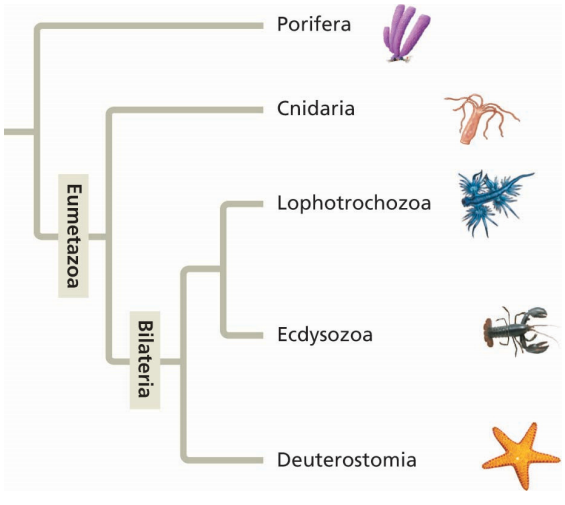
Chapter 33: An Introduction to Invertebrates

33.1 Describe the structure of the sponge body.
33.2 Characterize cnidarians and their life cycles.
33.3 Give examples of lophotrochozoans and describe their characteristics.
33.4 Give examples of ecdysozoans and describe their characteristics.
33.5 Identify major phylogenetic groups of deuterostomes and describe their characteristics.

Chapters 31, 32, and 33 should be considered as a single unit, and you should try to put the three chapters together in a single conceptual framework. It is not expected that you master the phylogeny of animals, but it will help you organize evolutionary adaptations if you become familiar with the names of some of the groups and the features that are unique to the group. For each of the phyla that we highlight in the following questions, learn the characters that are unique to that group and focus on the evolution of various systems. Our goal here is to direct your time and energy to the most fundamental information for each group. This will also help you be more literate in biology—we would be disappointed if our students did not know the difference between a reptile and an amphibian, or that insects have exoskeletons.

Study Tip: On the last page of this chapter's Reading Guide is a chart that you should fill out as you work through the concepts. Doing this will give you an opportunity to see the evolutionary changes as they occur.

This lengthy chapter is organized according to the Figure 33.1 in your text. Working with this figure will provide a touchstone for understanding the evolution of major phyla. Notice the five concepts for this chapter and the five divisions of the phylogenetic tree. Recreate the information in this figure, then take a second to look at the big picture. Trying to understand all the invertebrate phyla may be overwhelming but seeing the five evolutionary divisions is feasible.



Do not worry about all the technical names in Figure 33.2 in your text but spend a moment to enjoy and marvel at all the different forms of invertebrates.

1. What are invertebrates?

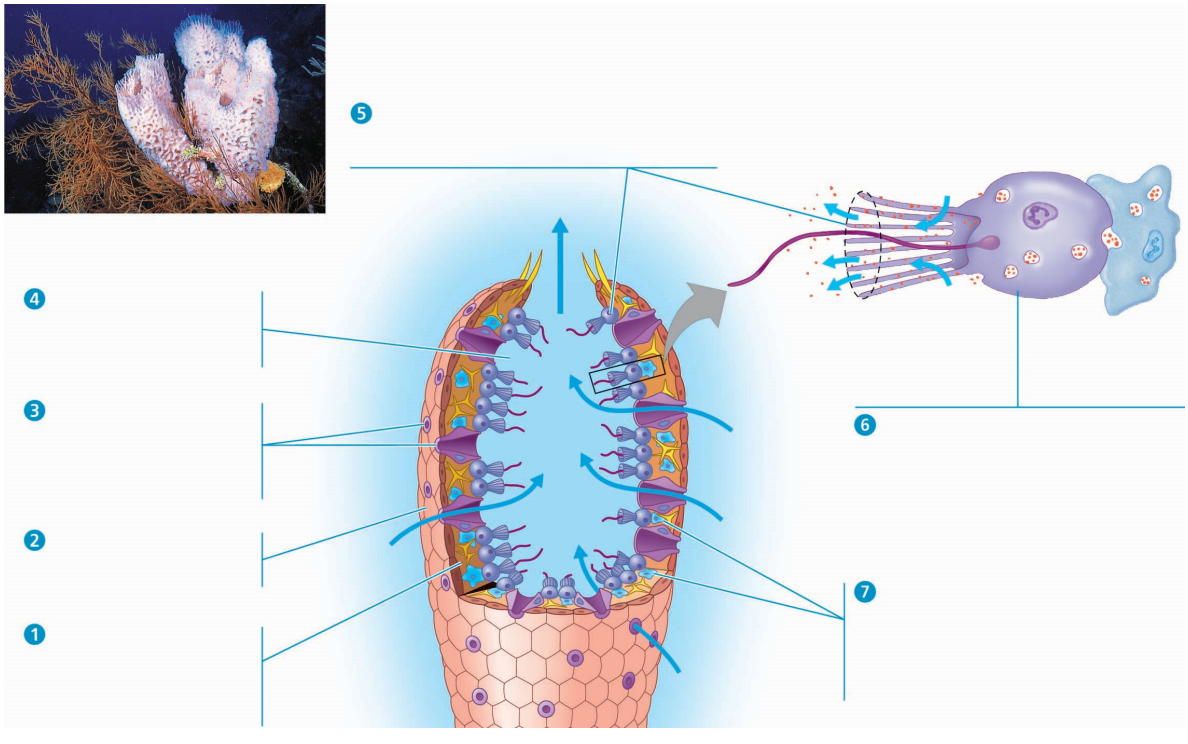
Concept 33.1 Sponges are basal animals that lack tissues

LO 33.1: Describe the structure of the sponge body.

As you read this concept fill out the first line on the chart found at the end of this chapter. Continue this pattern as new phyla are introduced.

2. You may have learned in an earlier course that sponges are in the phylum Porifera. This group is thought to be monophyletic, but scientists are still debating the issue. They are the simplest animals and lack true tissues. In the course of animal evolution, why are sponges considered to be *basal animals*?

3. Label the figure below, then at each number describe the structure's role. With a colored pencil draw the flow of water through the sponge.



4. Most sponges are *hermaphrodites*. What does this mean?

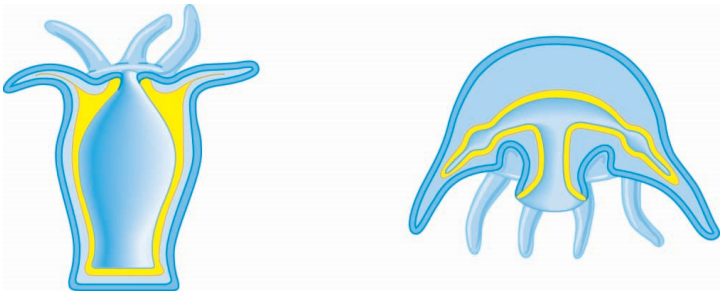
Concept 33.2 Cnidarians are an ancient phylum of eumetazoans

LO 33.2: Characterize cnidarians and their life cycles.

Now to the jellies (previously called jellyfish), hydras, sea anemones, corals, and their relatives. All the animals in this group have stinging cells and are called *cnidarians.*

5. An evolutionary jump is seen in the *eumetazoans*. Except for sponges, all animals are eumetazoans, meaning they have _____. An early clade from the eumetazoans is the phylum Cnidaria, which are characterized by a relatively simple, _____, _____ body plan.

6. Label the following using Figure 33.4 in your text as your guide. Below each diagram give two examples of cnidarians with that body plan. Color the *gastrovascular cavity*.



7. What are *nematocysts*, and how do they help a cnidarian obtain its food?

8. What is the "skeleton" of a cnidarian?

9. Explain how this type of support system works.

10. Although corals are relatively simple animals, their ecological importance to oceans is enormous. As your text states, "Coral reefs are to tropical seas what rain forest are to tropical land areas." What factors are placing coral reefs in danger?

As you finish this concept, cover the major evolutionary features by filling out the chart on cnidarians found at the end of this chapter.

Concept 33.3 Lophotrochozoans, a clade identified by molecular data, have the widest range of animal body forms

LO 33.3: Give examples of lophotrochozoans and describe their characteristics.

11. Look back at the first figure in this chapter, 33.1, and find the clade *Bilateria.* What two new evolutionary characteristics distinguish this group?

    a. Name the two additional characteristics most bilaterians demonstrate.

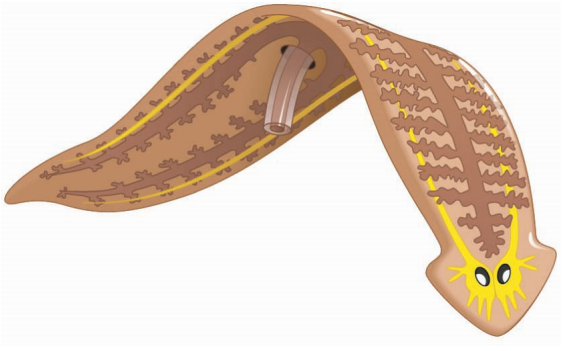
Bilateria are further divided into three major clades. Each clade will be featured in the next three Concepts in this chapter. The three clades are the Lophotrochozoa, Ecdysozoa, and the Deuterostomia. You may breathe a sigh of relief to know that while the technical terms are cumbersome and strange at this point, you will be familiar with most of the animal groups that fall under these clades. We are going to condense this section on the Lophotrochozoa and look at only three phyla: Platyhelminthes, Mollusca, and Annelida.

12. Platyhelminthes means "flatworm," which describes the shape of these worms. This is the first phylum that is triploblastic. Flatworms have no specialized system for gas exchange, so it occurs by diffusion. Refer to the *Make Connections* figure on p. 695 to see a beautiful flatworm. How does the shape of the flatworm body enhance the exchange of oxygen and carbon dioxide?

13. Here are three groups of flatworms you should know: planarians, flukes, and tapeworms. For each group, tell how they obtain food, and important features.

Examples	Lifestyle	Features to Note
Planarians		
Flukes (trematodes).		
Tapeworms		

14. Planarians are the only free-living (not parasitic) examples from the previous chart. Notice the presence of *eyespots* and *ganglia* in the planaria. Label all the structures on the planarian below. This is the first group with *bilateral symmetry* and sense organs concentrated at the anterior end. This is an important evolutionary trend.



15. Label the *mouth* in the planarian. Where do wastes leave? The digestive system seen here is sometimes called two-way. Why?

16. Trematodes often require two hosts, one of which can be a human. What is a common intermediate host?

    a. How do blood flukes infect humans? About how many people around the world suffer from the trematode disease *schistosomiasis*?

    b. What are its symptoms?

17. Look at the evil head of a tapeworm! How do they attach to the gut of the host? This is another worm with a complex life cycle. How might *you* get a tapeworm?

18. Tapeworms have no digestive system. Why not? Frame your response in terms of surface area as well as habitat.

This is a good point to complete the chart on the phylum Platyhelminthes at the end of the chapter.

19. The next phylum under the clade Lophotrochozoan is *Mollusca*. Look back at Figure 32.11 in your text to visualize the evolutionary relationships between phyla. Describe and give the functions of each of these important features of molluscs.

Mollusc Feature	Description	Function
muscular foot		
radula		
visceral mass		
mantle		

20. You are familiar with many molluscs. Give the key features of each class and provide examples.

Class	Key Features	Examples
Gastropoda		
Bivalvia		
Cephalopoda		

21. Molluscs account for about 40% of all documented extinctions of animal species. What are three major factors that have led to so many mollusc extinctions?

22. The final phylum in the group is the annelids (phylum *Annelida*), which includes leeches and earthworms.

    a. How do leeches manage to feed? In a related manner, how are they used in medicine?

    b. What important ecological role do earthworms play?

Concept 33.4 Ecdysozoans are the most species-rich animal group

LO 33.4: Give examples of ecdysozoans and describe their characteristics.

23. What do the root words that name this group mean?

    ecdyso–

    –zoan

24. The Nematodes (phylum *Nematoda*) include the worms we often call roundworms. Their bodies are cylindrical, unlike those of the flatworms, and lack segmentation. *Caenorhabditis elegans (C. elegans)*, a widely studied model research organism, is an example of a free-living nematode. Some interesting parasitic nematodes include the human parasites pinworms, hookworms, and *Trichinella*. How could you get trichinosis?

25. Parasites often display remarkable adaptations when it comes to taking resources from their hosts. *Trichinella* is no exception. How does *Trichinella* affect gene expression in its hosts?

26. Why are arthropods (phylum *Arthropoda*) considered the most successful of all animal phyla?

    If you were to invite all the arthropods on Earth home for dinner, about how many guests should you prepare for?

27. Arthropods have an *exoskeleton.* What molecule is it made of? How can an arthropod grow?

28. Describe the *open circulatory system* of arthropods. (Note that most molluscs have a similar type of circulatory system.)

29. How is respiration different in aquatic versus terrestrial arthropods?

30. Let's focus on some specific arthropod groups. *Arachnids* have _____ pairs of appendages and _____ pairs of walking legs. What are four examples of *arachnids*?

31. How do spiders obtain their food? (Extra straw. Anyone?)

32. Look back at Figure 33.8 on surface area. The figure uses four examples of maximizing surface area. Write a fifth example using *book lungs* as an example.

33. *Millipedes* and *centipedes* are placed in the subphylum Myriapoda, which means "many legs." Complete the following chart.

Example	Legs per Segment	Diet
Millipedes		
Centipedes		

34. *Crustaceans* are primarily aquatic arthropods and have many pairs of appendages. How many appendages does a lobster or a crayfish have?

35. Give four examples of crustaceans.

36. Insects form an enormous clade.

    a. How many legs do all members have?

    b. What are the three body regions of insects?

37. Insects show two types of metamorphosis. Explain each type and give examples for each one.

    incomplete metamorphosis

    complete metamorphosis

38. Are the wings of insects and the wings of birds homologous or analogous structures?

39. Beetles are everywhere—at least 350,000 species. Why are beetles so successful?

Concept 33.5 Echinoderms and chordates are deuterostomes

LO 33.5: Identify major phylogenetic groups of deuterostomes and describe their characteristics.

40. Look back at Figures 32.10 and 32.11 (pp. 682–683) to review deuterostome development and the phylogenetic tree showing this clade. DNA evidence indicates that echinoderms and chordates are closely related, with both phyla belonging to the _____ clade of _____ animals.

41. What does the phylum name *Echinodermata* mean?

42. Name three different echinoderm groups.

43. How does the unique *water vascular system* work?

    How does it function in locomotion and predation?

44. Sea stars seem at first glance to be radially symmetrical, as do many echinoderms. Why are they classified in the Bilateria clade?

45. Explain why echinoderms and chordates are closely related, but one group did not evolve from the other. (Hint: What do the two phyla share?)

46. Your comparison chart should be just about completed by now. The chordate row can wait until the next chapter. As a final review, go back to Figure 32.11 in your text and use it to note **key features** that separate the following taxa.

Porifera from all other groups

Cnidarians from all other groups

Echinodermata and chordates from other groups

Platyhelminthes from other protostomes

Nematodes from annelids and molluscs

Test Your Understanding, p. 717

Now you should be ready to test your knowledge. Place your answers here:

1._____ 2. _____ 3. _____ 4. _____ 5. _____

A Comparison of Important Features of Selected Animal Phyla

PHYLUM	Exam-ples	Unique Features	Circula-tory	Respira-tory	Nervous	Excreto-ry	Diges-tive
Porifera							
Cnidaria							
Platyhelminthes							
Mollusca							
Annelida							
Nematoda							
Arthropoda							
Echinodermata							
Chordata							