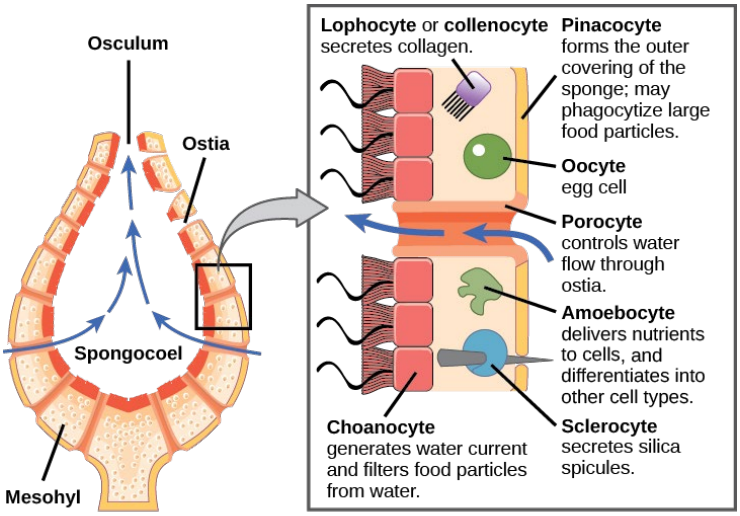
Biology 2e
Unit 5: Biological Diversity
Chapter 28: Invertebrates

Visual Connection Questions

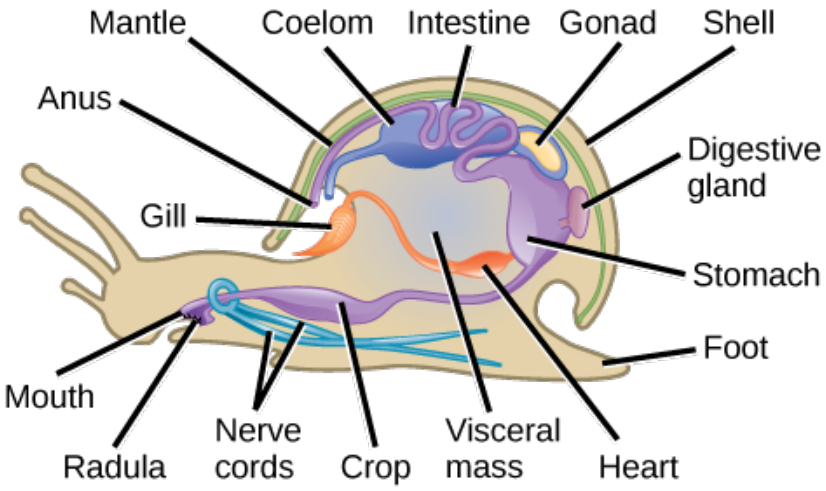
1. Which of the following statements is false?



(a) Basic sponge body plan (b) Some sponge cell types

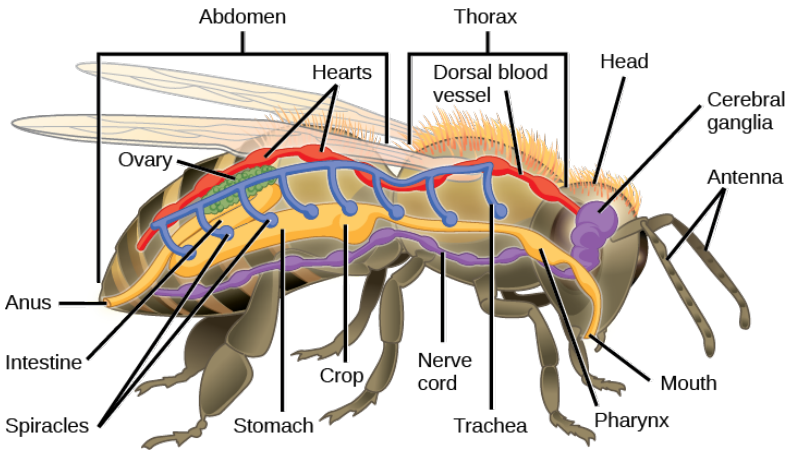
b. Pinacocytes can transform into any cell type.

2. Which of the following statements about the anatomy of a mollusk is false?



d. The digestive system includes a gizzard, a stomach, a digestive gland, and the intestine.

3. Which of the following statements about insects is false?



c. The trachea is part of the digestive system.

Review Questions

4. Mesohyl contains:

b. a collagen-like gel and suspended cells for various functions

5. The large central opening in the Parazoan body is called the:

d. osculum

6. Most sponge body plans are slight variations on a simple tube-within-a-tube design. Which of the following is a key limitation of sponge body plans?

b. The reliance on osmosis/diffusion requires a design that maximizes the surface area to volume ratio of the sponge.

7. Cnidocytes are found in _____.

d. phylum Cnidaria

8. Cubozoans are _____.

b. medusoids

9. While collecting specimens, a marine biologist finds a sessile Cnidarian. The medusas that bud from it swim by contracting a ring of muscle in their bells. To which class does this specimen belong?

c. Class Scyphozoa

10. Which group of flatworms are primarily ectoparasites of fish?

a. monogeneans

11. The rhynchocoel is a _____.
b. fluid-filled cavity

12. Annelids have a:
b. true coelom

13. A mantle and mantle cavity are present in:
c. phylum Mollusca

14. How does segmentation enhance annelid locomotion?
d. Muscle contractions can be localized to specific regions of the body to coordinate movement.

15. The embryonic development in nematodes can have up to _____ larval stages.
d. four

16. The nematode cuticle contains _____.
c. chitin

17. Crustaceans are _____.
a. ecdysozoans

18. Flies are_____.
b. hexapods

19. Which of the following is **not** a key advantage provided by the exoskeleton of terrestrial arthropods?
d. Grows with the arthropod throughout its life

20. Echinoderms have _____.
d. pentaradial symmetry

21. The circulatory fluid in echinoderms is _____.
c. water

22. Which of the following features does not distinguish humans as a member of phylum Chordata?
a. Human embryos undergo indeterminate cleavage.

23. The sister taxon of the Chordata is the _____.

Critical Thinking Questions

24. Describe the different cell types and their functions in sponges.

Pinacocytes are epithelial-like cells, form the outermost layer of sponges, and enclose a jelly-like substance called mesohyl. In some sponges, porocytes form ostia, single tube-shaped cells that act as valves to regulate the flow of water into the spongocoel. Choanocytes ("collar cells") are present at various locations, depending on the type of sponge, but they always line some space through which water flows and are used in feeding.

25. Describe the feeding mechanism of sponges and identify how it is different from other animals.

The sponges draw water carrying food particles into the spongocoel using the beating of flagella on the choanocytes. The food particles are caught by the collar of the choanocyte and are brought into the cell by phagocytosis. Digestion of the food particle takes place inside the cell. The difference between this and the mechanisms of other animals is that digestion takes place within cells rather than outside of cells. It means that the organism can feed only on particles smaller than the cells themselves.

26. Explain the function of nematocysts in cnidarians.

Nematocysts are "stinging cells" designed to paralyze prey. The nematocysts contain a neurotoxin that renders prey immobile.

27. Compare the structural differences between Porifera and Cnidaria.

Poriferans do not possess true tissues, while cnidarians do have tissues. Because of this difference, poriferans do not have a nervous system or muscles for locomotion, which cnidarians have.

28. Compare the differences in sexual reproduction between Porifera and Cubozoans. How does the difference in fertilization provide an evolutionary advantage to the Cubozoans?

There are two key differences between Porifera (sponges) and Cubozoans (box jellyfish) – gamete production and fertilization strategy. Box jellyfish have separate sexes, while a single sponge can produce both types of gametes. Box jellyfish also undergo internal fertilization, while sponges reproduce by external fertilization. Internal fertilization allows box jellyfish to control which sperm is used for fertilization and increases the likelihood of ova and spermatozoa meeting.

29. How does the tapeworm body plan support widespread dissemination of the parasite?

The tapeworm bodies are made of a series of small subunits called proglottids. Each proglottid contains a sexually mature reproductive system that can cross-fertilize within a single tapeworm. Proglottids containing fertilized eggs break off the tapeworm, and are transported to the environment to find a new host. Thus, each segment of a tapeworm's body is capable of infecting new hosts.

30. Describe the morphology and anatomy of mollusks.

Mollusks have a large muscular foot that may be modified in various ways, such as into tentacles, but it functions in locomotion. They have a mantle, a structure of tissue that covers and encloses the dorsal portion of the animal, and secretes the shell when it is present. The mantle encloses the mantle cavity, which houses the gills (when present), excretory pores, anus, and gonadopores. The coelom of mollusks is restricted to the region around the systemic heart. The main body cavity is a hemocoel. Many mollusks have a radula near the mouth that is used for scraping food.

31. What are the anatomical differences between nemertines and mollusks?

Mollusks have a shell, even if it is a reduced shell. Nemertines do not have a shell. Nemertines have a proboscis; mollusks do not. Nemertines have a closed circulatory system, whereas Mollusks have an open circulatory system.

32. How does a change in the circulatory system organization support the body designs in cephalopods compared to other mollusks?

Cephalopods have a closed circulatory system, while other members of the Mollusca phylum have open circulatory systems. Having a closed system allows blood to be moved more efficiently and rapidly through the animal, since the circulation is not limited by diffusion. For example, this allows the octopus to have a much more complex body plan, with branching tentacles, compared to a snail. In many cases, a closed circulatory system also allows the development of larger organisms.

33. Enumerate features of *Caenorhabditis elegans* that make it a valuable model system for biologists.

It is a true animal with at least rudiments of the physiological systems—feeding, nervous, muscle, and reproductive—found in “higher animals” like mice and humans. It is so small that large numbers can be raised in Petri dishes. It reproduces rapidly. It is transparent so that every cell in the living animal can be seen under the microscope. Before it dies (after 2–3 weeks), it shows signs of aging and thus may provide general clues as to the aging process.

34. What are the different ways in which nematodes can reproduce?

There are nematodes with separate sexes and hermaphrodites in addition to species that reproduce parthenogentically. The nematode *Caenorhabditis elegans* has a self-fertilizing hermaphrodite sex and a pure male sex.

35. Why are tardigrades essential to recolonizing habits following destruction or mass extinction?

Tardigrades are extremely hardy animals that are capable of surviving extreme conditions that kill other species. Following a catastrophic event in the ecosystem, tardigrades are likely to be one of the few surviving species. They can also function as a pioneer species that moves into a vacated habitat. Once the tardigrade population has expanded in the habitat, predators that use tardigrades as a food source are able to return. This pattern continues up the food web until the ecosystem is restored.

36. Describe the various superclasses that phylum Arthropoda can be divided into.

The Arthropoda include the Hexapoda, which are mandibulates with six legs, the Myriapoda, which are mandibulates with many legs and include the centipedes and millipedes, the Crustacea, which are mostly marine mandibulates, and the Chelicerata, which include the spiders and scorpions and their kin.

37. Compare and contrast the segmentation seen in phylum Annelida with that seen in phylum Arthropoda.

Arthropods have an exoskeleton, which is missing in annelids. Arthropod segmentation is more specialized with major organs concentrated in body tagma. Annelid segmentation is usually more uniform with the intestine extending through most segments.

38. How do terrestrial arthropods of the subphylum Hexapoda impact the world's food supply? Provide at least two positive and two negative effects.

Insects are the predominant members of the subphylum Hexapoda.
Advantages:

- Pollination
- Eliminate pests
- Cheap food source
- Produce food products (ex. honey)

Disadvantages:

- Damage to food crops
- Transmit disease to agricultural workers
- Contaminate/spoil food
- Destroy buildings storing food crops

39. Describe the different classes of echinoderms using examples.

The Asteroidea are the sea stars, the Echinoidea are the sea urchins and sand dollars, the Ophiuroidea are the brittle stars, the Crinoidea are the sea lilies and feather stars, the Holothuroidea are the sea cucumbers.