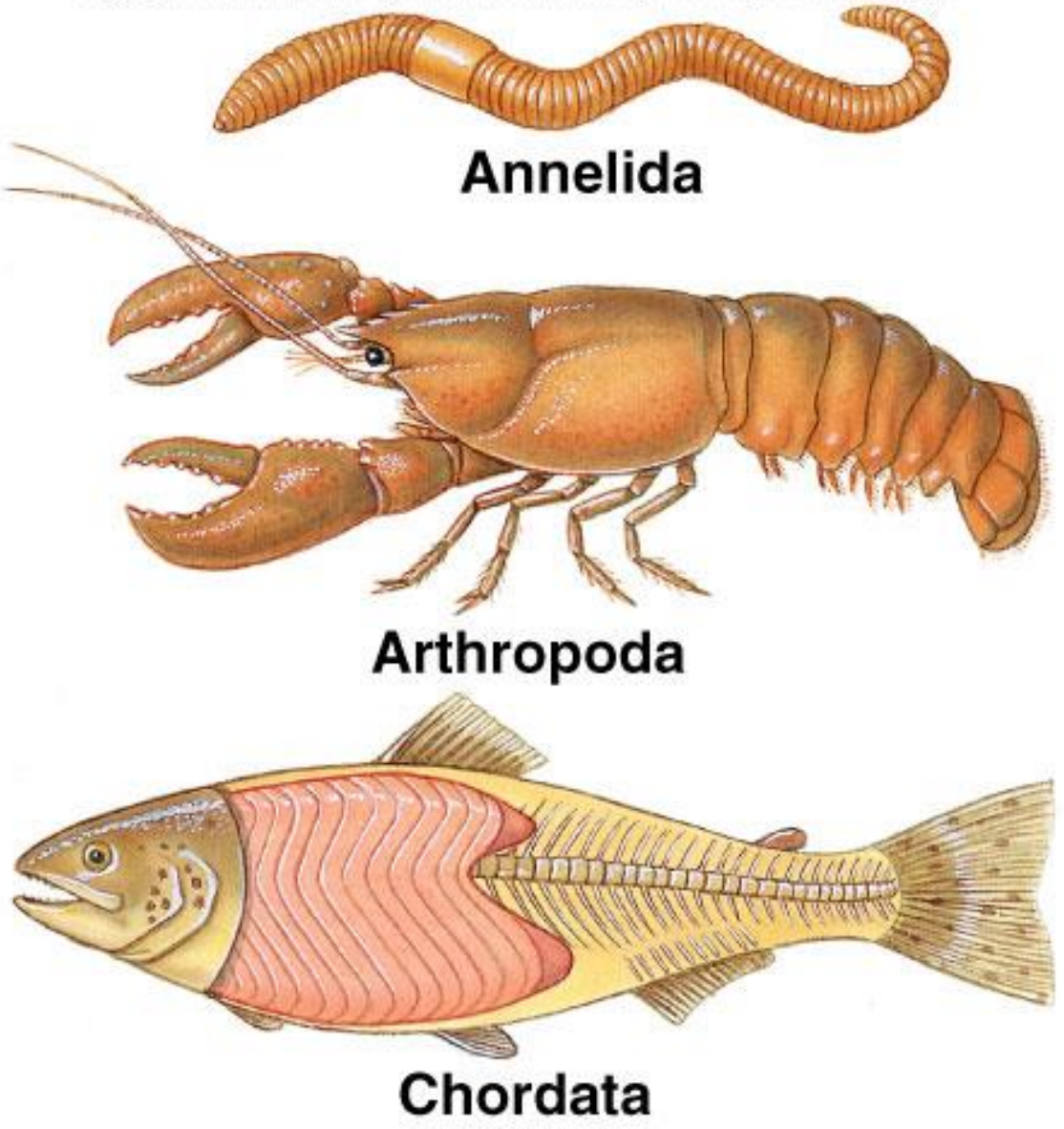
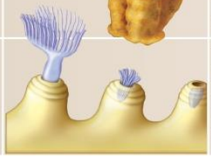


TABLE 33.1 Animal Phyla with the Most Species

Phylum	Typical Examples		Key Characteristics	Approximate Number of Named Species
Arthropoda (arthropods)	Beetles, other insects, crabs, spiders, krill, scorpions, centipedes, millipedes		Chitinous exoskeleton covers segmented, coelomate body. With paired, jointed appendages; many types of insects have wings. Occupy marine, terrestrial, and freshwater habitats. Most arthropods are insects (as are most animals!).	1,000,000
Mollusca (mollusks)	Snails, oysters, clams, octopuses, slugs		Coelomate body of many mollusks is covered by one or more shells secreted by a part of the body termed the mantle. Many kinds possess a unique rasping tongue, a radula. Members occupy marine, terrestrial, and freshwater habitats (35,000 species are terrestrial).	110,000
Chordata (chordates)	Mammals, fish, reptiles, amphibians		Each coelomate individual possesses a notochord, a dorsal nerve cord, pharyngeal slits, and a postanal tail at some stage of life. In vertebrates, the notochord is replaced during development by the spinal column. Members occupy marine, terrestrial, and freshwater habitats (20,000 species are terrestrial).	56,000
Platyhelminthes (flatworms)	Planarians, tapeworms, liver and blood flukes		Unsegmented, acoelomate, bilaterally symmetrical worms. Digestive cavity has only one opening; tapeworms lack a gut. Many species are parasites of medical and veterinary importance. Members occupy marine, terrestrial, and freshwater habitats (as well as the bodies of other animals).	20,000
Nematoda (roundworms)	*Ascaris*, pinworms, hookworms, filarial worms		Pseudocoelomate, unsegmented, bilaterally symmetrical worms; tubular digestive tract has mouth and anus. Members occupy marine, terrestrial, and freshwater habitats; some are important parasites of plants and animals, including humans.	25,000 (but it is thought by some that the number of nematode species may be much greater)
Annelida (segmented worms)	Earthworms, polychaetes, tube worms, leeches		Segmented, bilaterally symmetrical, coelomate worms with a complete digestive tract; most have bristles (chaetae) on each segment that anchor them in tubes or aid in crawling. Occupy marine, terrestrial, and freshwater habitats.	16,000
Cnidaria (cnidarians)	Jellyfish, *Hydra*, corals, sea anemones, sea fans		Radially symmetrical, acoelomate body has tissues but no organs. Mouth opens into a simple digestive sac and is surrounded by tentacles armed with stinging capsules (nematocysts). In some groups, individuals are joined into colonies; some can secrete a hard exoskeleton. The very few nonmarine species live in fresh water.	10,000
Echinodermata (echinoderms)	Sea stars, sea urchins, sand dollars, sea cucumbers		Adult body pentaradial (fivefold) in symmetry. Water-vascular system is a coelomic space; endoskeleton of calcium carbonate plates. Many can regenerate lost body parts. Fossils are more diverse in body plan than extant species. Exclusively marine.	7000
Porifera (sponges)	Barrel sponges, boring sponges, basket sponges, bath sponges		Bodies of most asymmetrical: defining "an individual" is difficult. Body lacks tissues or organs, being a meshwork of cells surrounding channels that open to the outside through pores, and that expand into internal cavities lined with food-filtering flagellated cells (choanocytes). Most species are marine (150 species live in fresh water).	7000
Bryozoa (moss animals) (also called Polyzoa and Ectoprocta)	Sea mats, sea moss		The only exclusively colonial phylum; each colony comprises numerous small, coelomate individuals (zooids) connected by an exoskeleton (calcareous in marine species, organic in most freshwater ones). A ring of ciliated tentacles (lophophore) surrounds the mouth of each zooid; the anus lies beyond the lophophore.	4500

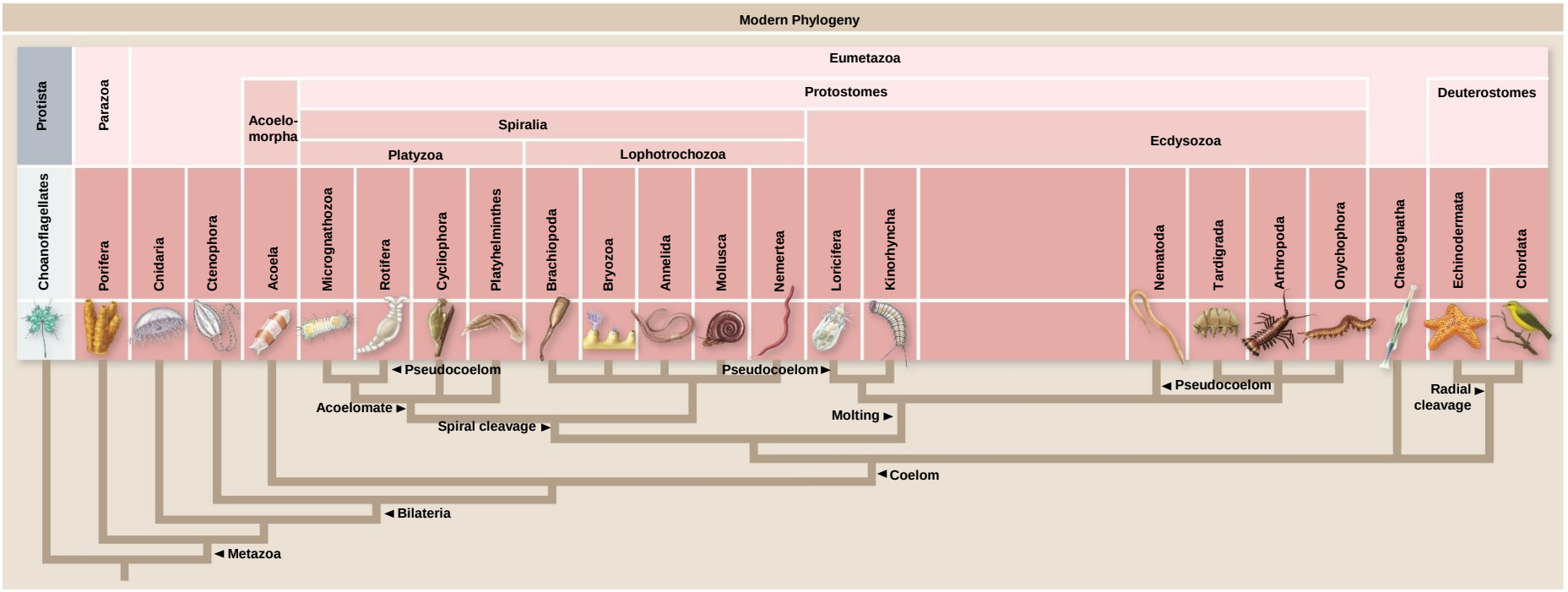
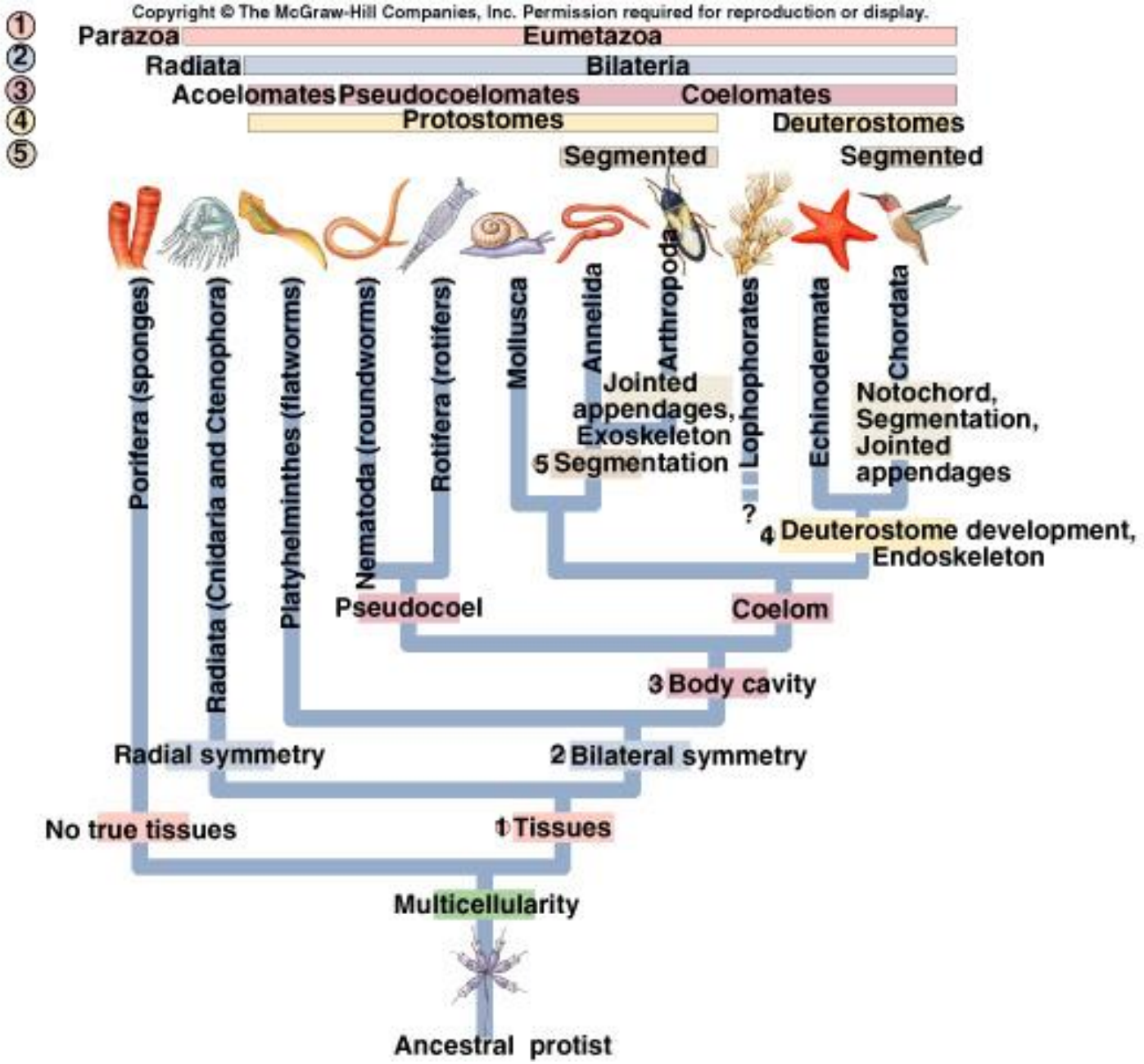


Figure 31.3 A traditional view of animal diversity based on body-plan grades



Phylum Porifera

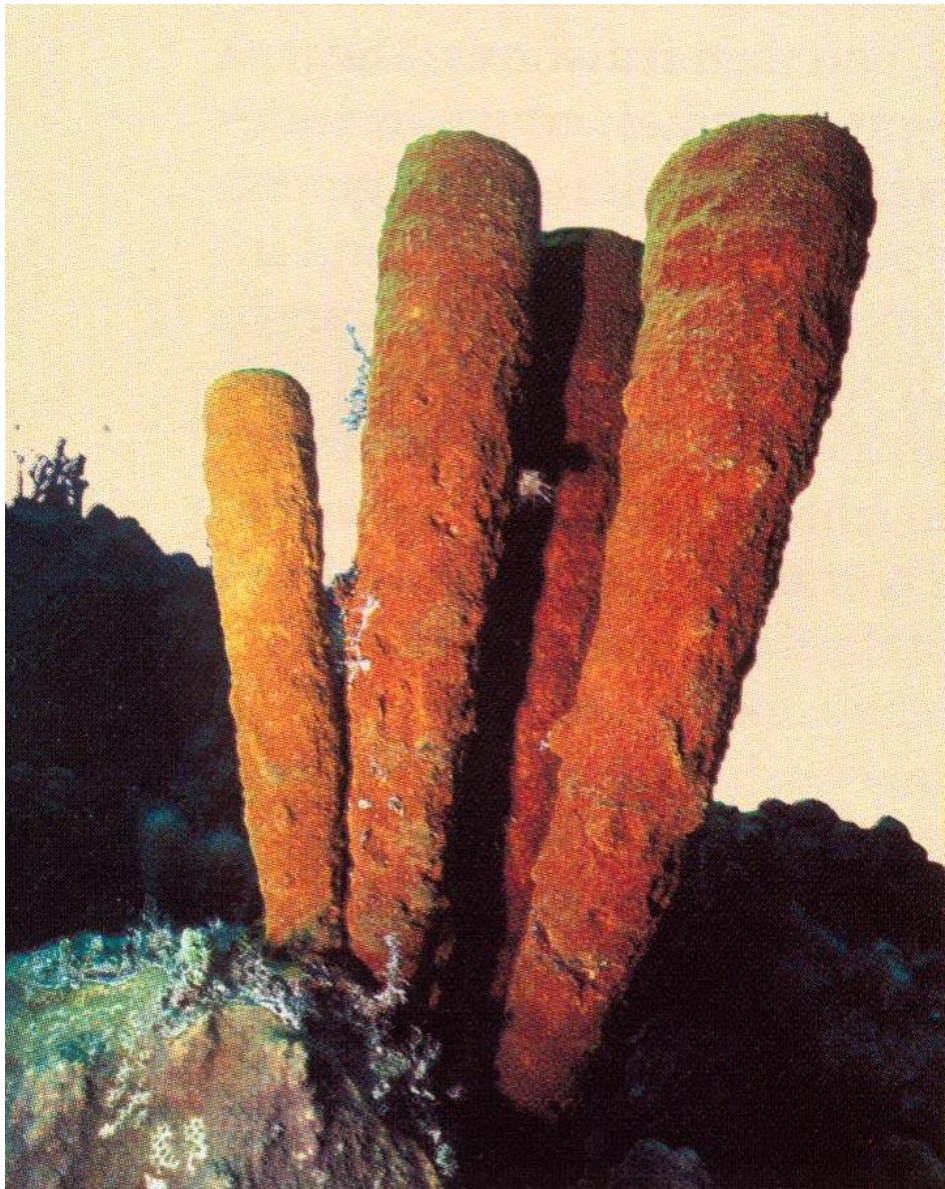
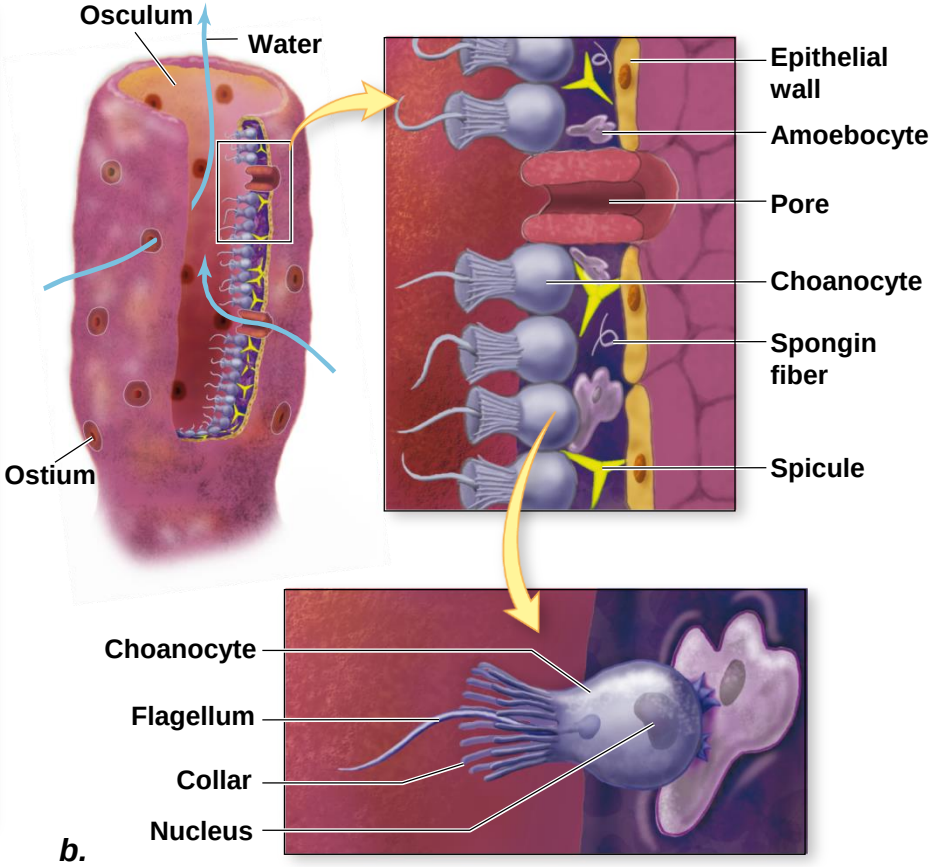


Fig. 33.7

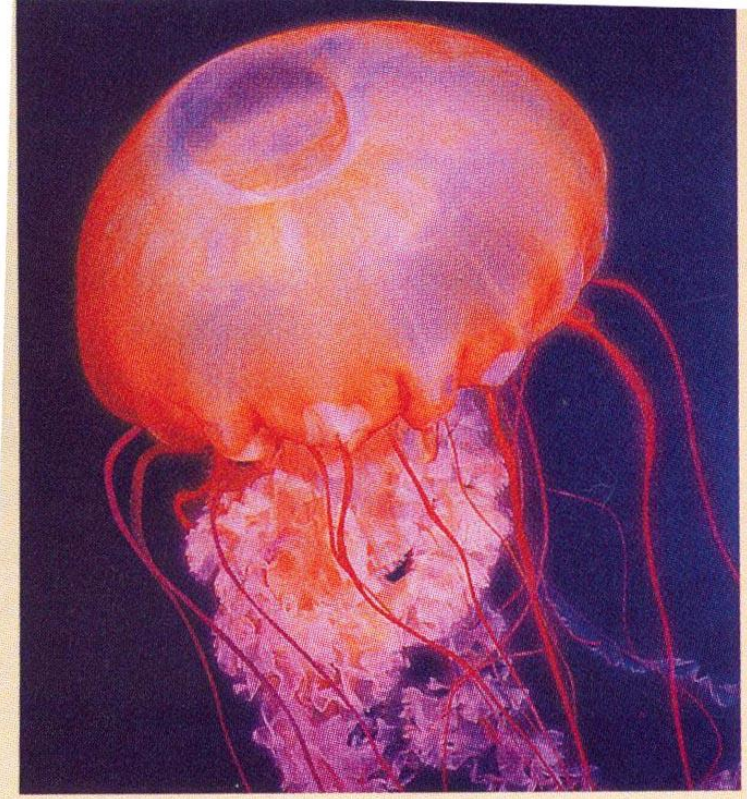
a.



b.

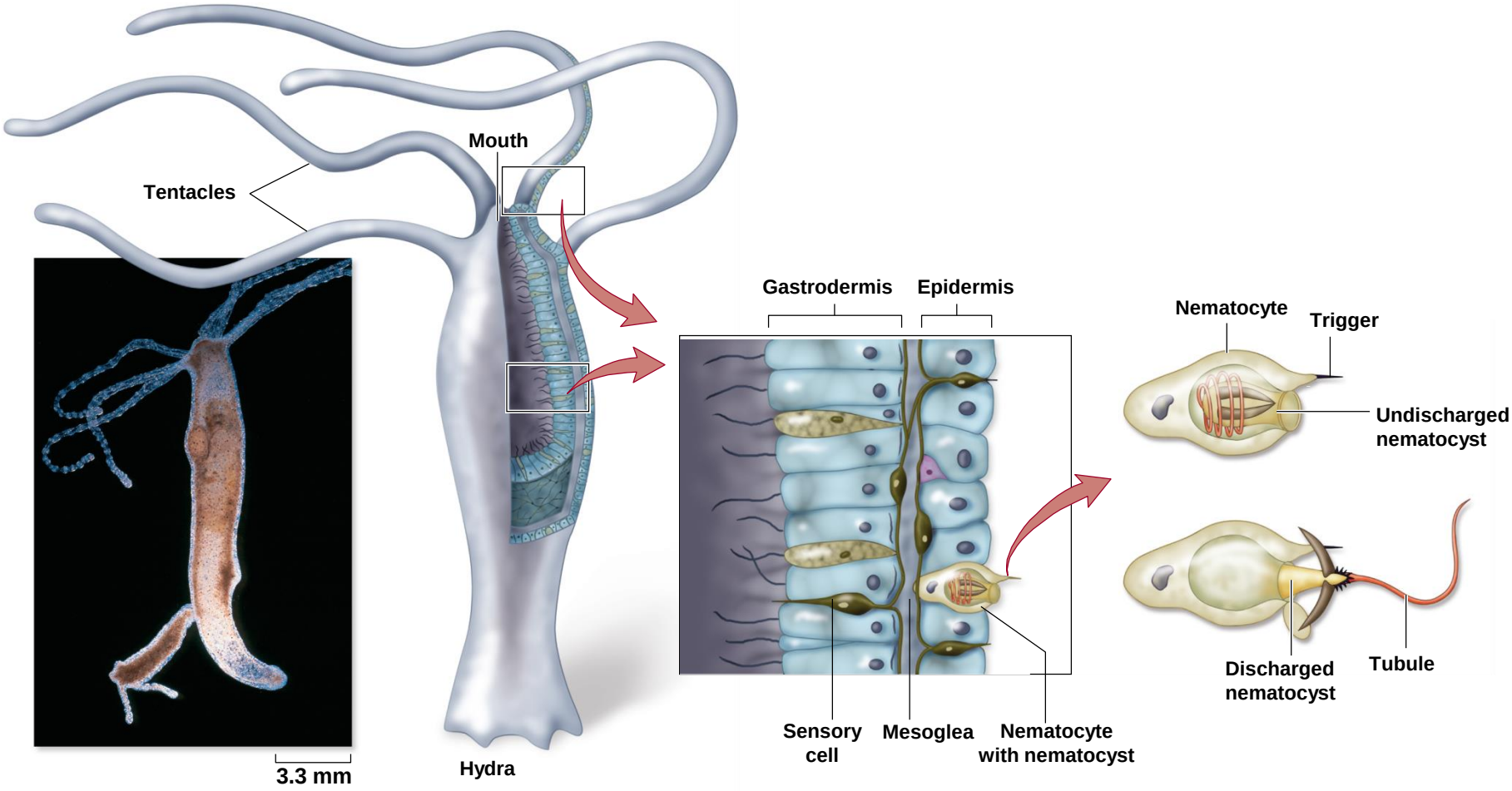
a: © Andrew J. Martinez/Photo Researchers, Inc.

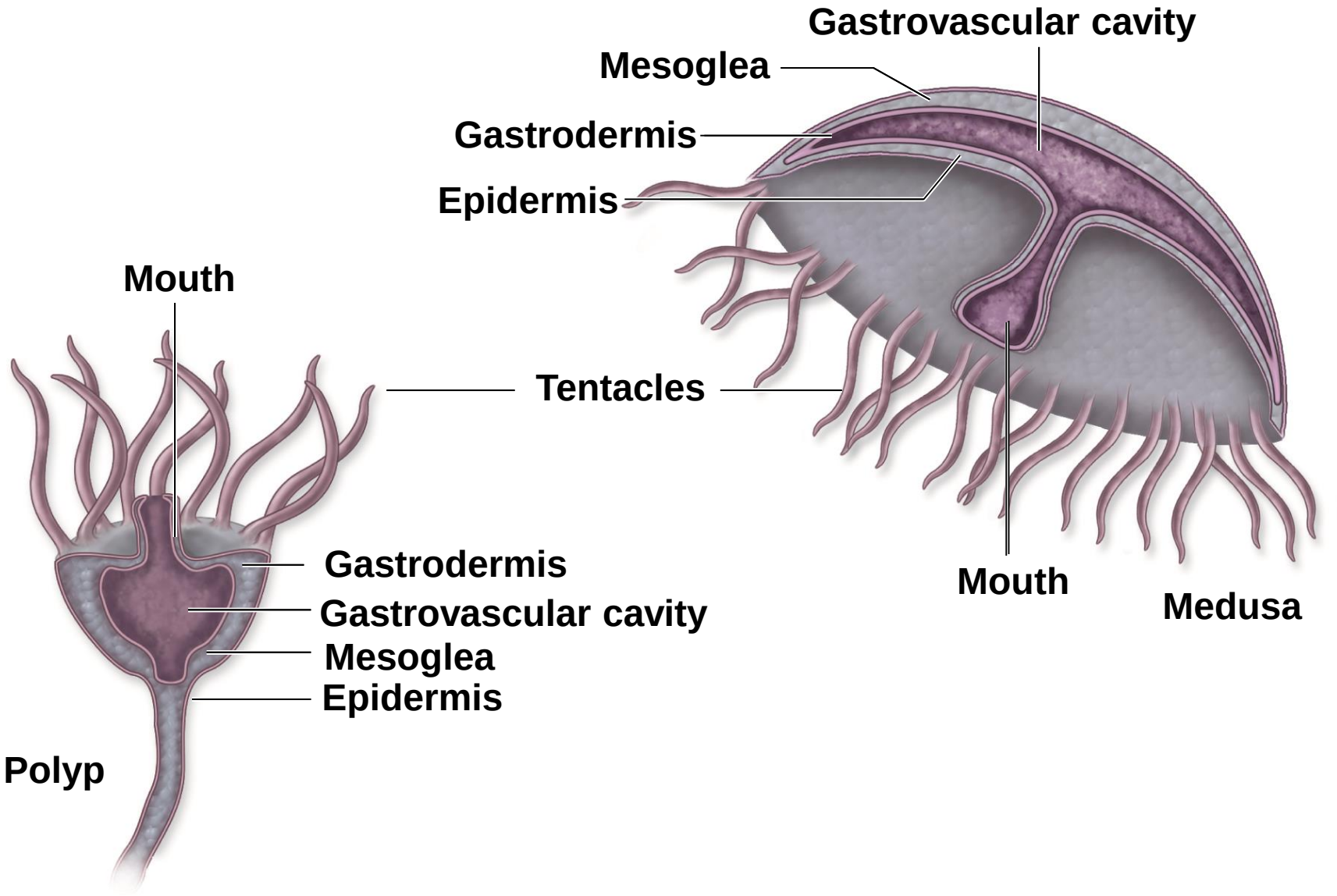
Phylum Cnidaria



Cnidarians include jellyfish, like the one seen swimming here, as well as anemones and corals. Members of this group, the first organisms to evolve true tissues, are named for their stinging cells, which they use for protection and to disable prey.

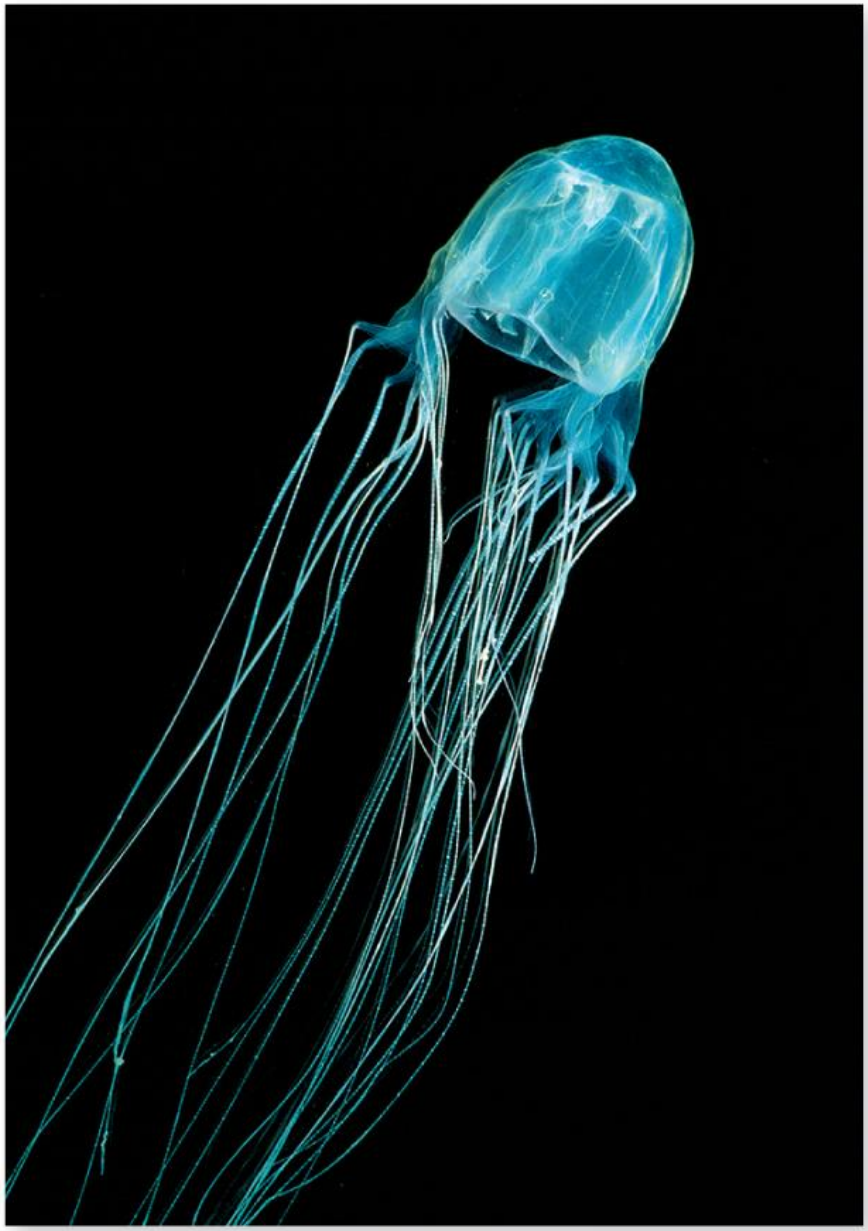
FIGURE 41.15
Class Anthozoa. The sessile soft-bodied sea anemone.


Mouth
Tentacles
3.3 mm
Hydra
Gastrodermis
Epidermis
Sensory cell
Mesoglea
Nematocyte with nematocyst
Nematocyte
Trigger
Undischarged nematocyst
Discharged nematocyst
Tubule



© Neil G. McDaniel/Photo Researchers, Inc.

© Viola's Photo Visions Inc./Animals Animals



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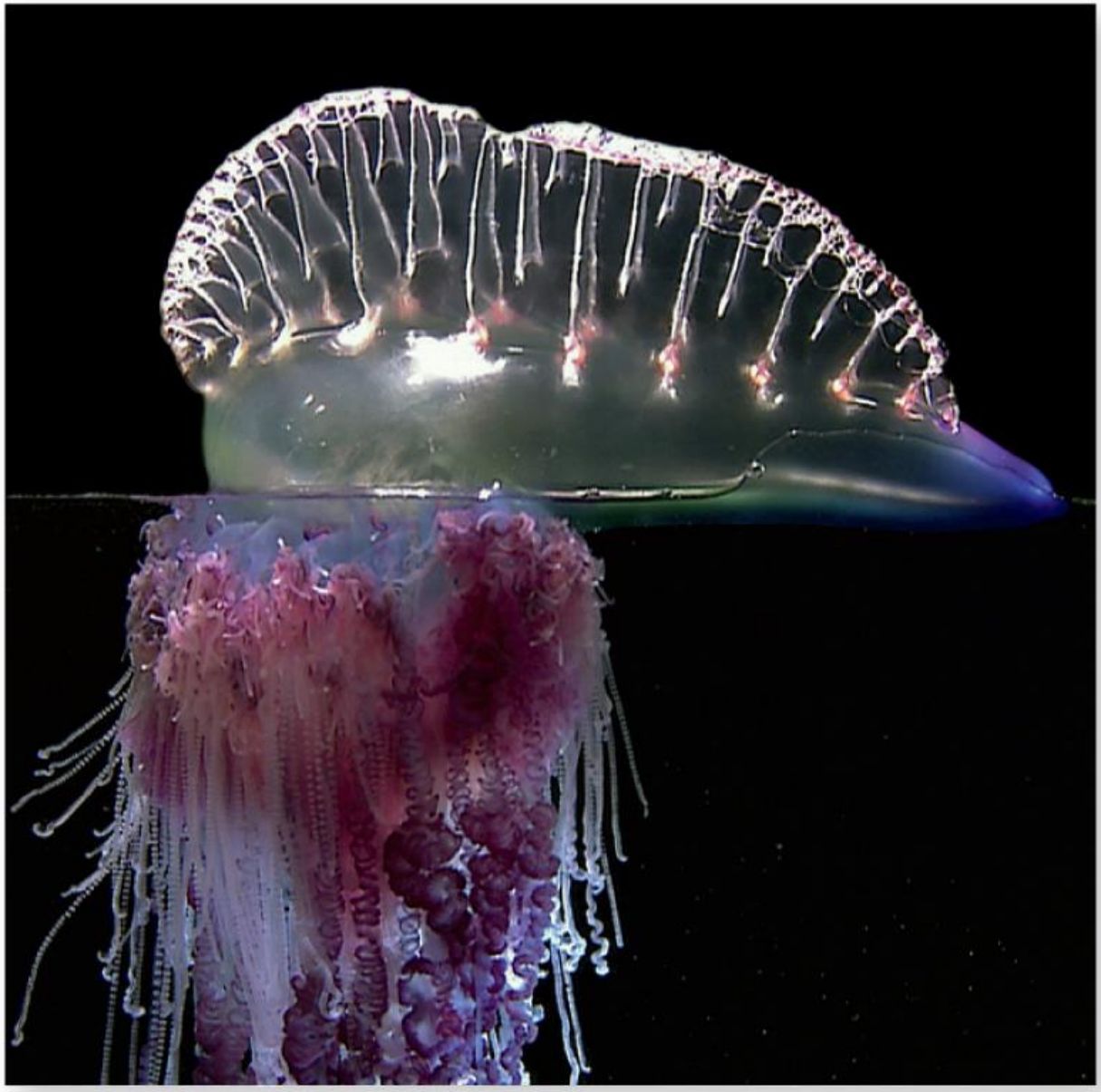

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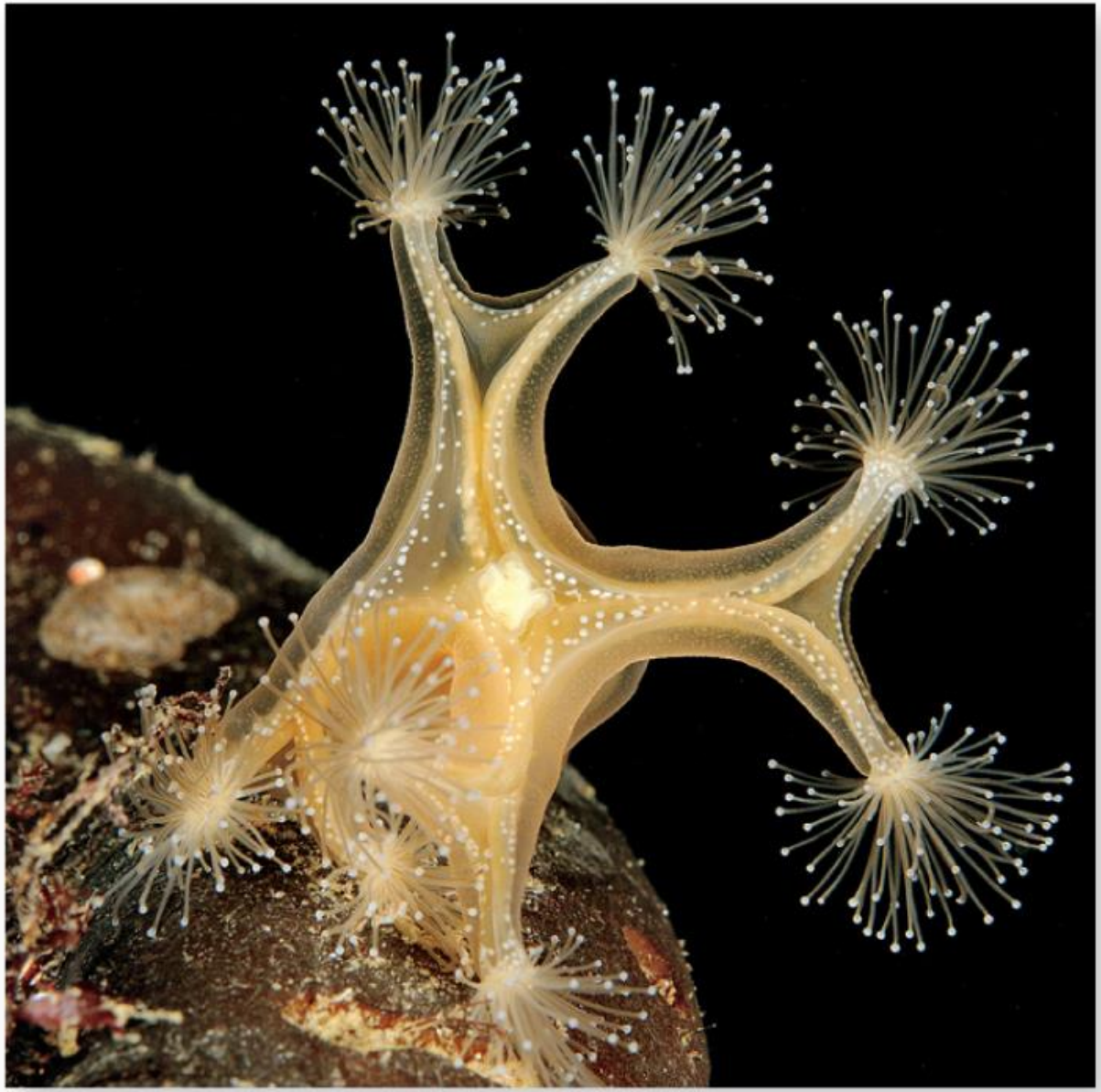
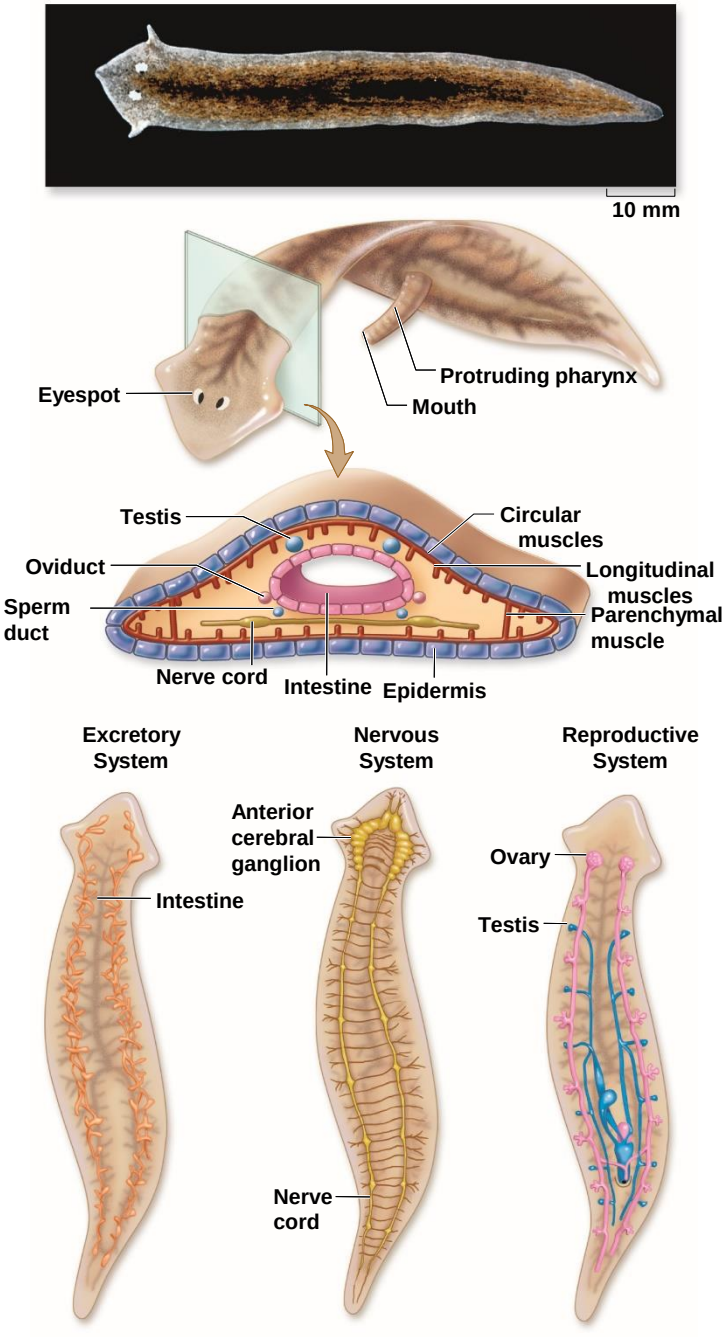
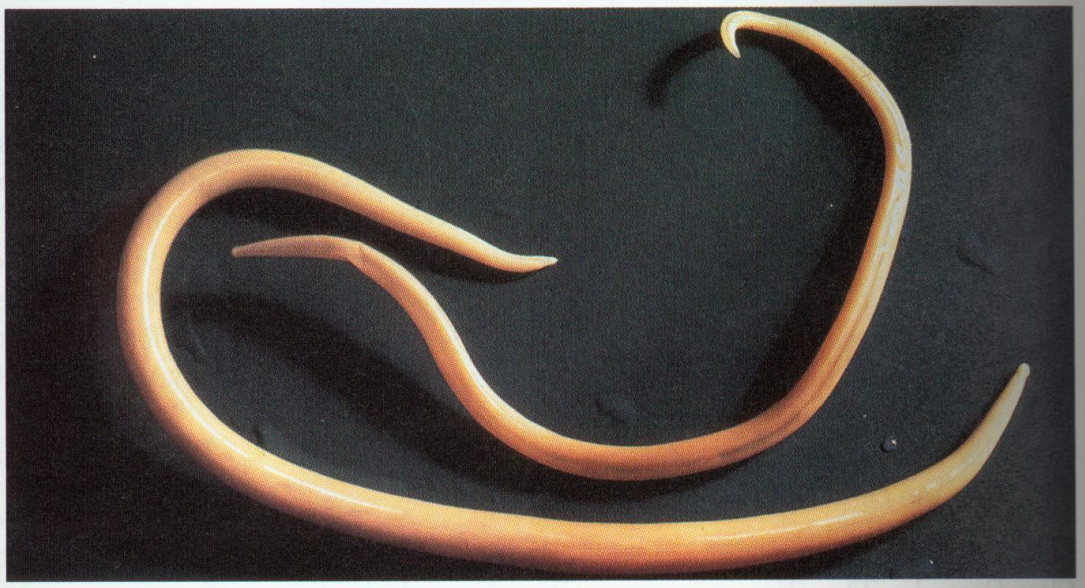


© Wolfgang Poelzer/WaterFrame/agefotostock

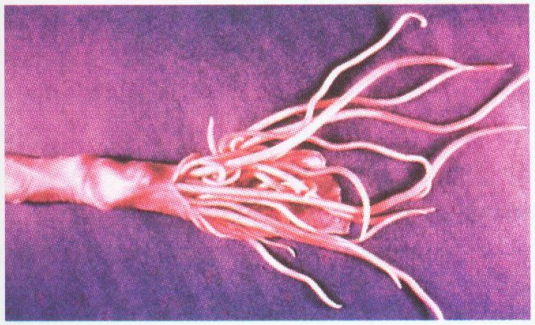
Phylum Platyhelminthes

Flatworms, like this oceangoing flatworm from the United States west coast, were among the earliest animals to evolve true organs and organ systems.

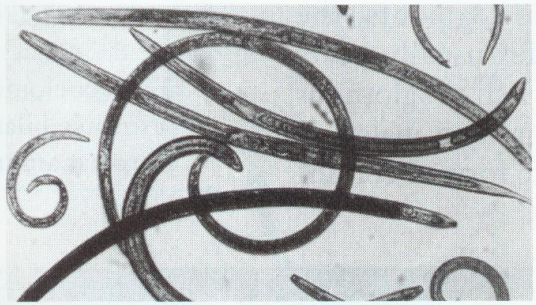




(a)



(b)



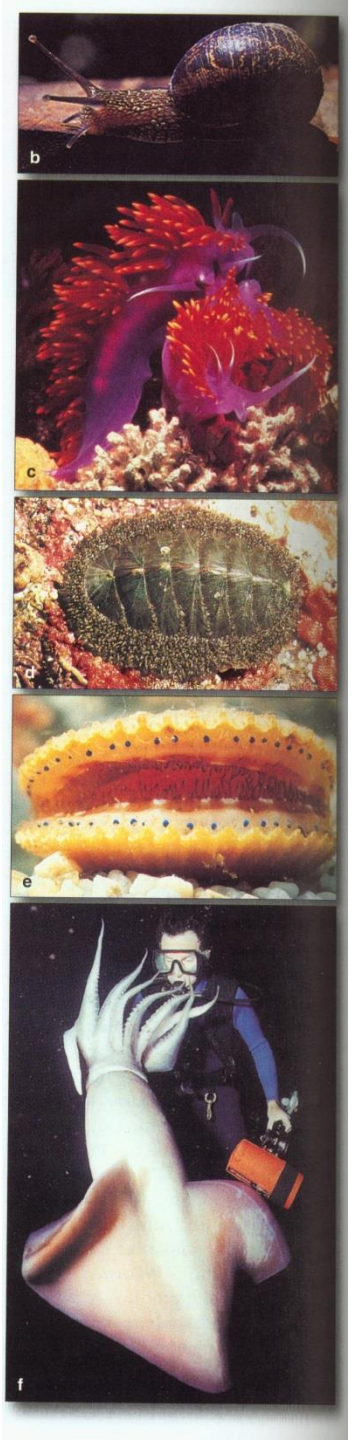
(c)

FIGURE 41.22
Nematodes. (a) *Ascaris lumbricoides*, an intestinal roundworm that infects humans and some other animals. Its fertilized eggs pass out with feces and can remain viable in soil for years. In unsanitary conditions, the eggs may be ingested because of improper hand washing. The young worms bore through the wall of the gut, pass through the heart and lungs, and pass out the breathing passage and are swallowed again. Adult females can be up to 30 centimeters long. (b) A pig's intestine opened up to show that it is filled to capacity with *Ascaris*. (c) Soil nematodes (42×). Although most are similar in form, they range from about 0.2 mm to about 6 mm long.

Phylum Nematoda

Phylum

Mollusca



a.

b.

c.

d.

a: © Marty Snyderman/Visuals Unlimited; b: © Alex Kerstitch/Visuals Unlimited; c: © Douglas Faulkner/Photo Researchers, Inc.; d: © agefotostock/SuperStock

Phylum Annelida

Photo by Fred Grassle © Woods Hole Oceanographic Institution

© David M. Dennis/Animals Animals

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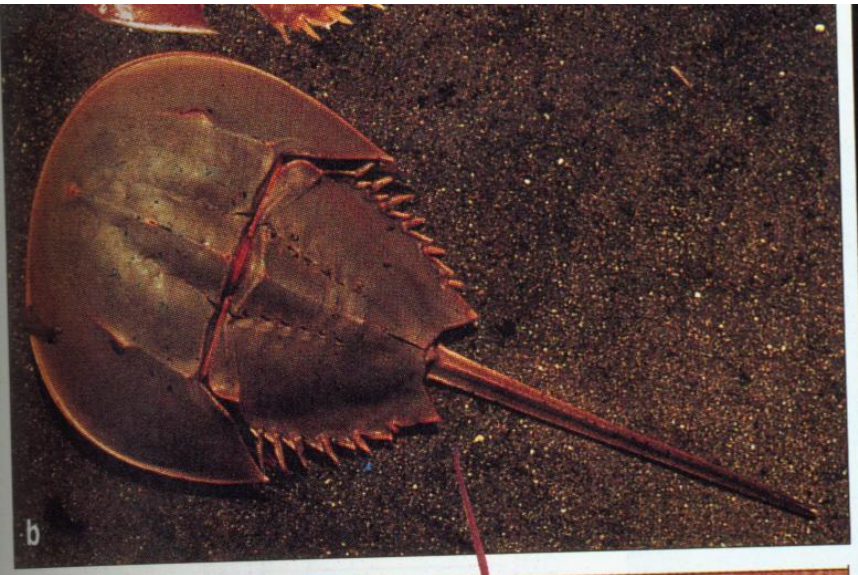
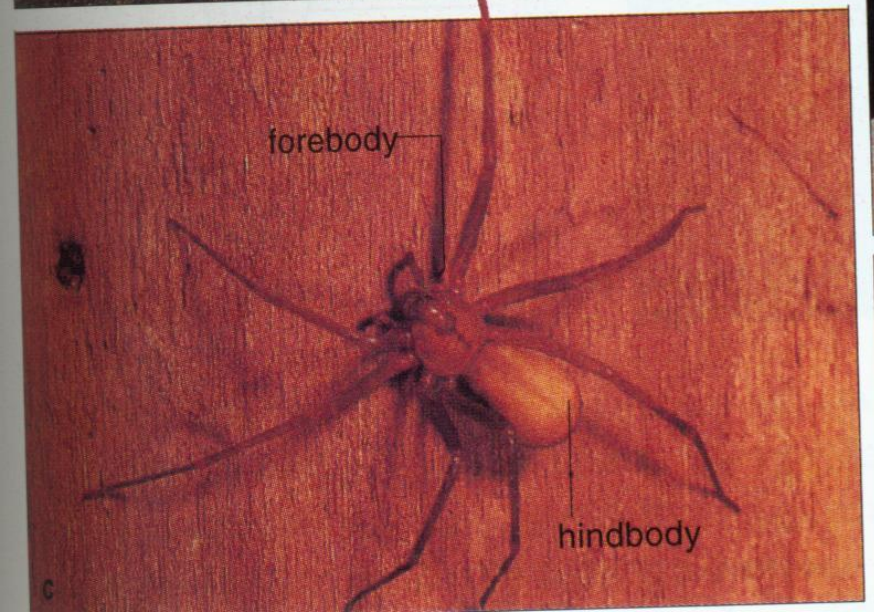
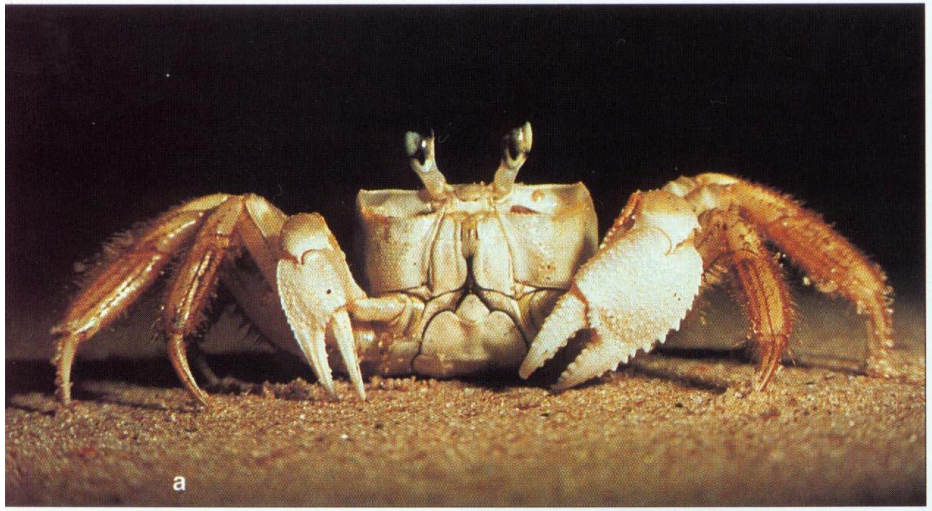
Phylum Arthropoda – Class Arachnida



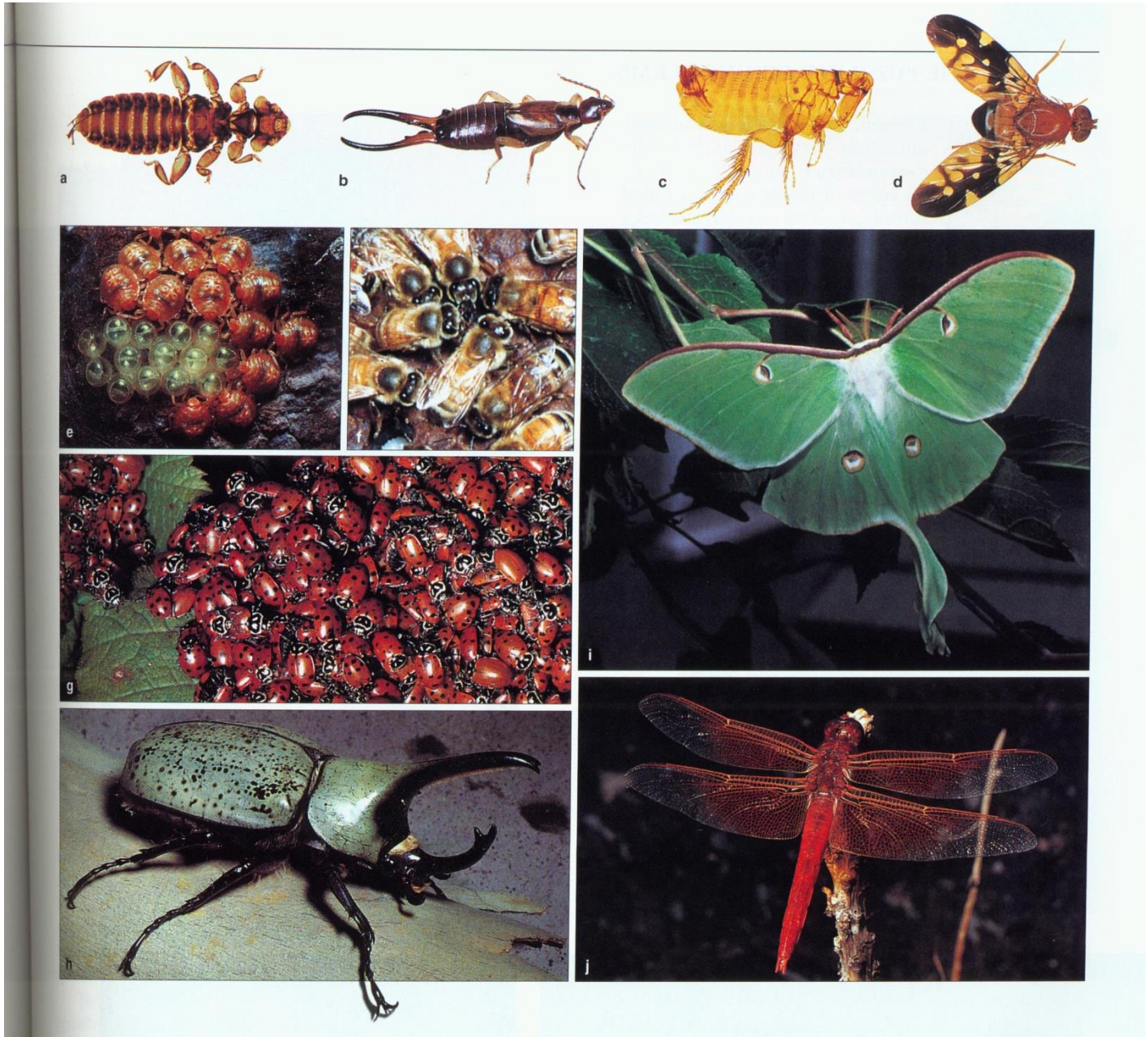




Phylum Arthropoda

Class Crustacea

Phylum Arthropoda – Class Insecta



Order: Lepidoptera

a.

Order: Homoptera

b.

Order: Coleoptera

c.

Order: Diptera

d.

Order: Orthoptera

e.

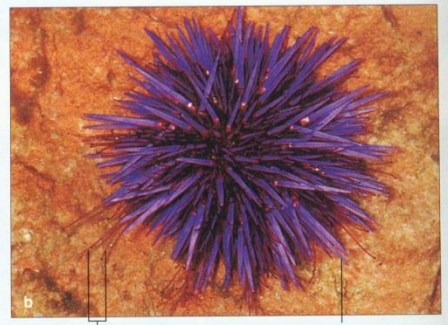
Order: Isoptera

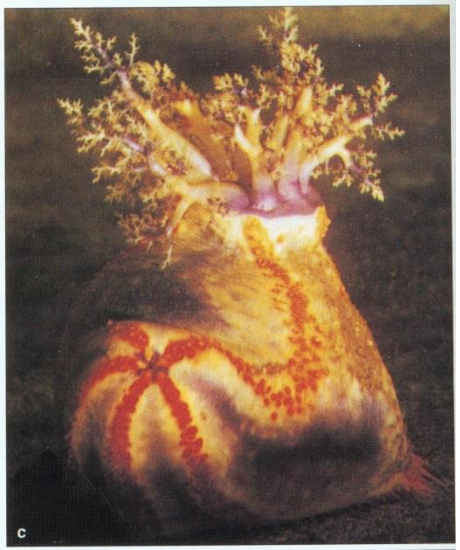
f.

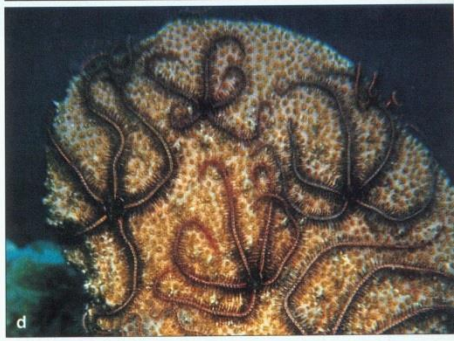
a: © Cleveland P. Hickman; b: © Valorie Hodgson/Visuals Unlimited; c: © Gyorgy Csoka, Hungary Forest Research Institute, Bugwood.org; d: © Kjell Sandved/Butterfl y Alphabet; e: © Greg Johnston/Lonely Planet Images/Getty Images; f: © Nature's Images/Photo Researchers, Inc.

Phylum

Echinodermata







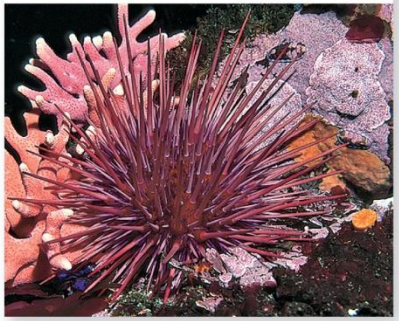
Class: Asteroidea

a.

Class: Holothuroidea

b.

Class: Echinoidea

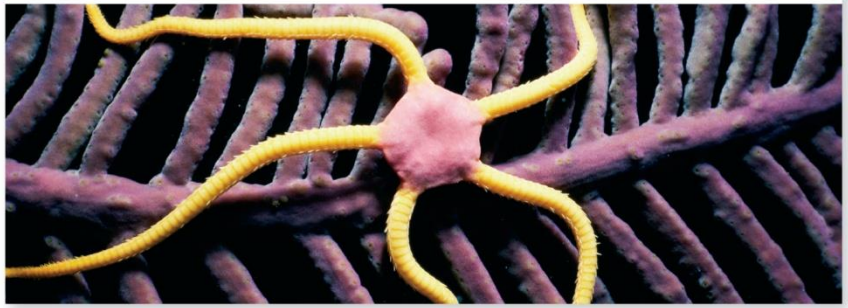


c.

Class: Crinoidea

d.

Class: Ophiuroidea



e.

Figure 34.4 Chordate characteristics

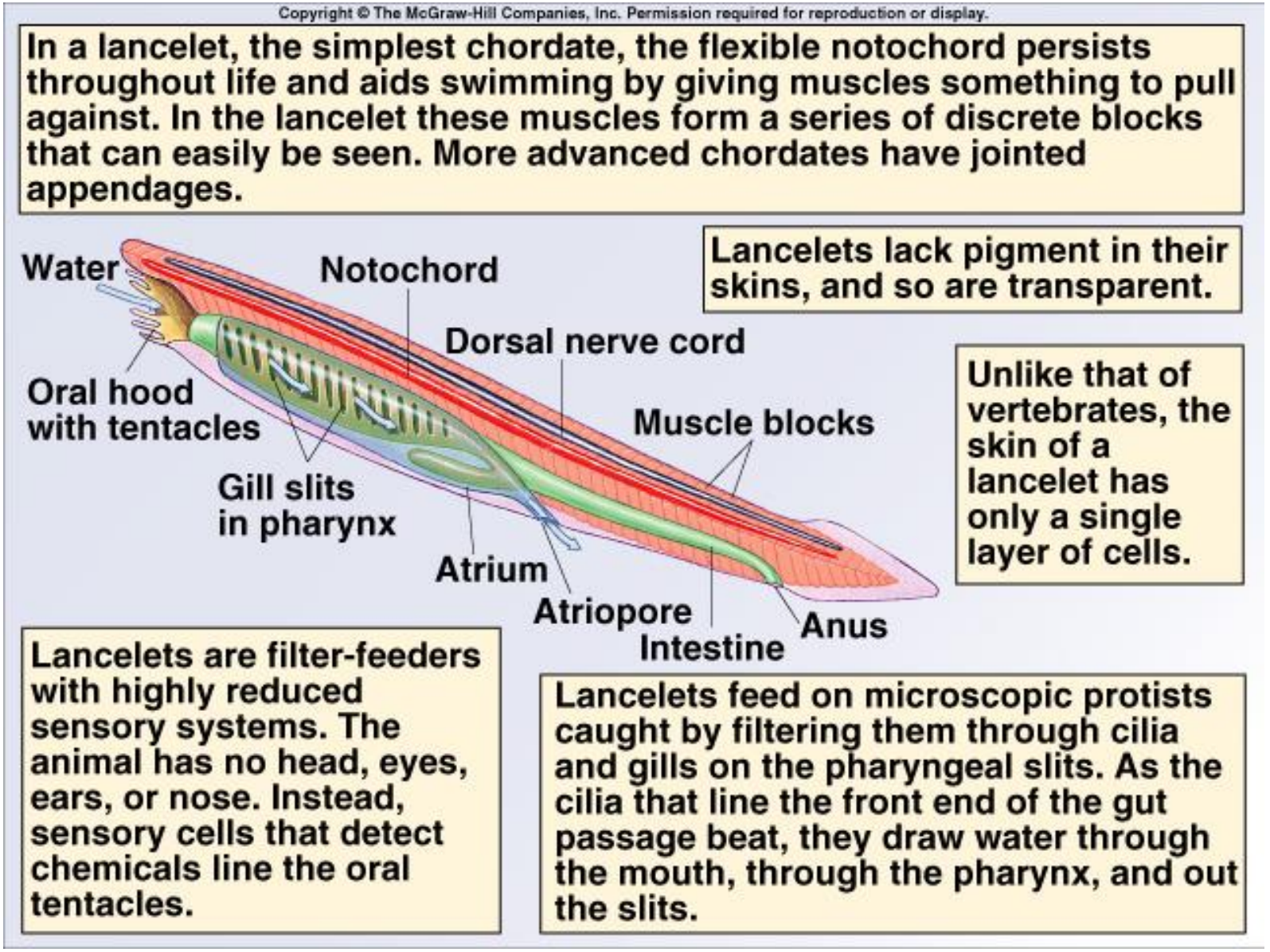
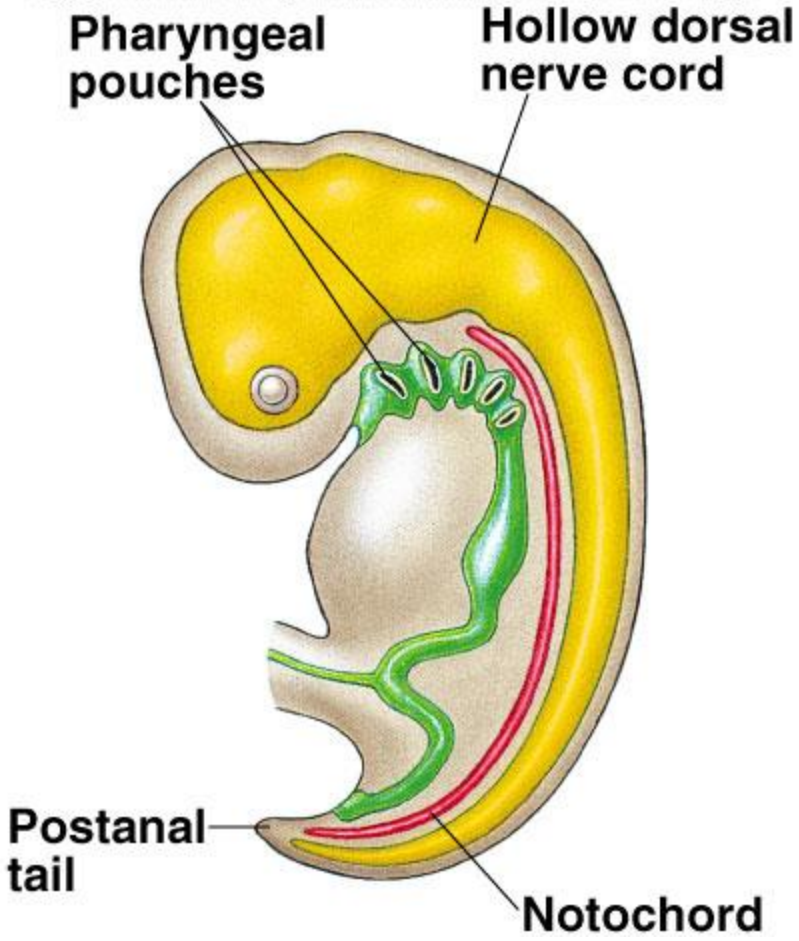


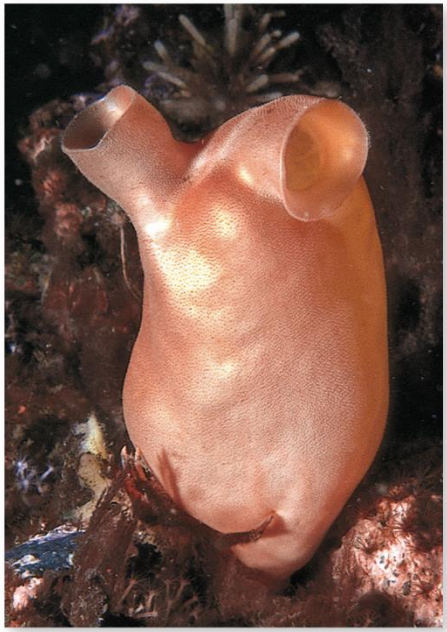
Figure 34.2 Chordate characteristics

Phylum Chordata

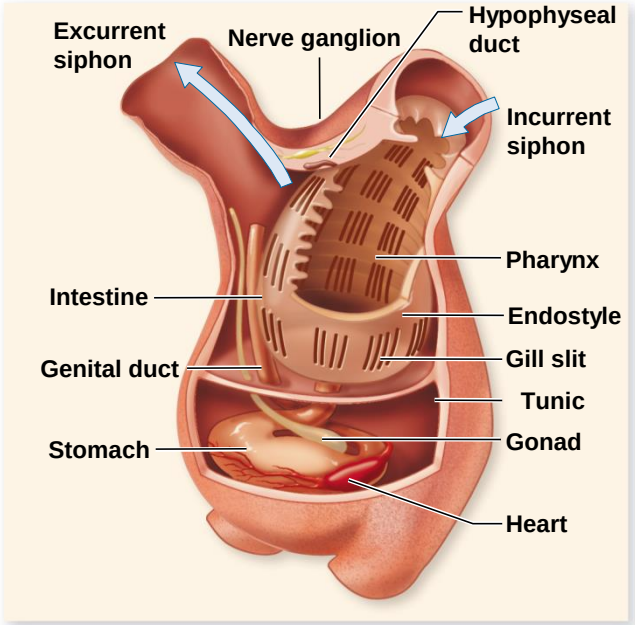


Phylum Chordata

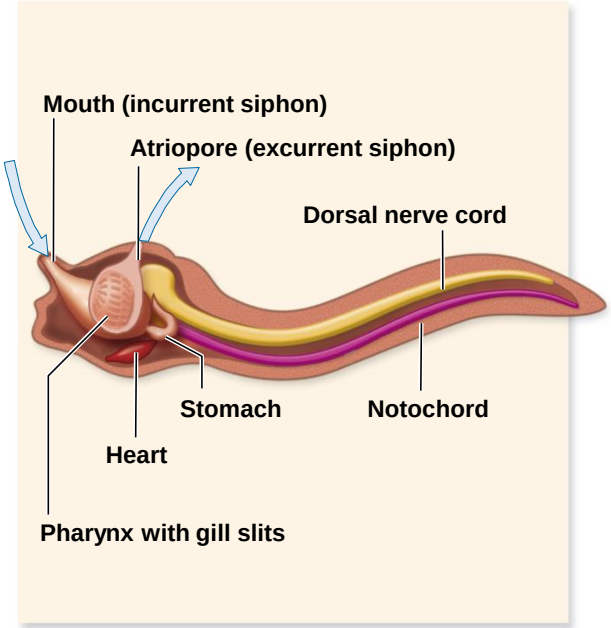
- Two Invertebrate Groups
  - Urochordates
  - Cephalochordates
- Subphylum Vertebrata



a.

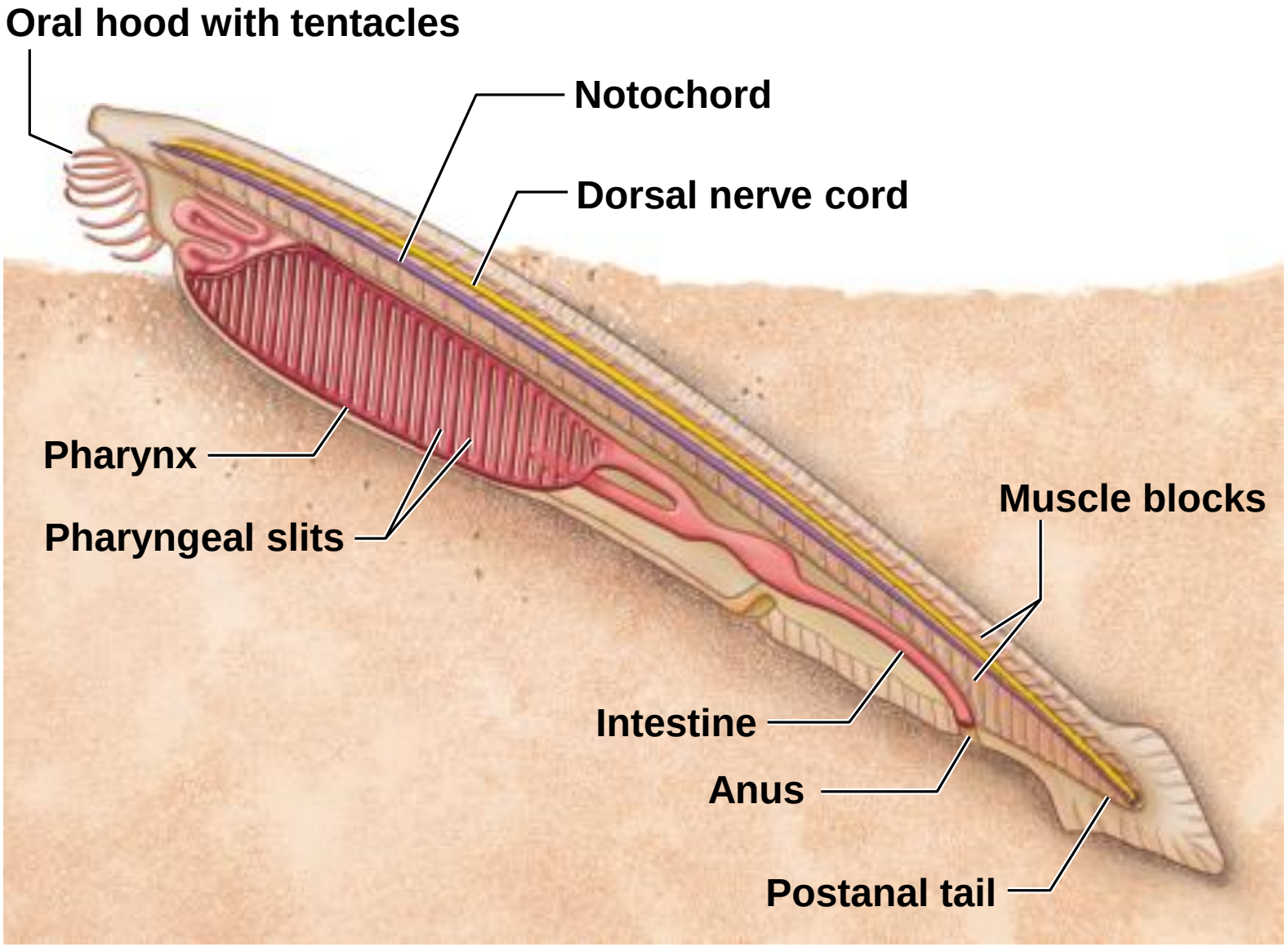


b.

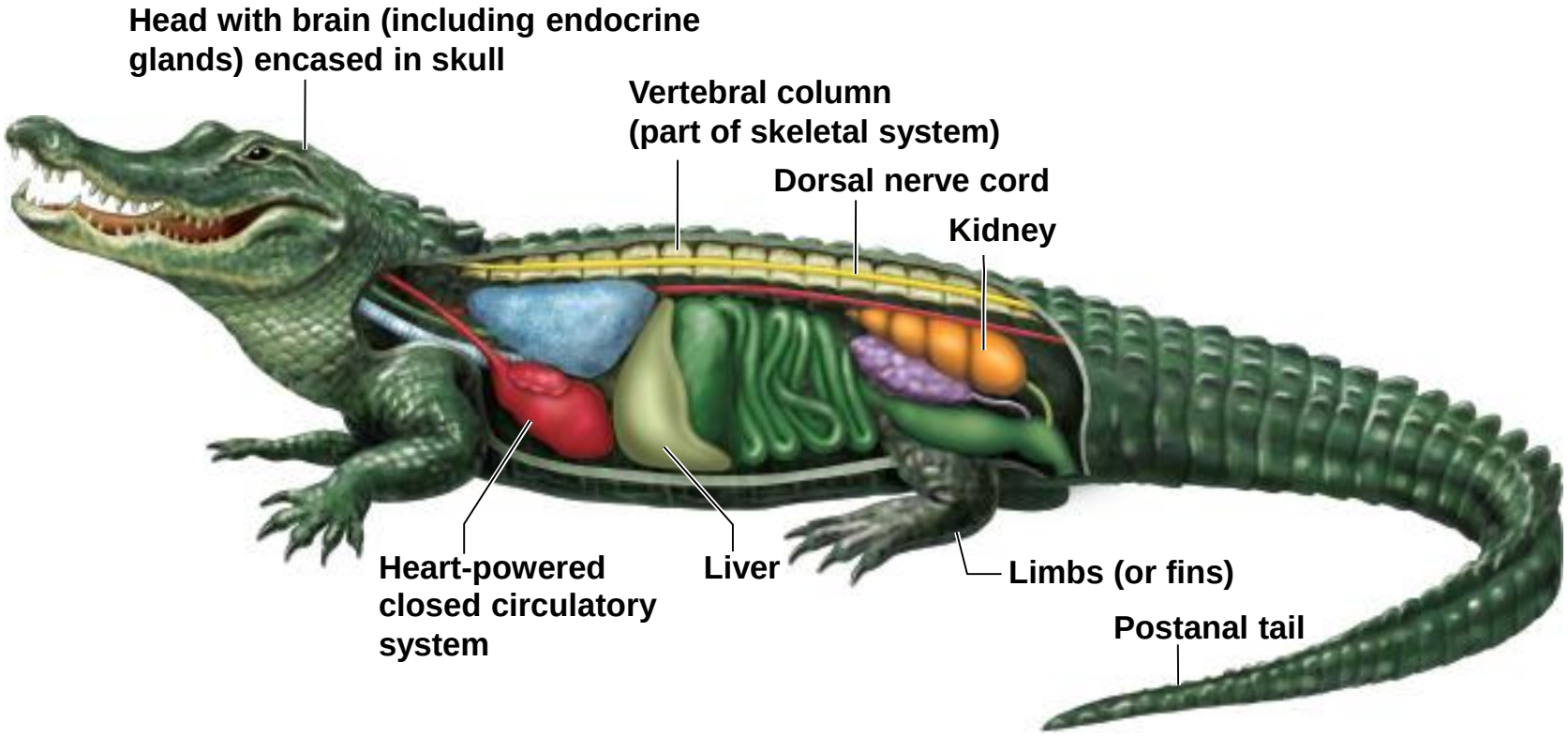


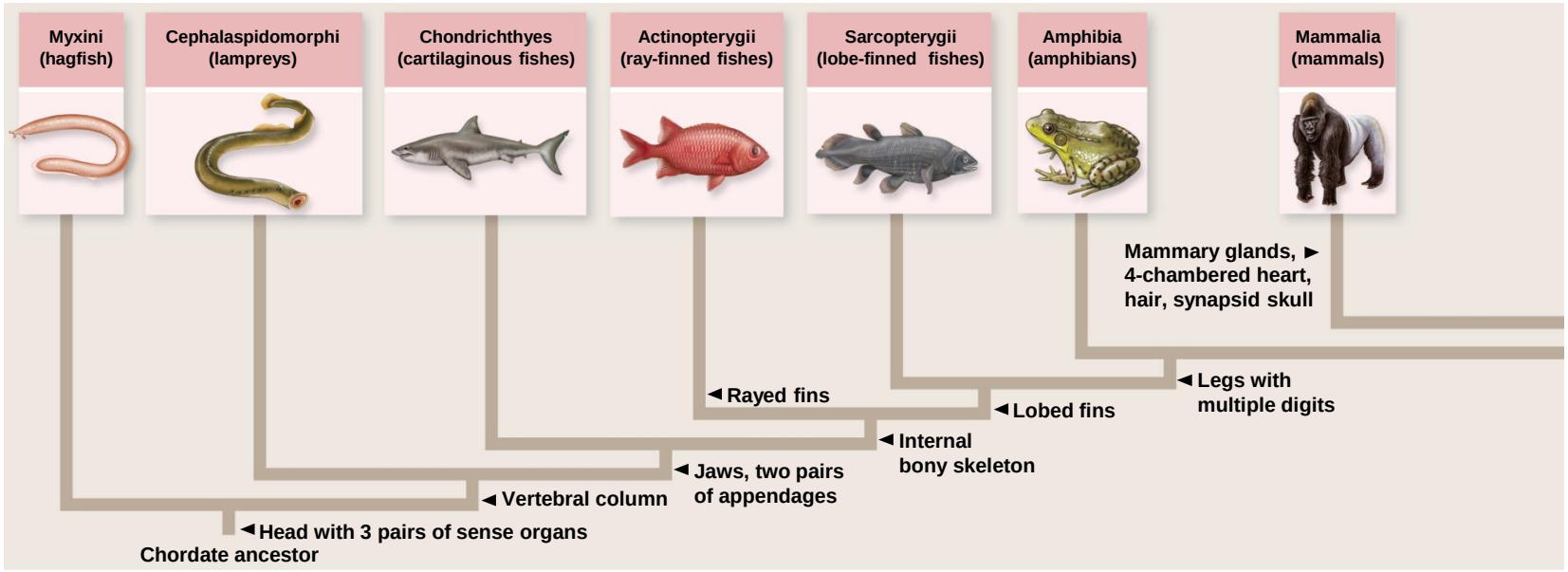
c.

a. © Rick Harbo



Subphylum Vertebrata





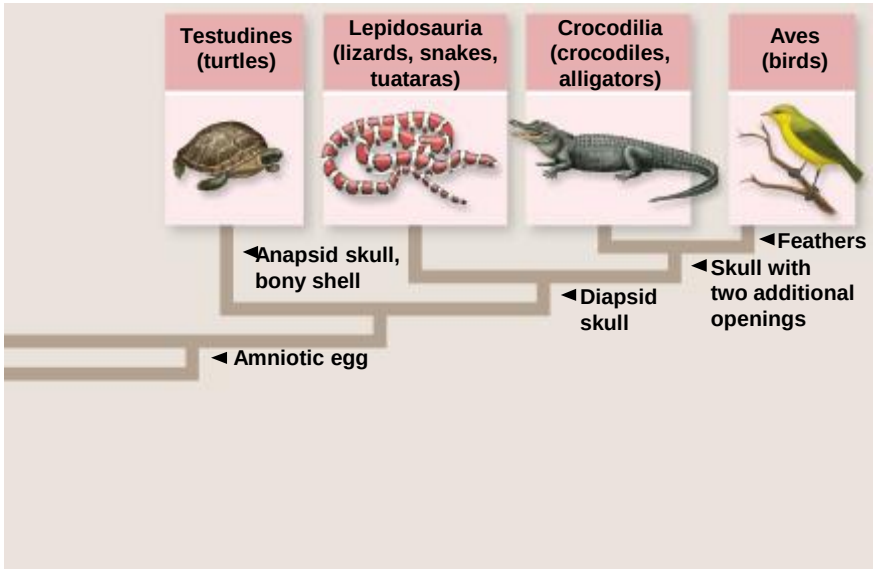


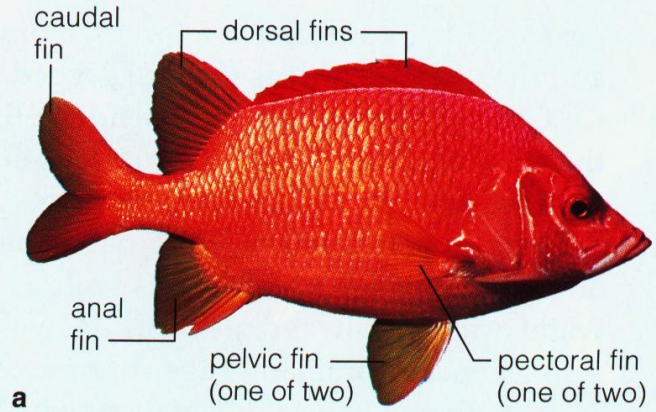
TABLE 35.1 Major Classes of Fishes

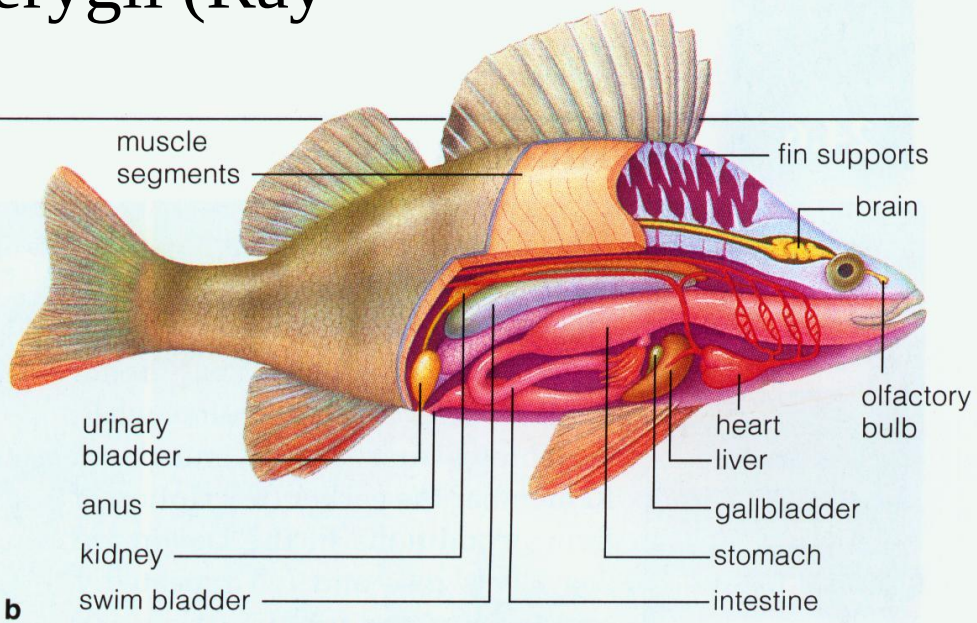
Class	Typical Examples	Key Characteristics	Approximate Number of Living Species
Sarcopterygii	Lobe-finned fishes 	Largely extinct group of bony fishes; ancestral to amphibians; paired lobed fins	8
Actinopterygii	Ray-finned fishes 	Most diverse group of vertebrates; swim bladders and bony skeletons; paired fins supported by bony rays	30,000
Chondrichthyes	Sharks, skates, rays 	Cartilaginous skeletons; no swim bladders; internal fertilization	750
Cephalaspidomorphi	Lampreys 	Largely extinct group of jawless fishes with no paired appendages; parasitic and nonparasitic types; all breed in fresh water	35
Myxini	Hagfishes 	Jawless fishes with no paired appendages; scavengers; mostly blind, but having a well-developed sense of smell	30
Placodermi	Armored fishes 	Jawed fishes with heavily armored heads; many were quite large	Extinct
Acanthodii and Ostracoderms	Spiny fishes 	Fishes with (acanthodians) or without (placoderms) jaws; paired fins supported by sharp spines; head shields made of bone; rest of skeleton cartilaginous	Extinct

A sea lamprey

Cartilaginous fishes (class Chondrichthyes): Great white shark (top left), silky shark (top right), southern stingray (bottom left), blue spotted stingray (bottom right)

The Bony Fish: Actinopterygii (Ray-finned) and Lobe-finned





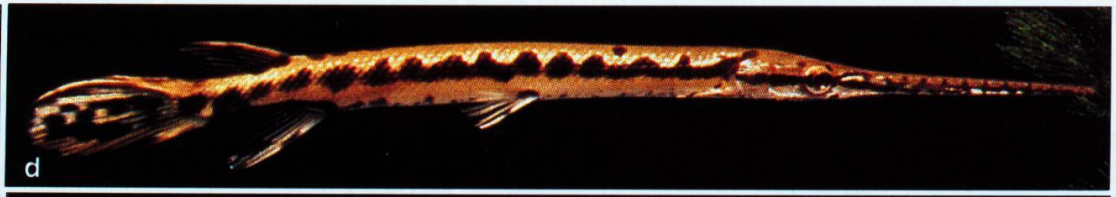


Figure 24.9 Common features of teleosts, the most diverse bony fishes: (**a**) Fins of a soldierfish. (**b**) Internal organs of a perch.

Just a few variations on the basic body plan: (**c**) Sea horse, which uses its tail to attach to substrates.

(**d**) Long-nose gar. (**e**) Coelacanth (*Latimeria*), a "living fossil." It shares traits with the early lobe-finned fishes. (**f**) Moray eel.

Class Amphibia

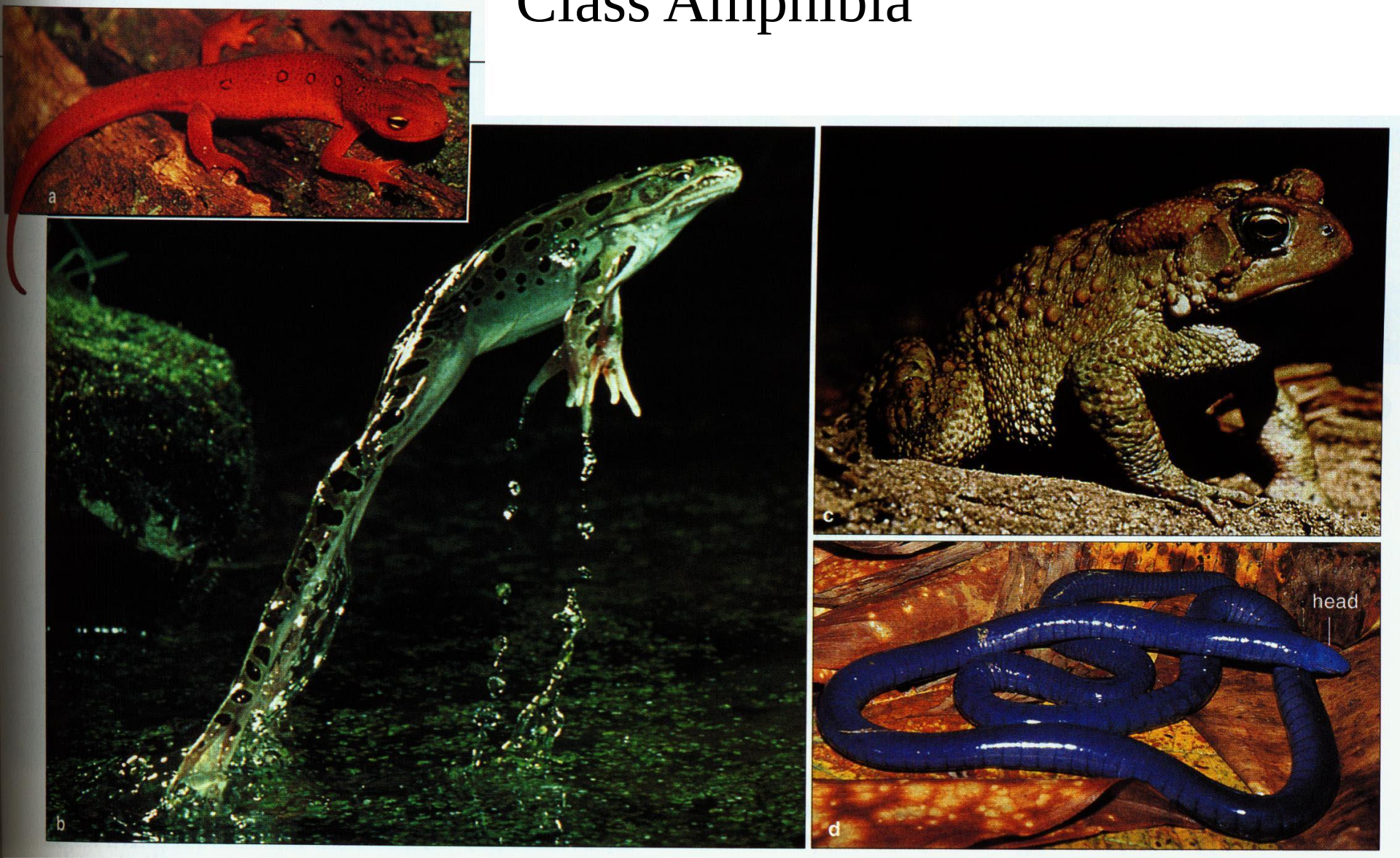


Figure 24.12 Amphibians. (**a**) Terrestrial stage in the life cycle of a red-spotted salamander. (**b**) A frog, splendidly jumping. (**c**) An American toad. (**d**) A caecilian.

Old Class Reptilia

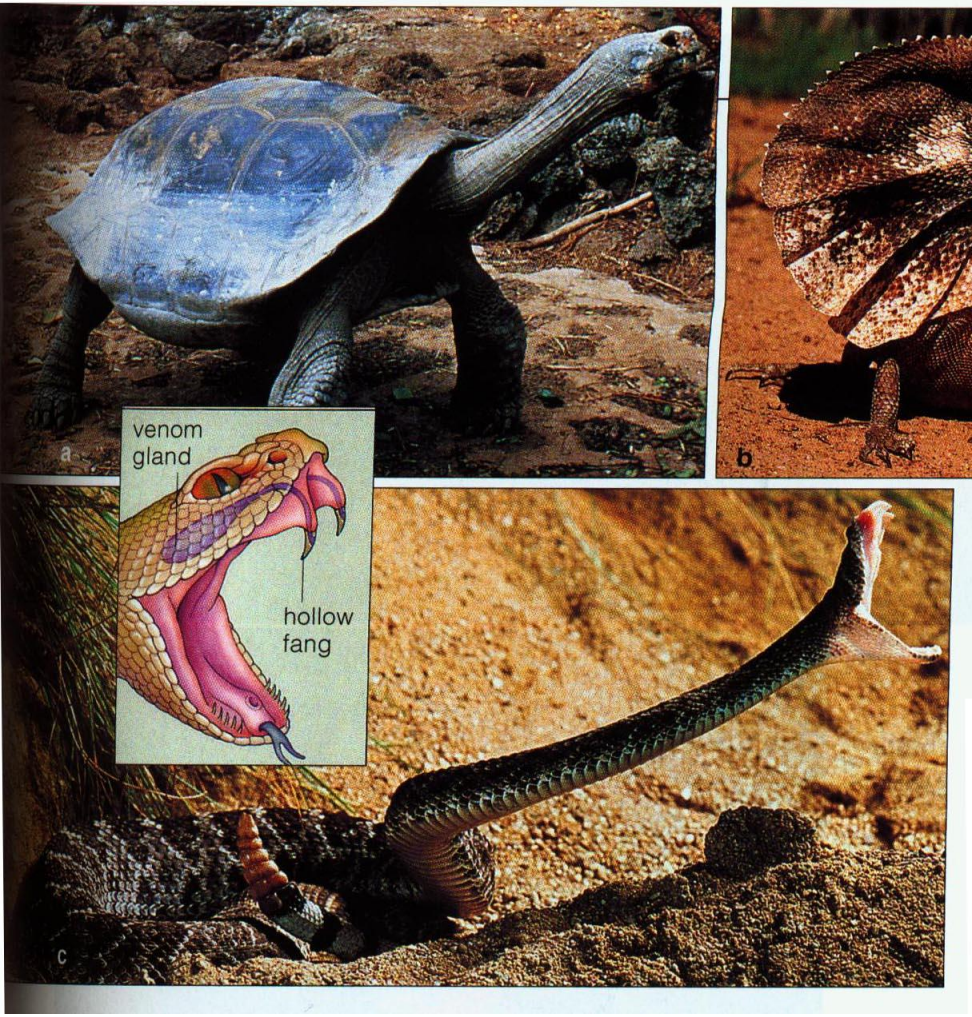
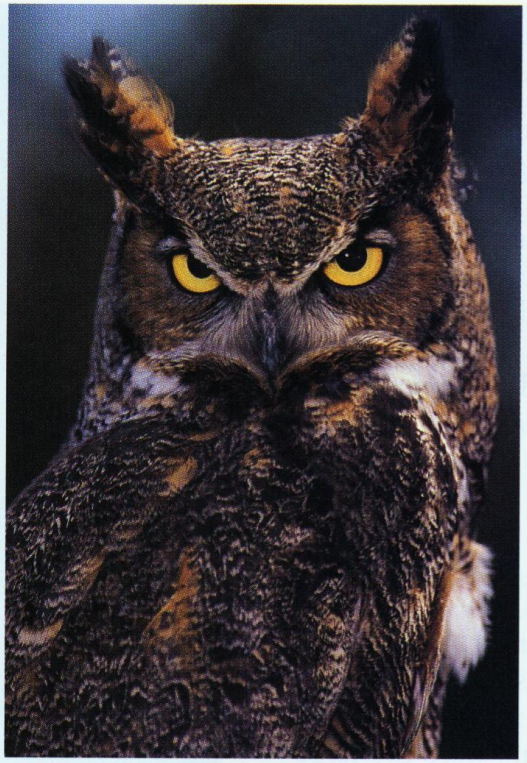


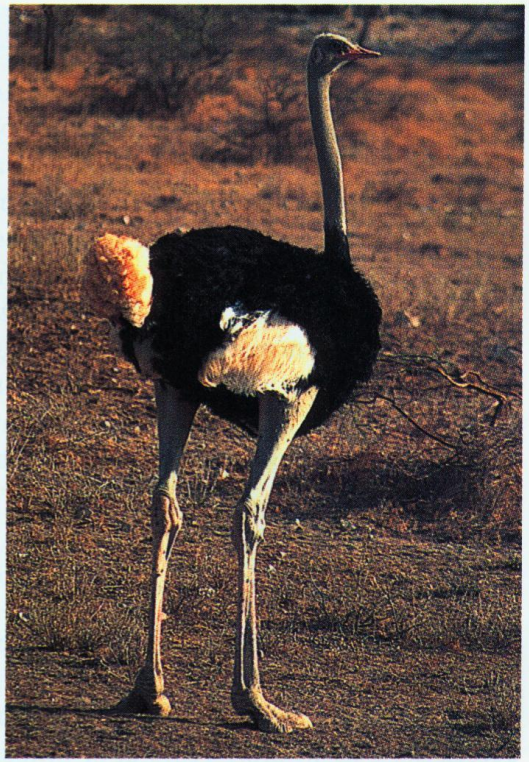
Figure 24.15 (**a**) Galápagos tortoise. (**b**) Frilled lizard, flaring a large ruff of neck skin as defensive behavior. (**c**) A rattlesnake in mid-strike. (**d**) Tuatara (*Sphenodon*).

Class

Aves



(a)



(b)

(c)

(d)

FIGURE 45.37
Class Aves. (a) Great-horned owl, *Bubo virginianus* (order Strigiformes). (b) Ostrich, *Struthio camelus* (order Struthioniformes). (c) A pair of wood ducks, *Aix sponsa* (order Anseriformes). (d) Western tanager, *Piranga ludoviciana* (order Passeriformes).

Monotreme Mammals

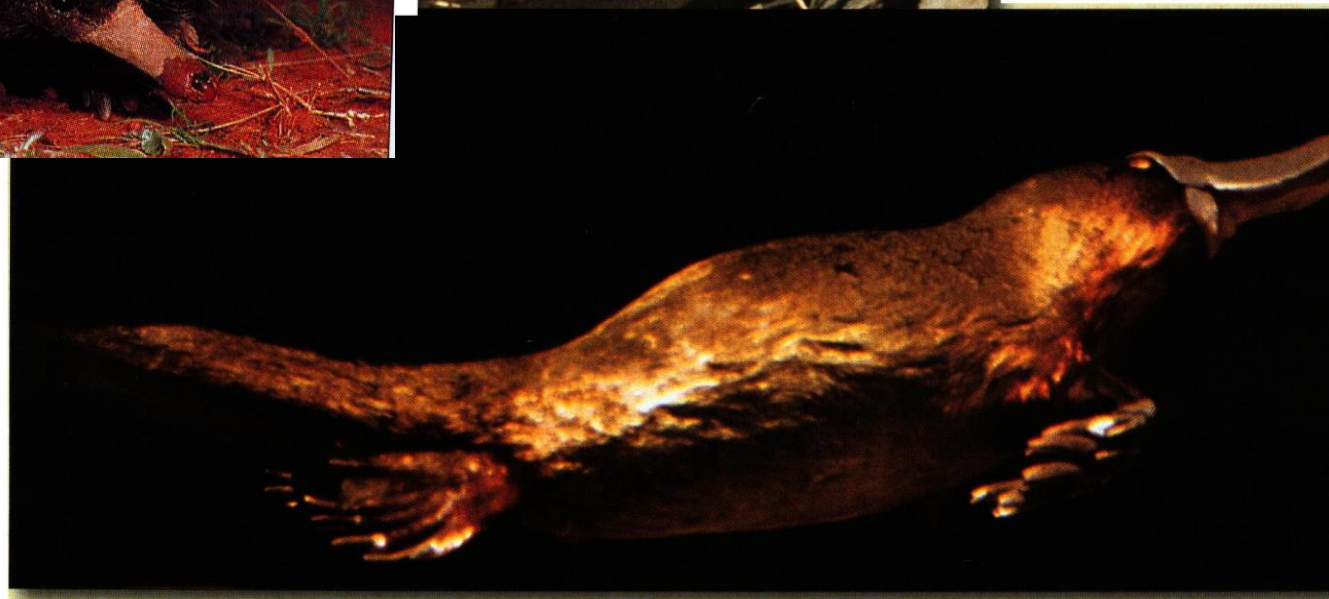


Figure 24.1 One of evolution's success stories—the platypus, (**a**) raising its incompletely formed offspring in a burrow and (**b**) underwater, eyes and ears shut, yet homing in on prey.

Marsupial Mammals

Mammals are characterized by milk-producing mammary glands in females, as well as young that are born live (rather than being born in an egg that later hatches open). These kangaroos are mammals, as are bears, dogs, lions, and humans.

Placental

Mammals