

25 Study Guide

Big idea Unity and Diversity of Life

Animals are multicellular, heterotrophic, eukaryotic organisms whose cells lack cell walls.

25.1 What Is an Animal?

Animals, members of the kingdom Animalia, are multicellular, heterotrophic, eukaryotic organisms whose cells lack cell walls.

Invertebrates include all animals that lack a backbone, or vertebral column.

All chordates exhibit four characteristics during at least one stage of life: a dorsal, hollow nerve cord; a notochord; a tail that extends beyond the anus; and pharyngeal pouches.

Like all organisms, animals must maintain homeostasis by gathering and responding to information, obtaining and distributing oxygen and nutrients, and collecting and eliminating carbon dioxide and other wastes. They also reproduce.

invertebrate (730)
chordate (731)
notochord (731)

pharyngeal pouch (731)
vertebrate (731)
feedback inhibition (732)



25.2 Animal Body Plans and Evolution

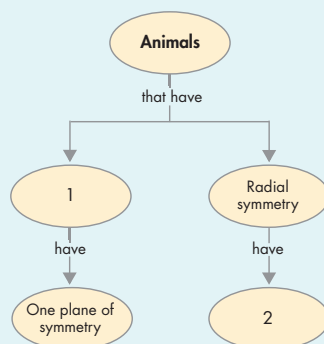
Features of animal body plans include levels of organization, body symmetry, differentiation of germ layers, formation of body cavities, patterns of embryological development, segmentation, cephalization, and limb formation.

Animal phyla are typically defined according to adult body plans and patterns of embryological development.

radial symmetry (738)
bilateral symmetry (738)
endoderm (738)
mesoderm (738)
ectoderm (738)
coelom (738)
pseudocoelom (738)
zygote (739)
blastula (739)
protostome (739)
deuterostome (739)
cephalization (740)

Think Visually

Using information from this chapter, complete the following concept map.



Study Online

BIOLOGY.com REVIEW AND ASSESSMENT RESOURCES

Editable Worksheets Pages of Study Workbooks A and B, Lab Manuals A and B, and the Assessment Resources Book are available online. These documents can easily be edited using a word-processing program.

Lesson Overview Have students reread the Lesson Overviews to help them study chapter concepts.

Vocabulary Review The *Flash Cards* and *Match It* provide an interactive way to review chapter vocabulary.

Chapter Assessment Have students take an online version of the Chapter 25 Assessment.

Standardized Test Prep Students can take an online version of the Standardized Test Prep. You will receive their scores along with ideas for remediation.

Diagnostic and Benchmark Tests Use these tests to monitor your students' progress and supply remediation.

Ubd Performance Tasks

SUMMATIVE TASK Have students use what they have learned about the essential functions of animals and their body plan features to assemble a class scrapbook. Divide the class into pairs, and assign each pair an essential function or a body plan feature described in the chapter. Each pair should prepare a two-page spread on the assigned topic. Students should use labeled drawings and/or photographs. Each spread in the scrapbook should have a title and a summary of the importance of the essential function or body plan feature.

TRANSFER TASK Ask students to imagine they have discovered a new animal. Then, divide the class into small groups, and ask each group to write an article for a science journal announcing its discovery. In their article, students should describe what the animal is like, explain how it meets the four criteria of an animal, and how it carries out essential functions. Finally, describe where it should be placed in the animal cladogram based on its body plan.

Answers

THINK VISUALLY

1. bilateral symmetry
2. any number of planes of symmetry

Lesson 25.1

UNDERSTAND KEY CONCEPTS

1. c 2. a 3. c 4. d
5. c 6. c
7. All members of the animal kingdom are multicellular, eukaryotic heterotrophs whose cells lack cell walls.
8. Feedback inhibition, or negative feedback, is a system in which the product or result of a process limits the process itself. Descriptions will vary. For example, when a person becomes too hot, he or she sweats to help lose heat. When the person is sufficiently cool, he or she will stop sweating.
9. The term *invertebrate* is used to describe all animals that are not chordates. It is a negative definition. Normally, a clade or category of true biological classification is defined by the presence of characteristics, rather than their absence.
10. The raccoon's nervous system collects and processes information such as the smell of a food source. The nervous and musculoskeletal systems move the raccoon to the food.

THINK CRITICALLY

11. Vertebrates develop a backbone made up of individual bones called vertebrae; nonvertebrate chordates do not.
12. The circulatory system picks up nutrients from the digestive system and oxygen from the respiratory system and takes these essential materials to all cells in the body. It also removes carbon dioxide from cells and carries it to the respiratory system for elimination.
13. Carbon dioxide exits the body through the respiratory system. Ammonia is removed by the excretory system.
14. Sensory receptors in the rabbit's nervous system gather visual, auditory, and chemical clues. This information is processed in the nervous system, which stimulates the muscles to contract, causing the rabbit to move away from the predator.

Lesson 25.2

UNDERSTAND KEY CONCEPTS

15. b 16. c 17. c
18. b 19. d 20. a 21. b
22. An acoelomate is an animal that lacks a body cavity or coelom.

25 Assessment

25.1 What Is an Animal?

Understand Key Concepts

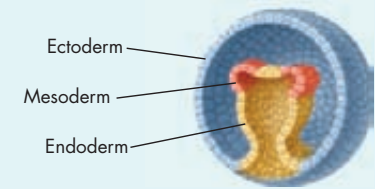
- A multicellular, eukaryotic heterotroph whose cells lack cell walls is a(n)
 - protist.
 - virus.
 - animal.
 - plant.
- Which of the following is characteristic of all chordates but not found in invertebrates?
 - a notochord
 - four legs
 - a circulatory system
 - an exoskeleton
- The process by which animals take in oxygen and give off carbon dioxide is known as
 - responding.
 - reproducing.
 - breathing.
 - excreting.
- Animals that have a backbone, also called a vertebral column, are known as
 - invertebrates.
 - prokaryotes.
 - homeostasis.
 - vertebrates.
- The job of collecting waste materials from a complex animal's body cells and delivering them to organs that will release them from the body is carried out by the
 - excretory system.
 - nervous system.
 - circulatory system.
 - digestive system.
- Most animals reproduce
 - sexually by producing diploid gametes.
 - asexually by cloning.
 - sexually by producing haploid gametes.
 - asexually by fission.
- List the characteristics shared by all members of the animal kingdom.
- Describe how feedback inhibition works.
- Explain why the word *invertebrate* may be a useful word but is not a true category in the system of classification.
- Which body systems are most involved when a raccoon discovers that a full trash can is a food source, and it knocks over the can to find the food?

Think Critically

- Classify** What characteristic distinguishes vertebrates from nonvertebrate chordates?
- Apply Concepts** In what ways do the digestive and respiratory systems depend on the circulatory system to carry out the functions of obtaining nutrients and eliminating wastes?
- Compare and Contrast** How does the way animals dispose of carbon dioxide differ from the way they dispose of ammonia?
- Relate Cause and Effect** Describe generally how the nervous and musculoskeletal systems of a rabbit react when it sees a predator such as a coyote.

25.2 Animal Body Plans and Evolution

Understand Key Concepts

15. Many animals have body symmetry with distinct front and back ends. This type of symmetry is
- radial.
 - bilateral.
 - circular.
 - dorsal.
16. The developing embryo shown below is a ____ group that includes ____.
- 
- protostome; invertebrates other than echinoderms
 - protostome; vertebrates
 - deuterostome; echinoderms and chordates
 - deuterostome; invertebrates
17. An animal whose mouth is formed from the blastopore is a(n)
- deuterostome.
 - endoderm.
 - protostome.
 - mesoderm.

23. In protostomes, the blastopore becomes the mouth, and the anus forms from a second opening at the opposite end of a tube that connects the two openings. In deuterostomes, the blastopore becomes the anus, and the mouth is formed from a second opening.
24. a hollow ball of cells
25. ectoderm, mesoderm, endoderm
26. Sample answer: bilateral symmetry and segmentation
27. With cephalization, animals respond efficiently, because sense organs and nerve

cells generally encounter the environment first.

THINK CRITICALLY

28. Animals with bilateral symmetry usually have specialized anterior, posterior, dorsal, and ventral regions. Sense organs are clustered at the head end, encounter the environment first, and give the animal an advantage in orientation, navigation, feeding, and defense.
29. multicellularity, tissues, protostome development, deuterostome development

18. A concentration of sense organs and nerve cells in the anterior end of the body is known as
- fertilization.
 - cephalization.
 - symmetry.
 - multicellularity.
19. Which of the following animals shows radial symmetry?
- earthworm
 - fish
 - insect
 - sea anemone
20. Which germ layer produces the nerves and sense organs of animals?
- ectoderm
 - endoderm
 - mesoderm
 - periderm
21. Most chordates that live on land have
- two limbs.
 - four limbs.
 - six limbs.
 - eight limbs.
22. What is an acoelomate?
23. Describe the major developmental difference that distinguishes protostomes from deuterostomes.
24. What is a blastula?
25. List the three germ layers.
26. Name two body plan characteristics shared by all arthropods and vertebrates.
27. What is one major advantage of cephalization?

Think Critically


28. **Apply Concepts** Why is bilateral symmetry an important development in the evolution of animals?
29. **Sequence** Rank the following developments in the order of their appearance during evolution: tissues, deuterostome development, multicellularity, protostome development.
30. **Form a Hypothesis** Animals with radial symmetry, such as sea anemones, lack cephalization, while animals with bilateral symmetry have it. State a hypothesis that would explain this observation.
31. **Infer** Why is it inaccurate to state that the cladogram of animals shows the improvements in body plans that have occurred over time?


solve the CHAPTER MYSTERY

SLIME DAY AT THE BEACH

Although most people had never seen creatures like these before, biologists had no trouble identifying them. They were salps—descendants of the most ancient members of phylum Chordata. Salps belong to a group of chordates called tunicates. As adults, most tunicates live attached to rocks or the seafloor. Salps are unusual among tunicates: The adults are free-swimming. They pump water in through their mouths and out the other end, feeding and propelling themselves through the water at the same time. Salps are usually found in the surface waters of tropical seas, but they can be carried north by the Gulf Stream and are sometimes washed onto beaches by storms.

- Compare and Contrast** How are salps different from jellyfish?
- Connect to the Big idea** Use the Internet to research salps and other tunicates. Explain why these peculiar-looking animals are classified in the phylum Chordata.





CHAPTER MYSTERY

After students have read through the Chapter Mystery, discuss the characteristics of salps to confirm where they fit into the animal kingdom.

Ask What two functions does the mouth of a salp serve? (*By taking water into the mouth and pumping it out the other end, a salp is propelled through the water. At the same time, it feeds on matter in the incoming water.*)

Ask What characteristics distinguish salps from other tunicates? (*In contrast to other tunicates, salps are free-swimming.*)

Ask If salps show bilateral symmetry and propel themselves through the water, what might you infer about their nervous system? Explain. (*You could infer that they have some cephalization, with nerve cells at the anterior end.*)

CHAPTER MYSTERY ANSWERS

- Salps are chordates: they are deuterostomes with bilateral symmetry and two body openings. Jellyfish are invertebrates: they are protostomes with radial symmetry and one body opening.
- Big idea** The characteristics that define chordates are a notochord; a dorsal, hollow nerve cord; pharyngeal pouches; and a postanal tail. Tunicates are classified as chordates, because at least while they are larvae, they show these characteristics. By the time they metamorphose to adulthood, however, most tunicates have lost all of these characteristics except the pharyngeal pouches.



Follow the crew of Untamed Science in the short movie, **What Is an Animal?**, as they find out how scientists decide if an organism is an animal.

30. Sample answer: Animals with radial symmetry have no cephalization, because they have no anterior end, while animals with bilateral symmetry have an anterior end and may exhibit cephalization.
31. While body plans in some groups may appear to be more “complex,” it is inaccurate to say they are “improved.” The fact that groups with less complex bodies continue to survive indicates that they are well adapted to their environments.

Connecting Concepts

USE SCIENCE GRAPHICS

32. Body temperature appears closest to the environment around 3 P.M.
33. There is virtually no relationship between body temperature and the temperature of the environment. Body temperature is largely independent of environmental temperature.
34. There is a minuscule increase in body temperature at the highest environmental reading. Basically, body temperature stays relatively constant throughout the day, no matter what the temperature of the environment is. Body temperature is controlled homeostatically through feedback inhibition.

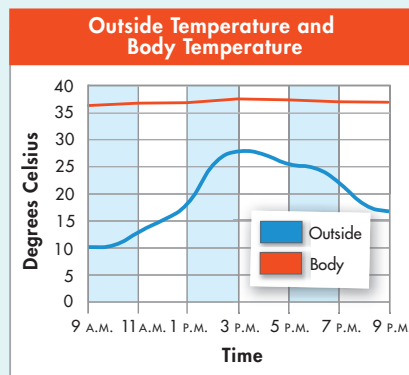
WRITE ABOUT SCIENCE

35. Sample answer: Cephalization concentrates sense organs and nervous tissue in the part of the body that encounters the environment first. Such concentration allows specialization of senses and responses to specific environmental conditions experienced by the animal. Segmentation allows modification of similar structures in different segments to adapt the animal to its environment.
36. **Big idea** Sample answer: I would look for evidence of multicellularity (if it were large enough to see without a microscope, it would be multicellular). I would then examine its cells for the presence of nuclei and the absence of cell walls. I would also look for evidence of heterotrophism, perhaps by seeing if it eats smaller organisms near it.

Connecting Concepts

Use Science Graphics

Use the graph to answer questions 32–34.



32. **Interpret Graphs** At what time of day is the body temperature closest to that of the outside environment?
33. **Draw Conclusions** What is the relationship between body temperature and the temperature of the environment?
34. **Infer** How do you explain the shape of the graph for body temperature?

Write About Science

35. **Explanation** Discuss how cephalization and segmentation have helped animals achieve such great diversity.
36. **Assess the Big idea** If you were presented with a small, living organism, how would you try to determine whether it was an animal?

Analyzing Data

The human digestive system converts food into glucose, a sugar that the body can use for energy. The following data were collected by taking a sample of blood from a person at various times during the day and measuring the relative volume of glucose in the blood.

Time of Day	Amount of Glucose (mg/100 mL)
9 A.M.	102
10 A.M.	98
11 A.M.	130
12 noon	115
1 P.M.	103
2 P.M.	100
3 P.M.	102

37. **Interpret Tables** During which time interval is it most likely that this person ate a meal?
 - a. 9 A.M. to 10 A.M.
 - b. 10 A.M. to 11 A.M.
 - c. 1 P.M. to 2 P.M.
 - d. 2 P.M. to 3 P.M.
38. **Infer** Which value in the table would you expect to be closest to the homeostatic value for the amount of glucose in the blood?
39. **Apply Concepts** Explain how feedback inhibition might be involved in the changing levels of glucose in the blood.

Analyzing Data

PURPOSE Students will analyze data to understand the effect of time on blood glucose levels.

PLANNING Explain to students that after eating, food is broken down to glucose in the digestive system. A healthy pancreas produces insulin, which acts as a gatekeeper, allowing glucose to enter cells where it can be broken down to release energy.

ANSWERS

37. b
38. About 102 mg/100 mL
39. Sample answer: The body likely has a way to sense changing glucose levels in the blood and regulate it with feedback inhibition. If glucose levels are high (such as after a meal), the body will decrease blood glucose levels. If glucose levels get too low, the body will respond by increasing blood glucose levels.

Standardized Test Prep

Multiple Choice

- Which of the following is a type of tissue that arises in most animals during development?
A endoderm C ectoderm
B mesoderm D all of the above
- Which of the following is NOT a characteristic of animals?
A the ability to make their own food
B the ability to move
C eukaryotic cells
D cells that lack cell walls
- A hollow ball of cells formed after the zygote undergoes division is called a
A coelom. C deuterostome.
B protostome. D blastula.
- Which trend did NOT occur during invertebrate evolution?
A specialization of cells
B development of a notochord
C bilateral symmetry
D cephalization
- What is a function of the excretory system?
A to supply cells with oxygen and nutrients
B to rid the body of metabolic wastes
C to gather information from the environment
D to break down food
- Animals often respond to information processed by their nervous system by moving around, using their
A circulatory system.
B excretory system.
C musculoskeletal system.
D digestive system.
- The concentration of nerve tissue and organs in one end of the body is called
A cephalization.
B segmentation.
C body symmetry.
D nerve nets.

Questions 8 and 9

A biology student has two samples of earthworms in soil, as shown below. The student knows that, because the worms' body temperature changes with the environment, the worms in Sample A have a higher body temperature than those in Sample B. The student uses a stereomicroscope to count the number of heartbeats per minute for three worms from each sample.



Sample A:
At temperature of
worms' soil environment

Sample B:
In ice water

- Look at the student's two samples. What can you conclude?
A Sample A is the control.
B Sample B is the control.
C Either sample can serve as a control.
D This is not a controlled experiment.
- The student finds that the worms from Sample A have a faster heart rate than the worms from Sample B. What hypothesis might you form based on this observation?
A The worms in Sample A are healthier than the worms in Sample B.
B A decrease in body temperature corresponds to an increase in heart rate.
C There is no relationship between body temperature and heart rate.
D A decrease in body temperature corresponds to a decrease in heart rate.

Open-Ended Response

- What characteristics distinguish invertebrates from nonvertebrate chordates?

Answers

- D
- A
- D
- B
- B
- C
- A
- A
- A
- Nonvertebrate chordates are animals that have a dorsal nerve cord, pharyngeal pouches, a tail that extends beyond the anus, and a notochord at some time during development. Invertebrates do not have all of the above characteristics.

If You Have Trouble With . . .

Question	1	2	3	4	5	6	7	8	9	10
See Lesson	25.2	25.1	25.2	25.2	25.1	25.1	25.2	25.1	25.1	25.1

Introduction to Animals **749**

Test-Taking Tip

READ ALL THE ANSWER CHOICES

Caution students that when evaluating multiple-choice answers, they should read all of the answer choices before making a selection. Even if the first choice seems correct, students should make certain the one they choose is the best answer.