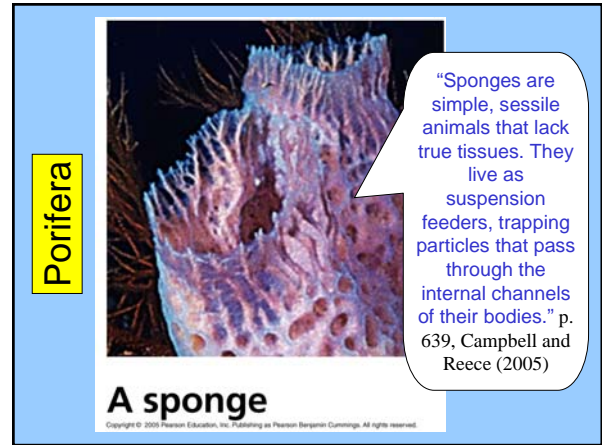


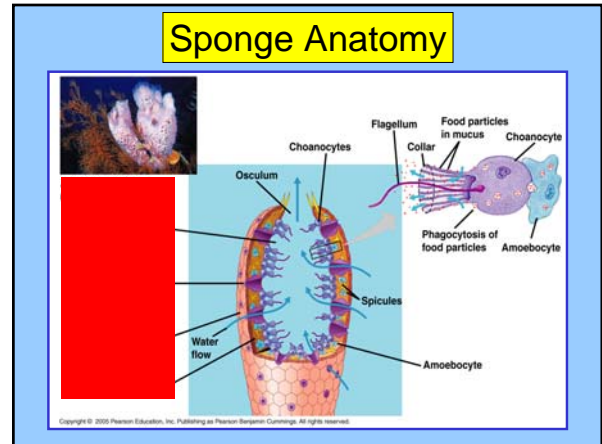
Some Animal Phyla

Phylum	Description
Porifera (sponges)	Lack true tissues, have choanocytes (collar-cells) specialized cells that ingest bacteria and tiny food particles
Cnidaria (jellyfish, polyps, sea anemones, hydras)	Shape arising among animals, each found in a specialized cell (cnidocytes) (poisonous stinging) (digestive compartment with a single opening)
Platyhelminthes (flatworms)	Evolutionarily flattened, unsegmented acoelomates, gastrovascular cavity or no digestive tract
Nemata (nematodes)	Parasitiform with alternative round (digestive) tube with mouth and anus (gastrovascular cavity), head with dorsal nerve
Mollusca (clams, snails, mussels)	Coelomates with three main body parts (respirator foot, visceral mass, mantle) (carbon dioxide, waste) have hard shell made of calcium carbonate
Annelida (segmented worms)	Coelomates with segmented body wall and dorsal (digestive) cavity (digestive tract, which is compartmentalized)
Nematoda (roundworms)	Cylindrical, unsegmented pseudocoelomates with tapered ends, no circulatory system
Arthropoda (insects, crustaceans, arachnids)	Coelomates with segmented body, jointed appendages, and circulatory made of protein and chitin
Mollusca (sea slugs, sea snails)	Coelomates with muscular foot (locomotion) (digestive tract) (respiratory system) (circulatory system)
Chordata (vertebrates, tunicates, lancelets)	Coelomates with notochord, dorsal hollow nerve cord, pharyngeal slits, muscular, post-anal tail


Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.



- Porifera Characteristics**
- ❑ Sponges
 - ❑ Sole member of the Parazoa
 - ❑ Lack true tissues, simplest of animals, no nerves or muscles
 - ❑ Choanocytes (collar cells) → "Unique flagellated cells that ingest bacteria and tiny food particles"
 - ❑ Choanocytes look a lot like Choanoflagellates
 - ❑ Amoebocytes transfer food to rest of cells
 - ❑ Adults sessile, larvae non-sessile
 - ❑ "Cells tend to be totipotent (retain zygote's ability to form the whole animal)"



Cnidaria



"Cnidarians include corals, jellies, and hydras. These animals share a distinctive body plan that includes a gastrovascular cavity with a single opening that serves as both mouth and anus." p. 639, Campbell and Reece (2005)


A jelly

Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Cnidaria Characteristics

- ❑ Hydras, Jellies, Sea Anemonies, Corals
- ❑ One member of the Radiata (also Ctenophora)
- ❑ Diploblastic, Carnivorous, Tentacled
- ❑ Lack true muscles (since no mesoderm)
- ❑ Possess nerve net
- ❑ Cnidocytes → Cells that shoot stinging or grasping threads at potential prey
- ❑ Gastrovascular cavity (only one opening) = Hydrostatic Skeleton
- ❑ Polyps vs. Medusa

Various Cnidarians



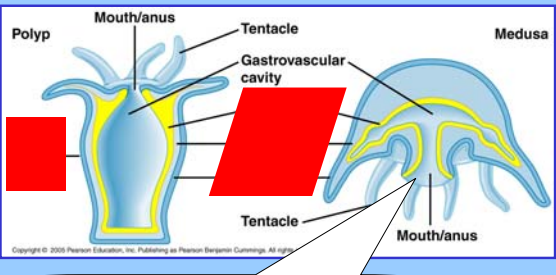
(a) Hydrozoans
Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

(b) Scyphozoans (jellies)

(c) Cubozoan (sea wasp)

(d) Anthozoan (sea anemone)

Cnidaria Anatomy



Polyp

Mouth/anus

Tentacle

Gastrovascular cavity

Medusa

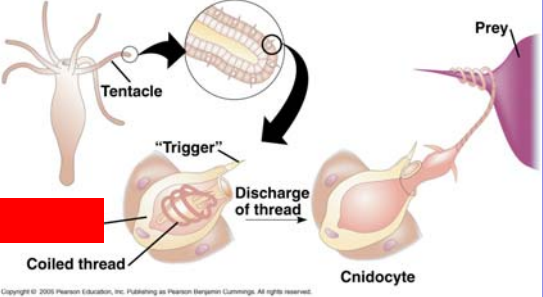
Tentacle

Mouth/anus

Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Don't forget that cnidarians are carnivorous

Cnidocytes



Tentacle

Prey

"Trigger"

Discharge of thread

Coiled thread

Cnidocyte

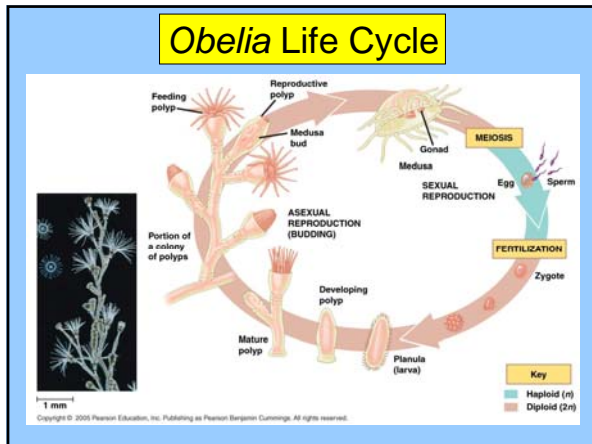
Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Cnidaria Classes

Table 33.1 Classes of Phylum Cnidaria

Class and Examples	Main Characteristics
Hydrozoa (Portuguese man-of-war, hydras, Obelia, some corals; see Figures 33.7a and 33.8)	Most marine, a few freshwater; both polyp and medusa stages in most species; polyp stage often colonial
Scyphozoa (jellies, sea nettles; see Figure 33.7b)	All marine; polyp stage reduced; free-swimming; medusae up to 2 m in diameter
Cubozoa (box jellies, sea wasps; see Figure 33.7c)	All marine; box-shaped medusae; complex eyes
Anthozoa (sea anemones, most corals, sea fans; see Figure 33.7d)	All marine; medusa stage completely absent; most sessile; many colonial

Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.



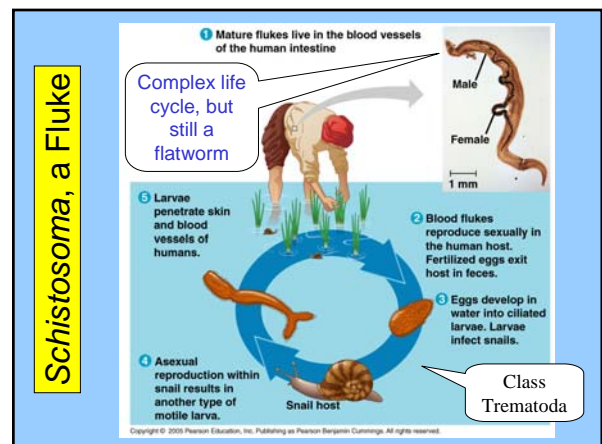
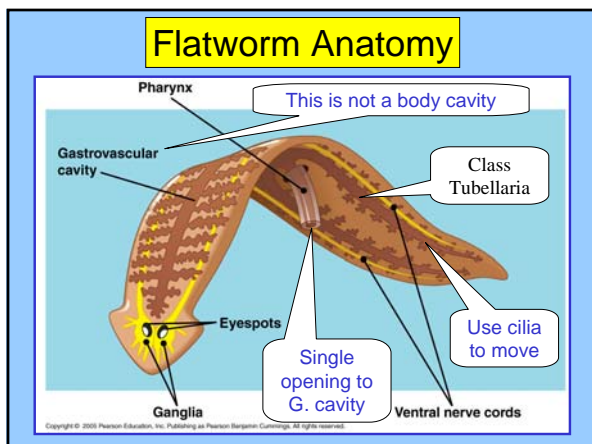
Platyhelminthes

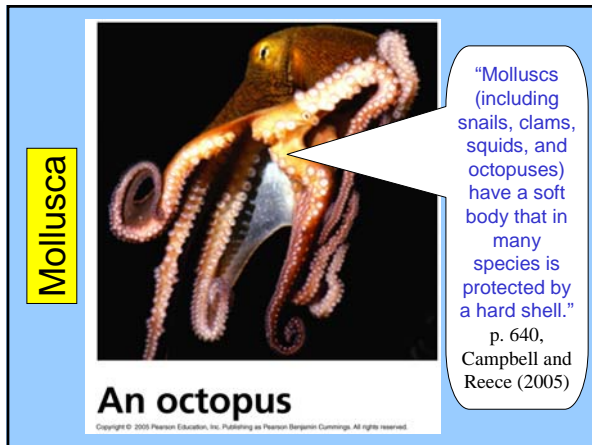
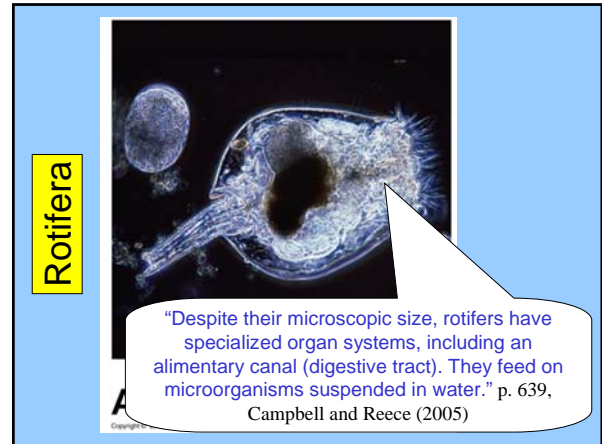
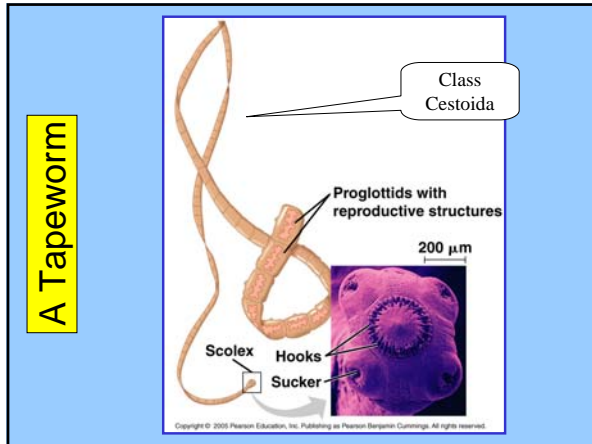
“Flatworms (including tapeworms, planarians, and flukes) have bilateral symmetry and a central nervous system that processes information from eyes and other sensory structures. They have no body cavity or organs for circulation.” p. 639, Campbell and Reece (2005)

- ### Platyhelminth Characteristics
- ❑ Flatworms (including Flukes and Tapeworms)
 - ❑ Bilaterally symmetrical acoelomates
 - ❑ Flat, unsegmented, single opening to gastrovascular cavity
 - ❑ Eyespots, flaps on head involved in sense of smell
 - ❑ No circulatory system (instead diffusion)
 - ❑ The flat shape makes diffusion a very real option for movement of stuff (digestive products, nitrogenous waste, oxygen, CO₂ about the animal or relative to the outside world)
 - ❑ Tapeworms have no digestive system
 - ❑ Use ventral cilia to locomote across surfaces (but some can swim)
 - ❑ Cephalized, have nervous system

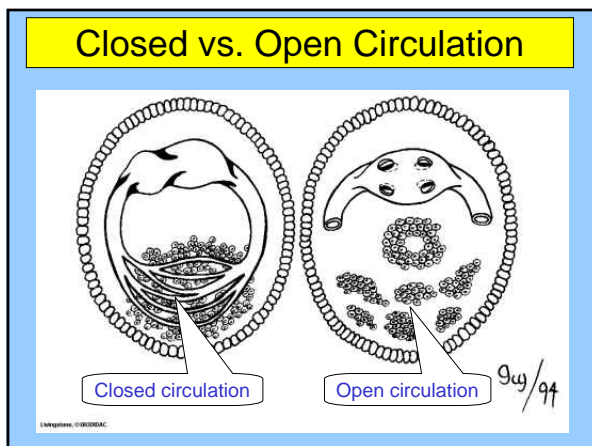
Platyhelminthes Classes

Table 33.2 Classes of Phylum Platyhelminthes	
Class and Examples	Main Characteristics
Turbellaria (mostly free-living flatworms, such as <i>Dugesia</i> ; see Figures 33.9 and 33.10)	Most marine, some freshwater, a few terrestrial; predators and scavengers; body surface ciliated
Monogenea (monogeneans)	Marine and freshwater parasites; most infect external surfaces of fishes; life history simple; ciliated larva starts infection on host
Trematoda (trematodes, also called flukes; see Figure 33.11)	Parasites; almost always of vertebrates; two suckers attach to host; most life cycles include intermediate hosts
Cestoda (tapeworms; see Figure 33.12)	Parasites of vertebrates; scolex attaches to host; proglottids produce eggs and break off after fertilization; no head or digestive system; life cycle with one or more intermediate hosts





- Mollusk Characteristics**
- Snails, Slugs, Clams, Squids, Octopi, etc.
 - Class Gastropoda, Class Bivalvia, Class Cephalopoda, etc.
 - Mollusks are Protostomes
 - Basic body plan built around a muscular foot, a visceral mass, and a mantle
 - Most (but not all) have calcium carbonate shell
 - Slugs and many cephalopods don't have a shell
 - Mollusks lack segmentation
 - Most have an Open Circulatory System
 - Cephalopods have Closed Circulatory System
 - A closed circulatory system is one in which blood flows throughout an animal entirely within a series of tubes



Mollusca Classes

Table 33.3 Major Classes of Phylum Mollusca	
Class and Examples	Main Characteristics
Gastropoda (snails, slugs; see Figures 33.18 and 33.19)	Marine, freshwater, or terrestrial; asymmetrical body; usually with a coiled shell; shell reduced or absent in some; foot for locomotion; radula
Bivalvia (clams, mussels, scallops, oysters; see Figures 33.20 and 33.21)	Marine and freshwater; flattened shell with two valves; head reduced; most are suspension feeders; mantle forms siphons
Cephalopoda (squids, octopuses, cuttlefish, chambered nautilus; see Figure 33.22)	Marine; head surrounded by grasping tentacles, usually with suckers; shell external, internal, or absent; mouth with or without radula; locomotion by jet propulsion using siphon made from foot

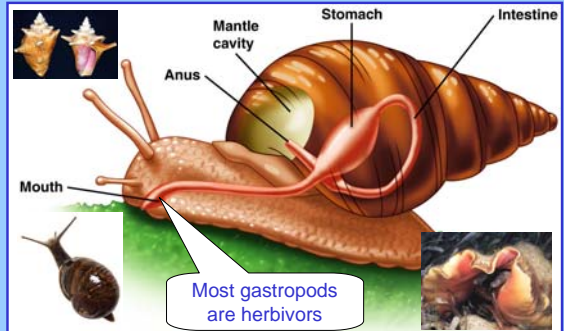
Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Class Polyplacophora (chitons)

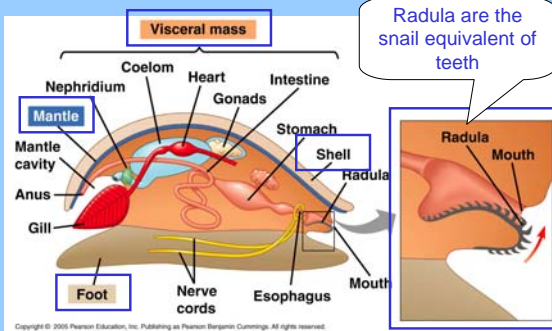


Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Class Gastropoda



Gastropoda Anatomy



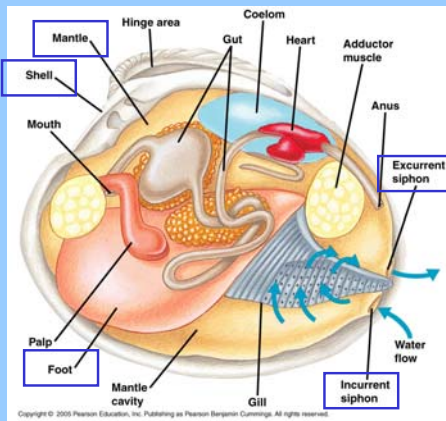
You should be able to ID the indicated parts on this diagram

Class Bivalvia



Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Bivalvia Anatomy

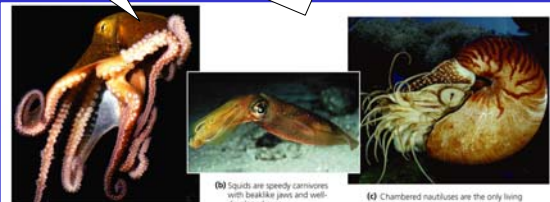


Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Class Cephalopoda

Cephalopods are carnivorous

Cephalopods include the largest invertebrates and also possess a closed circulatory systems




(a) Octopuses are considered among the most intelligent invertebrates.

(b) Squids are speedy carnivores with beaklike jaws and well-developed eyes.

(c) Chambered nautilus are the only living cephalopods with an external shell.

Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Annelida



“Annelids, or segmented worms, are distinguished from other worms by their body segmentation. Earthworms are the most familiar annelids, but the phylum also includes marine and freshwater species.” p. 640, Campbell and Reece (2005)

A marine annelid

Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Annelid Characteristics

- Phylum Annelida includes the segmented worms
- The segmented worms live in moist and wet environments
- The segmented worms are Protostomes
- These worms, of course, are also segmented
- They possess a closed circulatory system
- They are cephalized
- Earthworms (Oligochaeta), marine worms (Polychaeta), & leeches (Hirudinea) are all annelids

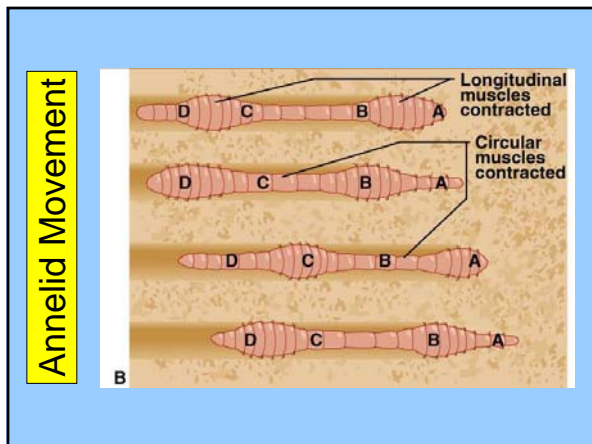
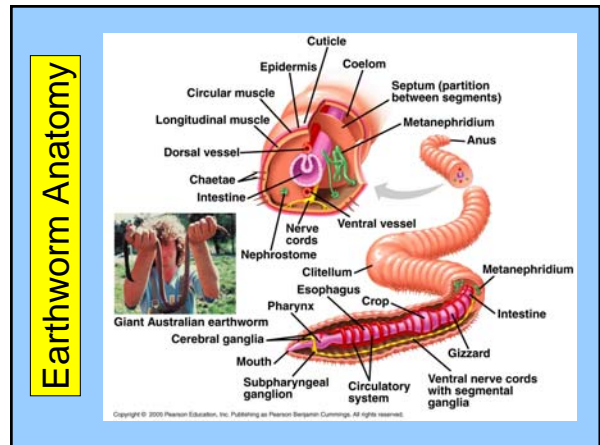


Annelida Classes


Table 33.4 Classes of Phylum Annelida

Class and Examples	Main Characteristics
Oligochaeta (freshwater, marine, and terrestrial segmented worms, such as earthworms; see Figure 33.23)	Reduced head; no parapodia, but chaetae present
Polychaeta (mostly marine segmented worms; see Figure 33.24)	Well-developed head; each segment usually has parapodia with chaetae; tube-dwelling and free-living
Hirudinea (leeches; see Figure 33.25)	Body usually flattened, with reduced coelom and segmentation; chaetae absent; suckers at anterior and posterior ends; parasites, predators, and scavengers

Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.



Nematoda



“Roundworms are enormously abundant and diverse in the soil and in aquatic habitats; many species parasitize plants and animals. The most distinctive feature of roundworms is a tough cuticle that coats the body,” p. 641, Campbell and Reece (2005)

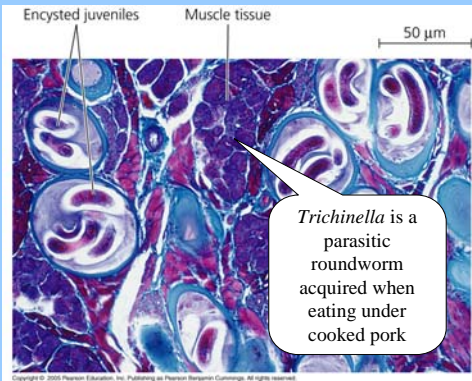
A roundworm

Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Nematode Characteristics

- Nematodes are the roundworms
- A tough but flexible cuticle covers their bodies
- "They have a complete digestive tract, and the pseudocoelom with its fluid serves as a blood vascular system that transports nutrients throughout the body."
- "Roundworms are among the most numerous of all animals in both species and individuals."
- Roundworms can be found in most moist habitats, both free living and as symbionts (including parasitic symbionts)
- There are many free-living nematodes
- Parasitic nematodes include pinworms and hookworms
- Includes *Caenorhabditis elegans*, a very important research organism to developmental biology

Roundworms & Trichinosis



Arthropoda



A scorpion
(an arachnid)

Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

"The vast majority of known animal species, including insects, crustaceans, and arachnids, are arthropods. All arthropods have segmented exoskeleton and jointed appendages." p. 641, Campbell and Reece (2005)

Arthropod Characteristics

- Insects, Crustaceans, Spiders, Scorpions, Horseshoe crabs, Millipedes, Centipedes, Ticks, Mites, etc. are all arthropods
- "On the criteria of species diversity, distribution, and sheer numbers, arthropods must be regarded as the most successful of all animal phyla." p. 656, Campbell & Reece (2005)
- Arthropods are protostomes with segmented bodies, jointed appendages, and hard, chitinous exoskeletons that they periodically molt
- "The diversity and success of arthropods is largely related to their segmentation, hard exoskeleton, and jointed appendages." p. 656, Campbell & Reece (2005)
- Arthropods also have well-developed senses and open circulation, circulating hemolymph

Arthropoda Subphyla

Table 33.5 Subphyla of Phylum Arthropoda

Subphylum and Examples	Main Characteristics
Cheliceriformes (horseshoe crabs, spiders, scorpions, ticks, mites; see Figures 33.30-33.32)	Two pairs of appendages (chelicerae, pedipalps, and four pairs of walking legs); mostly terrestrial or marine
Myriapoda (millipedes and centipedes; see Figures 33.33 and 33.34)	Distinct head bearing antennae and chewing mouthparts; terrestrial; millipedes are herbivorous and have two pairs of walking legs per trunk segment; centipedes are carnivorous and have one pair of walking legs per trunk segment and poison claws on first body segment
Hexapoda (insects; see Figures 33.35-33.37)	Body divided into head, thorax, and abdomen; antennae present; mouthparts modified for chewing, sucking, or lapping; three pairs of legs and usually two pairs of wings; mostly terrestrial
Crustacea (crabs, lobsters, crayfish, shrimp; see Figures 33.29 and 33.38)	Body of two or three parts; antennae present; chewing mouthparts; three or more pairs of legs; mostly marine and freshwater

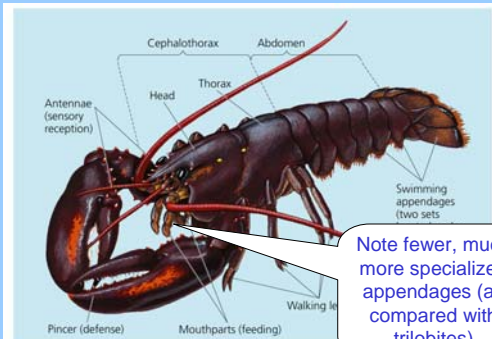
Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Trilobites: Extinct Arthropods



Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Lobster, a Crustacean



Note fewer, much more specialized appendages (as compared with trilobites)

Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Sub-Phylum Cheliceriformes



Chelicerae are feeding appendages



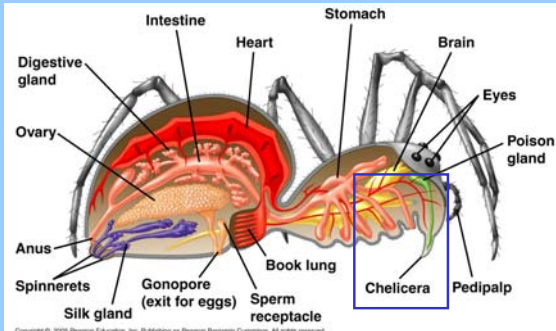
(a) Scorpions have pedipalps that are pincers, specialized for defense and the capture of food. The tip of the tail bears a poisonous stinger.

(b) Dust mites are ubiquitous scavengers in human dwellings but are harmless except to those people who are allergic to them. (colored SEM).

(c) Web-building spiders are generally most active during the daytime.

Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Cheliceriform Anatomy



Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Subphylum Myriapoda

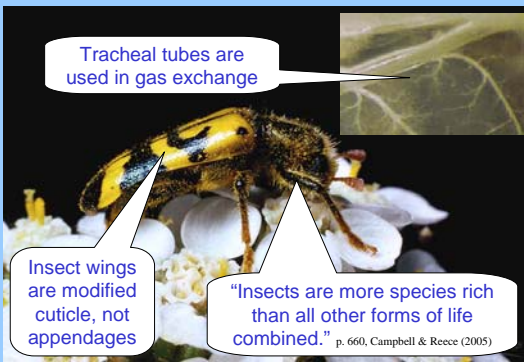


Millipedes, herbivores, were perhaps the first land animals



Centipedes are carnivores

Subphylum Hexopoda

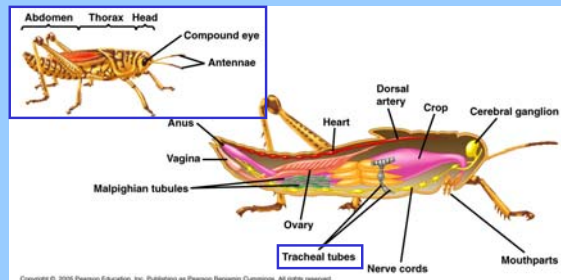


Tracheal tubes are used in gas exchange

Insect wings are modified cuticle, not appendages

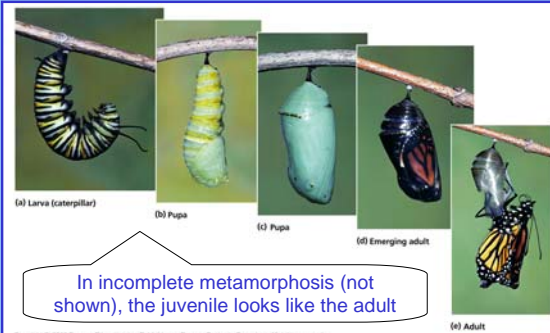
"Insects are more species rich than all other forms of life combined." p. 660, Campbell & Reece (2005)

Hexopoda Anatomy



Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Complete Metamorphosis



In incomplete metamorphosis (not shown), the juvenile looks like the adult

Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Phylum Crustacea



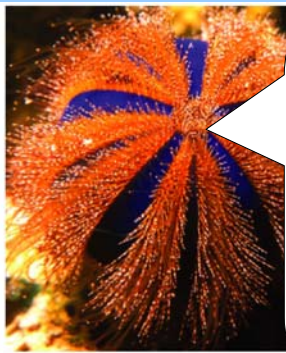
The crustaceans are the most successful of the extant *marine* arthropods



Many examples possess "gobs" of sophisticated appendages (e.g., 19 pairs for lobsters and crayfish including multiple examples of antennae, mouthparts, legs, and swimming appendages, on a single animal!)

Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Echinodermata



"Echinoderms, such as sand dollars, sea stars, and sea urchins, are aquatic animals that display radial symmetry as adults. They move and feed by using a network of internal cannals to pump water to different parts of the body." p. 641, Campbell and Reece (2005)

A sea urchin

Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Echinoderm Characteristics

- Sea stars, brittle stars, sea urchin, sea lilies, sea cucumbers
- Coelomates, Deuterostomes
- The Echinoderms "share features characteristic of deuterostomes: radial cleavage, development of the coelom from the archenteron, and formation of a mouth at the end of the embryo opposite the blastopore." p. 665, Campbell & Reece (2005)
- Multiple arms, tube feet, water vascular system, calciferous endoskeleton
- Radial symmetry, but radial symmetry likely derived (i.e., not radiata)
- Larvae are bilaterally symmetrical

Echinodermata Classes

Table 33.6 Classes of Phylum Echinodermata

Class and Examples	Main Characteristics
Asteroidea (sea stars; see Figures 33.39 and 33.40a)	Star-shaped body with multiple arms; mouth directed to substrate
Ophiuroidea (brittle stars; see Figure 33.40b)	Distinct central disk; long, flexible arms; tube feet lack suckers
Echinoidea (sea urchins, sand dollars; see Figure 33.40c)	Roughly spherical or disk-shaped; no arms; five rows of tube feet enable slow movement; mouth ringed by complex, jaw-like structure
Crinoidea (sea lilies, feather stars; see Figure 33.40d)	Feathered arms surrounding upward-pointing mouth
Holothuroidea (sea cucumbers; see Figure 33.40e)	Cucumber-shaped body; five rows of tube feet; additional tube feet modified as feeding tentacles; reduced skeleton; no spines
Concentricycloidea (sea daisies; see Figure 33.40f)	Disk-shaped body ringed with small spines; incomplete digestive system; live on submerged wood

Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Echinoderm Types



(a) A sea star (class Asteroidea)



(b) A brittle star (class Ophiuroidea)



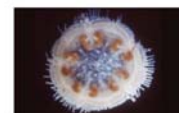
(c) A sea urchin (class Echinoidea)



(d) A feather star (class Crinoidea)



(e) A sea cucumber (class Holothuroidea)



(f) A sea daisy (class Concentricycloidea)

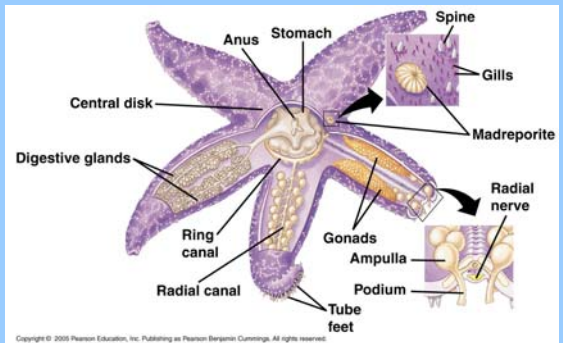
Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Sea Stars



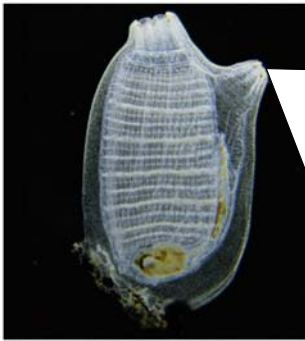
Sea stars possess multiple arms, upon which are numerous tube feet, and a calciferous endoskeleton

Echinoderm Anatomy



Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

Chordata



A tunicate

Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

"More than 90% of all chordate species are animals with backbones (vertebrates). However, the phylum Chordata also includes three groups of invertebrates: tunicates, lancelets, and hagfish." p. 641, Campbell and Reece (2005)

Link to Next Presentation

