Chapter 26 Organizer

Refer to pages 4T-5T of the Teacher Guide for an explanation of the National Science Education Standards correlations.

Section	Objectives	Activities/Features
Section 26.1 **Sponges** NSES UCP.1, UCP.5; C.1, C.5-6 (1/2 session)	1. **Relate** the sessile life of sponges to their food-gathering adaptations. 2. **Describe** the reproductive adaptations of sponges.	**Inside Story:** A Sponge, p. 714 **Problem-Solving Lab 26-1:** p. 715
Section 26.2 **Cnidarians** NSES UCP.1, UCP.3, UCP.5; A.1, A.2; C.1, C.3, C.5-6; F.3, F.4 (1 session)	3. **Distinguish** the different classes of cnidarians. 4. **Sequence** the stages in the life cycle of cnidarians. 5. **Evaluate** the adaptations of cnidarians for obtaining food.	**MiniLab 26-1:** Watching Hydra Feed, p. 719 **Inside Story:** A Cnidarian, p. 720 **Problem-Solving Lab 26-2:** p. 724 **Biology & Society:** Why are the corals dying? p. 736
Section 26.3 **Flatworms** NSES UCP.1, UCP.5; A.1; C.3, C.5-6; F.1, F.5; G.1 (1 session)	6. **Distinguish** the adaptive structures of parasitic flatworms and free-living planarians. 7. **Explain** how parasitic flatworms are adapted to their way of life.	**Problem-Solving Lab 26-3:** p. 727 **Inside Story:** A Planarian, p. 728 **Investigate BioLab:** Observing Planarian Regeneration, p.734
Section 26.4 **Roundworms** NSES UCP.1, UCP.5; A.1, A.2; C.5-6; E.1, E.2; F.1, F.5; G.1, G.2 (1 1/2 sessions)	8. **Compare** the structural adaptations of roundworms and flatworms. 9. **Identify** the characteristics of four roundworm parasites.	**MiniLab 26-2:** Observing the Larval Stage of a Pork Worm, p. 732 **Problem-Solving Lab 26-4:** p. 733

Need Materials? Contact Carolina Biological Supply Company at 1-800-334-5551 or at **http://www.carolina.com**

MATERIALS LIST

BioLab

p. 734 planarian culture, petri dish, springwater, camel hair brush, microscope slide, stereomicroscope, single-edged razor blade, marking pencil

MiniLabs

p. 719 microscope, watch glass, dropper, culture dish, hydra culture, brine shrimp culture, water

p. 732 microscope, prepared slide of pork worm larvae

Alternative Lab

p. 714 stereomicroscope, forceps, balance, wax pencil, beakers, petri dish, sea sponges, unused synthetic sponges

Quick Demos

p. 716 dried marine sponges

p. 720 microprojector, prepared slides of nematocysts

p. 728 slide projector, planarian culture, water, 35-mm deep-well slide

Key to Teaching Strategies

- L1 Level 1 activities should be appropriate for students with learning difficulties.
- L2 Level 2 activities should be within the ability range of all students.
- L3 Level 3 activities are designed for above-average students.
- ELL ELL activities should be within the ability range of English Language Learners.
- COOP LEARN Cooperative Learning activities are designed for small group work.
- P These strategies represent student products that can be placed into a best-work portfolio.
- These strategies are useful in a block scheduling format.

Sponges, Cnidarians, Flatworms, and Roundworms

Teacher Classroom Resources

Section	Reproducible Masters	Transparencies
Section 26.1 **Sponges**	Reinforcement and Study Guide, p. 115 L2 Concept Mapping, p. 26 L3 ELL Critical Thinking/Problem Solving, p. 26 L3 Content Mastery, pp. 129-132 L1	Section Focus Transparency 63 L1 ELL Basic Concepts Transparency 45 L2 ELL Basic Concepts Transparency 46 L2 ELL
Section 26.2 **Cnidarians**	Reinforcement and Study Guide, p. 116 L2 BioLab and MiniLab Worksheets, p. 117 L2 Laboratory Manual, pp. 187-188 L2	Section Focus Transparency 64 L1 ELL Basic Concepts Transparency 45 L2 ELL Basic Concepts Transparency 46 L2 ELL Basic Concepts Transparency 47 L2 ELL
Section 26.3 **Flatworms**	Reinforcement and Study Guide, p. 117 L2 Laboratory Manual, pp. 189-190 L2 Content Mastery, pp. 129-132 L1	Section Focus Transparency 65 L1 ELL Reteaching Skills Transparency 39 L1 ELL
Section 26.4 **Roundworms**	Reinforcement and Study Guide, p. 118 L2 BioLab and MiniLab Worksheets, pp. 118-120 L2 Content Mastery, pp. 129-132 L1	Section Focus Transparency 66 L1 ELL

Assessment Resources

Chapter Assessment, pp. 151-156
MindJogger Videoquizzes
Performance Assessment in the Biology Classroom
Alternate Assessment in the Science Classroom
Computer Test Bank
BDOL Interactive CD-ROM, Chapter 26 quiz

Additional Resources

Spanish Resources L1 ELL
English/Spanish Audiocassettes L1 ELL
Cooperative Learning in the Science Classroom COOP LEARN
Lesson Plans/Block Scheduling

NATIONAL GEOGRAPHIC Teacher's Corner

Index to National Geographic Magazine

The following articles may be used for research relating to this chapter:

"Consider the Sponge," by Michael E. Long, March 1977.

GLENCOE TECHNOLOGY

The following multimedia resources are available from Glencoe.

Biology: The Dynamics of Life

CD-ROM ELL

Video: *Ocean Cnidarians*
Video: *Coral Reefs*
BioQuest: *Biodiversity Park*

Videodisc Program

Ocean Cnidarians

The Infinite Voyage

To the Edge of the Earth

Getting Started Demo

Visual-Spatial Have students observe the live freshwater sponge, *Spongilla,* with hand lenses. Ask students to note the asymmetrical shape of the sponge and its many pores. Explain that all sponges have a large number of pores. L2 ELL

Theme Development

The themes of **evolution** and **homeostasis** are emphasized in this chapter. Evolutionary relationships among the animal phyla are stressed, as are adaptations to the environment and the homeostatic mechanisms at work in the different animals.

0:00 Out of Time?

If time does not permit teaching the entire chapter, use the BioDigest at the end of the unit as an overview.

GLENCOE TECHNOLOGY

CD-ROM
Biology: The Dynamics of Life Exploration: *The Five Kingdoms* Disc 3

Resource Manager

Section Focus Transparency 63 and Master L1 ELL

Chapter

26 Sponges, Cnidarians, Flatworms, and Roundworms

What You'll Learn

- You will compare and contrast the characteristics of sponges, cnidarians, flatworms, and roundworms.
- You will describe how sponges, cnidarians, flatworms, and roundworms are adapted to their habitats.

Why It's Important

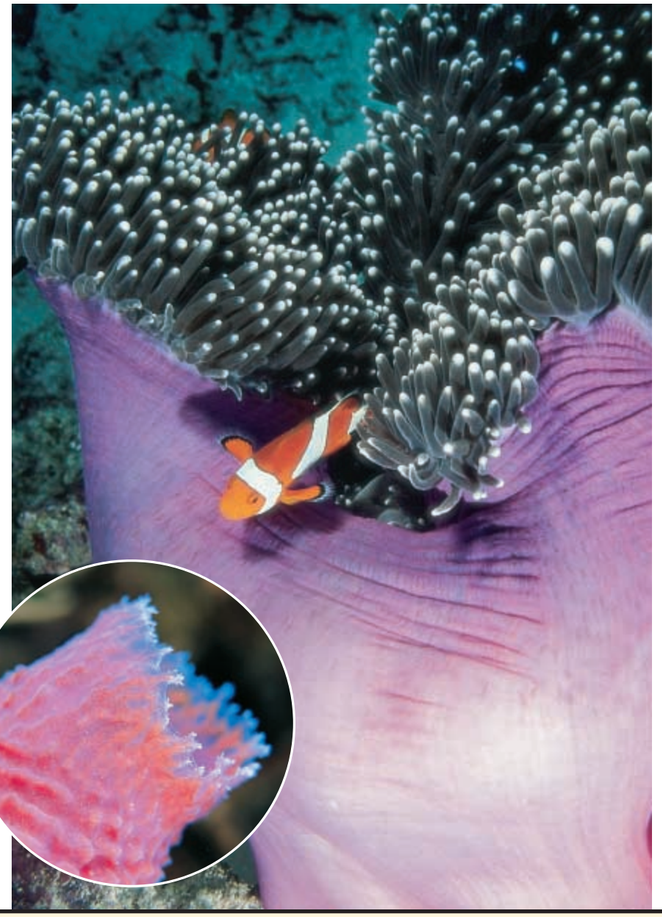
Sponges and cnidarians are two major groups of animals that are important to aquatic biomes. Flatworms and roundworms include many species that cause diseases that affect both plants and animals.

Getting Started

Observing a Sponge

Look at a natural bath sponge using a hand lens or under a binocular microscope. *Does a sponge have a skeleton?*

interNET CONNECTION To find out more about sponges, cnidarians, flatworms, and roundworms, visit the Glencoe Science Web Site. **www.glencoe.com/sec/science**



The sea anemone and the sponge (inset) share common traits. Both are invertebrates with simple body plans.

Multiple Learning Styles

Look for the following logos for strategies that emphasize different learning modalities.

Kinesthetic Quick Demo p. 716; Building a Model, p. 722

Visual-Spatial Biology Journal, p. 716; Meeting Individual Needs, pp. 716, 723; Visual Learning, p. 720, Biology Journal, pp. 721, 723, 729; Display, p. 721; Tech Prep, p. 729

Interpersonal Portfolio, p. 722; Reteach, p. 725

Intrapersonal Cultural Diversity, p. 718; Going Further, p. 736

Linguistic Enrichment, p. 716; Portfolio, p. 727

Naturalist Meeting Individual Needs, p. 728; Check for Understanding, p. 729; Portfolio, p. 731

Section

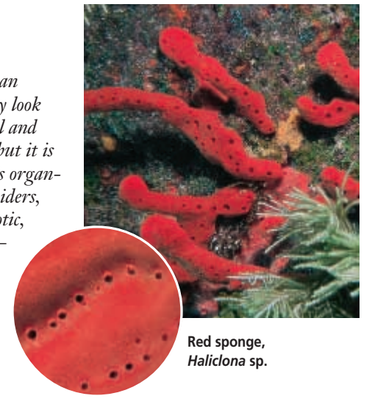
26.1 Sponges

SECTION PREVIEW

Objectives
Relate the sessile life of sponges to their food-gathering adaptations.
Describe the reproductive adaptations of sponges.

Vocabulary
filter feeding
hermaphrodite
external fertilization
internal fertilization

Is this red organism a plant or an animal? At first glance, it may look like a plant because it is colorful and doesn't move from place to place, but it is an animal. How do you know this organism is an animal? Like snakes, spiders, and you, this organism is eukaryotic, multicellular, and heterotrophic—characteristics that place it in the animal kingdom. This sessile animal is a sponge that filters water through many small pores on the outside of its body.



Red sponge, *Haliclona* sp.

What Is a Sponge?

Sponges are asymmetrical aquatic animals that have a variety of colors, shapes, and sizes. Many are bright shades of red, orange, yellow, and green. Some sponges are ball shaped; others have many branches. Sponges can be as small as a quarter or as large as a door. Although sponges do not resemble more familiar animals, they carry on the same life processes as all animals. ***Figure 26.1*** shows a natural sponge harvested from the ocean.

Sponges are pore-bearers

Sponges are classified in the invertebrate phylum Porifera, which means *pore-bearer.* Of the 5000 described species of sponges, most live in the ocean; only 100 species can be found in freshwater environments.

No matter where sponges live, they are mainly sessile organisms. Because most adult sponges are sessile, they can't travel in search of food. Sponges get their food by **filter feeding,** a method in which an organism feeds by filtering small particles of food from water as it passes by or through some part of the organism. How does a sponge get rid of its wastes? Find out by reading the *Inside Story.*

Word Origin
porifera
From the Latin words *porus*, meaning "pore," and *fera*, meaning "bearer." Phylum Porifera includes animals with pores that allow water to flow through their bodies.

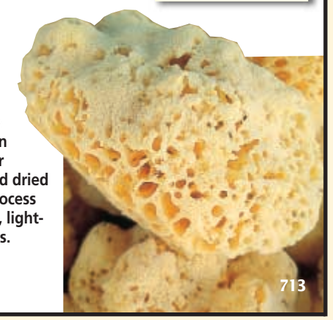


Figure 26.1
This heavy bath sponge is dark brown or black in its natural habitat. After harvest, it is washed and dried in the sun. When the process is complete, only a pale, lightweight skeleton remains.

Assessment Planner

Portfolio Assessment
Problem-Solving Labs, TWE, pp. 715, 732
Portfolio, TWE, pp. 722, 727, 733
BioLab, TWE, p. 735

Performance Assessment
Performance Assessments, TWE, pp. 716, 717, 723, 725
Problem-Solving Lab, TWE, p. 724
BioLab, SE, p. 734-735
MiniLabs, SE, p. 719, 732

Knowledge Assessment
Section Assessments, SE, pp. 717, 725, 730, 733
Problem-Solving Lab, TWE, p. 727
Chapter Assessment, SE, pp. 737-739
Knowledge Assessment, TWE, pp. 729, 730

Skill Assessment
Alternative Lab, TWE, p. 715
Problem-Solving Lab, TWE, p. 732

Prepare

Key Concepts

Students will learn the main features of sponges and discuss their adaptations, origins, and ecology.

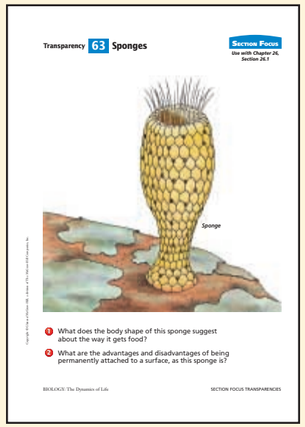
Planning

- Collect dried natural and synthetic sponges for the Alternative Lab and Quick Demo.
- Gather butcher paper and colored markers for the Check for Understanding.

1 Focus

Bellringer

Before presenting the lesson, display **Section Focus Transparency 63** on the overhead projector and have students answer the accompanying questions. L1 ELL



2 Teach

INSIDE STORY

Purpose

Students will observe the basic features of a sponge and examine how it accomplishes filter feeding.

Teaching Strategies

- Explain that sponges obtain food in a process called filter feeding.

Visual Learning

- Point out that food particles in water are pulled into collar cells and digested. Nutrients from food are then distributed by amoebocytes to other body cells.

Critical Thinking

Sponges carry on the same life processes as all animals. They are multicellular eukaryotes that do not have cell walls around their cells.

Resource Manager

Basic Concepts Transparencies 45 and 46 and Masters L2 ELL
Concept Mapping, p. 26 L3
Critical Thinking/Problem Solving, p. 26 L3

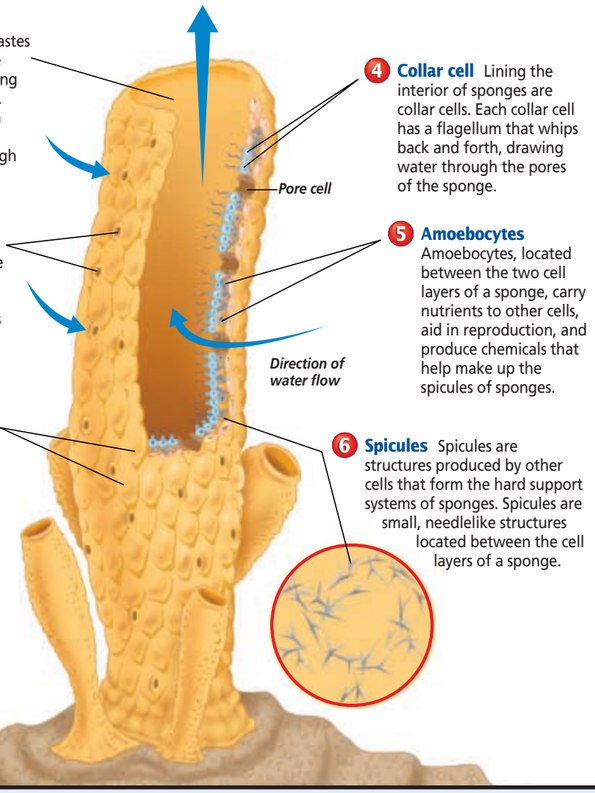
INSIDE STORY

A Sponge

Sponges have no tissues, organs, or organ systems. The body plan of a sponge is simple, being made up of only two layers of cells with no body cavity. Between these two layers is a jellylike substance that contains other cells as well as the components of the sponge's internal support system. Sponges have four types of cells that perform all the functions necessary to keep them alive.

Orange tube sponges

Critical Thinking *Why are sponges classified as animals?*



1 Osculum Water and wastes are expelled through the osculum, the large opening at the top of the sponge. A sponge no bigger than a pen can move more than 20 L of water through its body per day.

2 Pore cell Surrounding each pore is a single pore cell. Pore cells bring water carrying food and oxygen into the sponge's body.

3 Epithelial cell Epithelial cells are thin and flat. They contract in response to touch or to irritating chemicals, and in so doing, close up pores in the sponge.

4 Collar cell Lining the interior of sponges are collar cells. Each collar cell has a flagellum that whips back and forth, drawing water through the pores of the sponge.

5 Amoebocytes Amoebocytes, located between the two cell layers of a sponge, carry nutrients to other cells, aid in reproduction, and produce chemicals that help make up the spicules of sponges.

6 Spicules Spicules are structures produced by other cells that form the hard support systems of sponges. Spicules are small, needlelike structures located between the cell layers of a sponge.

Cell organization in sponges

Like all animals, sponges are multicellular. Sponges have different types of cells that perform functions that help the animal survive. Read the *Problem-Solving Lab* on this page to find out how sponges survive in different environments. The activities of the different types of cells are coordinated in a sponge, but sponges do not have tissues like those found in other animals. Tissues are groups of cells that are derived from the ectoderm, endoderm, and mesoderm in the embryo. Sponge embryos do not develop endoderm or mesoderm, so they do not have cells organized into tissues.

However, the cells of a sponge are organized. If you took a living sponge and put it through a sieve, you would witness a rather remarkable event. Not only would you see the sponge's many cells alive and separated out, but you also would be able to see these same cells coming together to form a whole sponge once again. It may take several weeks for the sponge's cells to reorganize themselves.

Many biologists hypothesize that sponges evolved directly from colonial, flagellated protists, such as *Volvox*. More importantly, however, sponges demonstrate what appears to have been a major step in the evolution of animals—the change from a unicellular life to a division of labor among groups of organized cells.

Reproduction in sponges

Sponges reproduce both sexually and asexually. They reproduce asexually when fragments break off from the parent animal and form new sponges, or by forming external buds. Buds may break off, float away, and eventually settle and become separate animals. Sometimes the buds remain attached to the parents, forming a colony of sponges. You can see a colony in ***Figure 26.2.***

Problem-Solving Lab 26-1 Applying Concepts

Why are there more species of marine sponges than freshwater sponges? Most sponges are marine. They live in a saltwater environment. Is there an advantage for sponges to live in a marine environment rather than in a freshwater environment? A series of statements is provided below. Read them over and then answer the questions that follow.

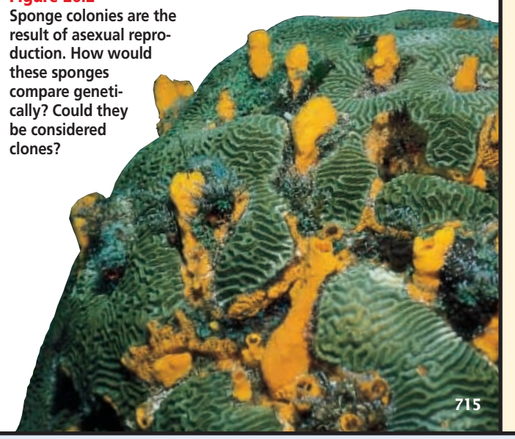
Analysis

A. The internal tissues of marine organisms are isotonic with their surroundings.
B. Oceans do not have problems with rapid changes in velocity (rate of flow) of water.
C. Young marine animals often spend the early part of their life cycles as free-floating organisms.

Thinking Critically

1. Using statement A, how might a freshwater environment vary? How might this be a disadvantage for freshwater sponges?
2. Using statement B, how might a freshwater environment vary? How might this be a disadvantage for freshwater sponges?
3. Using your collective answers, explain why few sponge species are found in freshwater environments.

Figure 26.2
Sponge colonies are the result of asexual reproduction. How would these sponges compare genetically? Could they be considered clones?



Problem-Solving Lab 26-1

Purpose

Students will determine that freshwater environments are more difficult for sponge survival than saltwater environments.

Process Skills

think critically, analyze data, compare and contrast, draw a conclusion

Teaching Strategies

- You may want to review osmosis with students.
- Review the concepts of freshwater versus saltwater environments. Make sure students understand that lakes, streams, and rivers are freshwater environments.

Thinking Critically

1. The internal environment of freshwater sponges is not isotonic with its surroundings, thus energy must be used to eliminate excess water from cells of the organism.
2. The flow of water may be rapid in rivers or streams, thus washing adult or embryonic sponges away.
3. Many environmental factors in freshwater environments limit or make it impossible for sponges to survive.

Assessment

Portfolio Ask students to research the number of sponge species that live in freshwater environments. L2 P

Alternative Lab

Natural and Synthetic Sponges

Purpose

Students will compare the water-holding capacity and microscopic appearance of natural and synthetic sponges. Remind students to wash their hands after handling sponges.

Materials

stereomicroscope, forceps, balance, wax marking pencil, 150 mL beakers, Petri dish bottoms, sea sponges (one piece each of four different types: grass, yellow, sheep's wool, hard head—each piece 3 cm × 3 cm × 2 cm), unused synthetic sponges (one piece each of four different types—each piece 3 cm × 3 cm × 2 cm)

Procedure

Give students the following directions.

1. Examine each piece of sponge at its thinnest point under the microscope.
2. Draw the skeletal framework of each sponge. Label each sponge piece.
3. Predict which type of sponge will hold more water. Base your prediction on microscopic examination of the sponge structures.
4. Place each sponge piece in a Petri dish and obtain its mass. Soak each sponge piece in a beaker of water for 10 minutes and again obtain the mass of each sponge.
5. Calculate the mass of the water absorbed by each sponge. Compare the data for all sponges.

Expected Results

Natural sponges have greater water holding capacity than synthetic sponges.

Analysis

1. Which sponges, natural or synthetic, have greater water-holding capacity? *natural sponges*
2. Of what adaptive value is it for a sponge to be able to take in large amounts of water? *They are filter feeders. Taking in more water increases the chances of taking in more food.*

Assessment

Skill Design and conduct an experiment to determine whether the temperature of water affects the water-holding capacity of a sponge. Use the Performance Task Assessment List for Designing an Experiment in **PASC,** p. 23. L3 ELL

Enrichment

Linguistic Some sponges give off toxic chemicals that deter predators and the buildup of other sessile animals on their exterior surfaces. One of these chemicals, from a Caribbean sponge, is being used currently to treat cancer. Other chemicals produced by sponges are being used to fight fungal infections. Have interested students research this subject and write a report. L3

Assessment

Performance Have students assume that a particular marine sponge harbors single-celled algae as symbionts in its cells. Ask students to make a sketch and describe in a paragraph what the best shape would be for this sponge to enable the algae to get maximum sunlight. L2 ELL P

Quick Demo

Kinesthetic From a scientific supply house, obtain the dried skeletons of a variety of marine sponges. Ask students to examine them and describe how these animals would be different if they were alive. L2 ELL

3 Assess

Check for Understanding

Visual-Spatial Give students a large piece of butcher paper and colored markers. Ask them to draw a large sponge indicating epithelial cells, pore cells, collar cells, amoebocytes, spicules, and osculum. L2 ELL

Most sponges reproduce sexually. Some sponges have separate sexes, but most sponges are hermaphrodites. A **hermaphrodite** (hur MAF ruh dite) is an individual animal that can produce both eggs and sperm. Hermaphrodism increases the likelihood of fertilization in sessile or slow-moving animals. Eggs and sperm are formed from amoebocytes. During reproduction, sperm released from one sponge can be carried by water currents to another sponge, where fertilization may occur.

Fertilization in sponges may be either external or internal. A few sponges have **external fertilization,** in which the eggs and sperm are both released into the water; fertilization occurs outside the animal's body. Most sponges have **internal fertilization,** in which eggs remain inside the animal's body, and sperm are carried to the eggs in the flow of water. In sponges, the collar cells collect the sperm and transfer them to amoebocytes. The amoebocytes then transport the sperm to ripe eggs. Most sponges reproduce sexually through internal fertilization. The result is the development of free-swimming, flagellated larvae, shown in ***Figure 26.3.***

Some freshwater sponges that live in temperate waters produce seedlike particles, called gemmules, in the fall. The adult sponges die over the winter, but the gemmules survive and grow into new sponges in the spring.

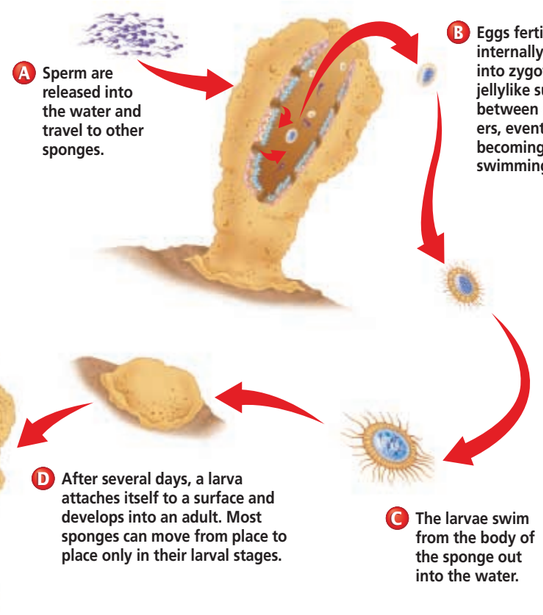


Figure 26.3
Sponges reproduce sexually when sperm from one sponge fertilize the eggs of another sponge.

Figure 26.4
The spicules of freshwater sponges, such as this lake sponge, protect it from predators (a). Spicules of the deep-water glass sponges form a rigid skeleton (b).

Support and defense systems in sponges

Sponges are soft-bodied invertebrates, yet they can be found in waters as deep as 8500 m. You might think that the water pressure at such depths would flatten sponges, yet they all have an internal support system that enables them to withstand such pressure. Some sponges have sharp, hard spicules located between the cell layers. Spicules may be made of glasslike material or of calcium carbonate. Some species, such as the river sponge shown in ***Figure 26.4,*** have thousands of tiny, sharp, needle-like spicules that make them hard for animals to eat. Other sponges have an internal skeleton made of silica or of spongin, a fibrous proteinlike material. Sponges can be classified according to their spicules and/or skeletons.

Besides sharp spicules, some sponges may have other methods of defense. Some tropical sponges contain chemicals that are toxic to fishes and to other predators. Many sponges produce toxins that are poisonous to sharks. Scientists are studying sponge toxins to identify those that possibly could be used as medicines.

Section Assessment

Understanding Main Ideas
1. How does a sponge obtain food?
2. Explain how epithelial cells control filter feeding in sponges.
3. Describe the steps involved in the sexual reproduction of sponges.
4. What are the functions of amoebocytes in sponges?

Thinking Critically
5. What advantages for obtaining food do multicellular organisms such as sponges have over unicellular organisms? Explain.

Skill Review
6. **Making and Using Tables** Make a table listing the cell types and other structures of sponges along with their functions. For more help, refer to *Organizing Information* in the **Skill Handbook.**

Reteach

Have students construct an outline to summarize this section. Have them include the phylum, symmetry, habitat, food-getting process, reproductive process, and means of protection of sponges. L1

Extension

Kinesthetic Ask student groups to construct a three-dimensional, cutaway model of a sponge. Have students label the parts of their model. L2 ELL COOP LEARN

Assessment

Performance Have students make a flowchart that shows the events involved in sexual reproduction of sponges. L2

4 Close

Discussion

Discuss with students situations in which natural sponges are more desirable than synthetic sponges, such as for bathing. Explain that natural sponges are not used for many cleaning purposes because of their expense.

Resource Manager
Reinforcement and Study Guide, p. 115 L2

Biology Journal

Sponge Gemmules

Visual-Spatial After observing prepared slides of sponge gemmules with a microscope, have students make drawings of gemmules in their journals. L1 ELL

Meeting Individual Needs

Gifted

Visual-Spatial Have your advanced students reread the description of fragmentation. Challenge these students to diagram this process and then work with other students to review fragmentation. L3

Section Assessment

1. Sponges take water into their bodies and filter food out of the water. They are filter feeders.
2. Epithelial cells can contract and relax, thus opening and closing pore cells.
3. Sperm are released in water and travel to other sponges. Eggs fertilized internally develop into zygotes in the jellylike substance between cell layers, eventually becoming free-swimming larvae that later attach to a surface and develop into adult sponges.
4. Amoebocytes carry food from the collar cells to all other body cells, carry sperm to eggs for fertilization, and produce chemicals that help make up the spicules of sponges.
5. Division of labor among cells enables the organism to carry out life functions more efficiently than a single cell can.
6. Students' tables should include the following features and their functions: epithelial cells, pore cells, collar cells, amoebocytes, spicules, and osculum.

Prepare

Key Concepts

Students will learn about the important characteristics of cnidarians.

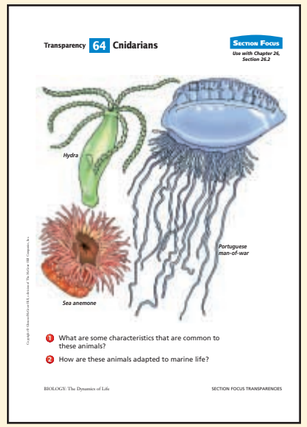
Planning

- Prepare salt dough for Building a Model.

1 Focus

Bellringer

Before presenting the lesson, display **Section Focus Transparency 64** on the overhead projector and have students answer the accompanying questions. L1 ELL



SECTION PREVIEW

Objectives

Distinguish the different classes of cnidarians.

Sequence the stages in the life cycle of cnidarians.

Evaluate the adaptations of cnidarians for obtaining food.

Vocabulary

polyp
medusa
nematocyst
gastrovascular cavity
nerve net

Section

26.2 Cnidarians

What's the largest structure ever built by living organisms? Is it the Sears Tower in Chicago? How about the Great Pyramid in Egypt? Actually, the largest structure ever built is the Great Barrier Reef, which extends for more than 2000 km along the northeastern coast of Australia, and it wasn't built by humans. This structure was built over many centuries by colonies of small marine invertebrate animals called corals. Corals and their relatives, jellyfishes and sea anemones, all belong to the phylum Cnidaria.

The Great Barrier Reef (above) and orange clump coral, *Tubastrea aurea* (left)

What Is a Cnidarian?

Cnidarians (ni DARE ee uns) are a group of marine invertebrates made up of more than 9000 species of jellyfishes, corals, sea anemones, and hydras. Cnidarians can be found worldwide, but coral species generally prefer the warmer oceans of the South Pacific and the Caribbean.

WORD Origin

cnidarian
From the Greek word *knide*, meaning "nettle," a plant with stinging hairs. Cnidarians have stinging tentacles.

Cnidarians have radial symmetry

Though cnidarians are a diverse group, all possess the same basic body structure, which supports the theory that they had a single origin. All cnidarians have radial symmetry. A cnidarian's body is made up of two cell layers with one body opening. The cell layers of cnidarians are organized into separate tissues with specific functions. Cnidarians have a simple nervous system, and both cell layers have cells that can contract as though they were muscles. The two cell layers of a cnidarian are derived from the ectoderm and endoderm of the embryo. The ectoderm of the cnidarian embryo develops into a protective outer layer of cells, and the endoderm is internal and adapted mainly to assist in digestion.

Cnidarians display only two basic body forms, which occur at different stages of their life cycles. These two forms are the polyp and medusa, ***Figure 26.5***. A **polyp** (PAHL up) is the stage with a tube-shaped body and a mouth surrounded by tentacles. A **medusa** (mih DEW suh) is the stage with a body shaped like an umbrella with tentacles hanging downward. The hydra has a typical polyp body form. How do hydras capture their food? You can find out by reading the *Inside Story* on the next page.

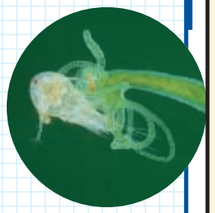
In cnidarians, one body form may be more conspicuous than the other. In jellyfishes, for example, the medusa stage is the dominant body form. The polyp stage of a jellyfish is small and not very noticeable. In hydras, the polyp stage is dominant, with a small and delicate medusa stage. The corals and sea anemones have only the polyp stage.

Digestion in cnidarians

Cnidarians are predators that capture or poison their prey with nematocysts. A **nematocyst** (nih MAT uh sihst) is a capsule that contains a coiled, threadlike tube. The tube may be sticky or barbed, and it may contain toxic substances. Nematocysts, located in stinging cells, are discharged like toy popguns, but much faster, in response to touch or chemicals in the environment. Prey organisms are then taken in for digestion.

In cnidarians, you can see the origins of a digestive process similar to that of animals that evolved later. Once captured by nematocysts on the ends of tentacles, prey is brought to the mouth by contraction of the tentacles. The inner cell layer of cnidarians surrounds a space called a **gastrovascular cavity** (gas troh VAS kyuh lur) in which digestion takes place. Cells adapted for digestion line the gastrovascular cavity and release enzymes over the newly captured prey. Any undigested materials are ejected back out through the mouth. You can observe a cnidarian feeding in the *MiniLab* on this page.

MiniLab 26-1 Observing



Hydra eating copepod

Watching Hydra Feed Hydras are freshwater cnidarians. They show the typical polyp body plan and symmetry associated with all members of this phylum. Observe how they capture their food.

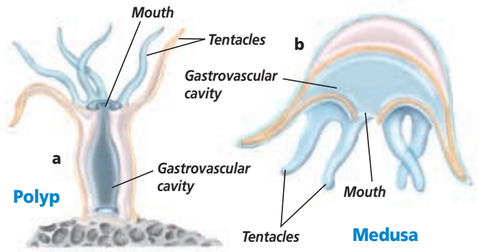
Procedure

1. Use a dropper to place a hydra into a watch glass filled with water. Wait several minutes for the animal to adapt to its new surroundings. **CAUTION:** ***Use caution when working with a microscope and glassware.***
2. Observe the hydra under low-power magnification.
3. Formulate a hypothesis as to how this animal obtains its food and/or catches its prey.
4. Place brine shrimp in a culture dish of freshwater to avoid introducing salt into the watch glass.
5. Add a drop of brine shrimp to the watch glass while continuing to observe the hydra through the microscope.
6. Note which structures the hydra uses to capture food.

Analysis

1. Describe how the hydra captures food.
2. Was your hypothesis supported or rejected?
3. Sequence the events that take place when a hydra captures and feeds upon its prey.
4. Explain how your observations support the fact that hydras have both nervous and muscular systems.

Figure 26.5
The two basic forms of cnidarians are the polyp form (a), and the medusa form (b).



2 Teach

MiniLab 26-1

Purpose
Students will observe the feeding behavior of hydra. Remind students they will be working with live animals, and to treat them gently. Have students wash their hands at the end of the MiniLab.

Process Skills
sequence, observe and infer, hypothesize, draw a conclusion

Teaching Strategies

- Hydra are available from biological supply houses. Add pieces of broken glass to the original container the day before students observe the animals. Hydra will cling to glass fragments. Remove the glass and attached hydra with a forceps to aid in dispensing the animals.
- Hatch brine shrimp from eggs 2 to 3 days prior to classroom need. Eggs are available from pet shops or biological supply houses. Follow directions on container for hatching. After hatching, shine a light at one edge of the tray—brine shrimp will move toward the light. Use a tea strainer to remove and rinse shrimp before feeding to hydra.
- Students will not to able to see the release of nematocysts from the tentacles.
- Binocular microscopes may be used, or use a 5× objective on the compound microscope if available.

Expected Results
Students will see the tentacles of hydra surround and capture brine shrimp. Food is then pushed by the tentacles into the animal's mouth.

Analysis

1. Nematocysts and tentacles work together to capture food.
2. Student answers will vary depending on their original hypothesis.
3. prey organisms brush against the tentacles, nematocysts are released, prey is captured by tentacles, tentacles push food into hydra's mouth
4. muscles move the tentacles, nervous system directs tentacles to trap and push food into mouth

Assessment

Portfolio Provide students with prepared slides of cnidarian nematocysts. Have them observe and diagram these cells under high-power magnification. Ask them to explain how nematocysts illustrate the concept of structure complimenting function. Use the Performance Task Assessment List for Scientific Drawing in **PASC,** p. 55. L3 ELL

Cultural Diversity

Hydra Myth

Intrapersonal Ask students to report about the Greek myth dealing with the water monster, Hydra. Students should indicate that Hydra had nine heads. Each time Hercules cut off one head, it grew back. Have students identify parts of the myth that are scientifically accurate and those that are not. L2

GLENCOE TECHNOLOGY

VIDEODISC
Biology: The Dynamics of Life
Ocean Cnidarians (Ch 31)
Disc 1, Side 2, 31 sec.

INSIDE STORY

Purpose

Students will gain an understanding of the polyp and medusa forms of cnidarians, and learn about the tentacles and nematocysts common to these animals.

Teaching Strategies

- Emphasize that polyps are sessile forms of cnidarians that live attached to a surface.
- Be sure that students recognize that the mouth of a polyp points upward whereas the mouth of a medusa points downward.

Visual Learning

Visual-Spatial Provide students with prepared slides of small cnidarian polyps and medusae. Have students observe the slides and make labeled drawings of their observations. L2 ELL

Critical Thinking

A sessile organism cannot hunt for prey or move away from predators. Stinging cells help sessile organisms get food and escape predation.

Quick Demo

Use a microprojector to show prepared slides of discharged nematocysts.

Resource Manager

Section Focus Transparency 64 and Master L1 ELL
BioLab and MiniLab Worksheets, p. 117 L2

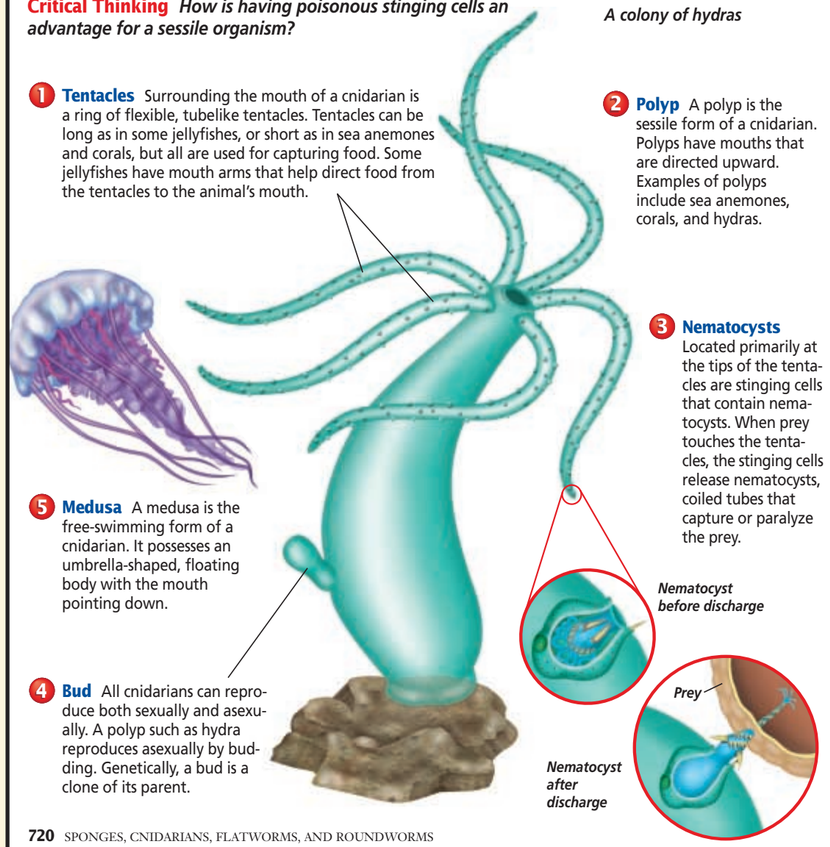
INSIDE STORY

A Cnidarian

Cnidarians display a remarkable variety of colors, shapes and sizes. Some can be as small as the tip of a pencil. The flowerlike forms of sea anemones are often brilliant shades of red, purple, and blue. Most cnidarians go through both the polyp and medusa stages at some point in their life cycles.

Critical Thinking ***How is having poisonous stinging cells an advantage for a sessile organism?***

A colony of hydras



1 **Tentacles** Surrounding the mouth of a cnidarian is a ring of flexible, tubelike tentacles. Tentacles can be long as in some jellyfishes, or short as in sea anemones and corals, but all are used for capturing food. Some jellyfishes have mouth arms that help direct food from the tentacles to the animal's mouth.

2 **Polyp** A polyp is the sessile form of a cnidarian. Polyps have mouths that are directed upward. Examples of polyps include sea anemones, corals, and hydras.

3 **Nematocysts** Located primarily at the tips of the tentacles are stinging cells that contain nematocysts. When prey touches the tentacles, the stinging cells release nematocysts, coiled tubes that capture or paralyze the prey.

4 **Bud** All cnidarians can reproduce both sexually and asexually. A polyp such as hydra reproduces asexually by budding. Genetically, a bud is a clone of its parent.

5 **Medusa** A medusa is the free-swimming form of a cnidarian. It possesses an umbrella-shaped, floating body with the mouth pointing down.

Cnidarians are classified into groups partly based on whether or not there are divisions within the gastrovascular cavity, and if there are, how many divisions are present.

Oxygen enters cells directly

Because of a cnidarian's simple, two-cell-layer body plan, as shown in the *Inside Story*, no cell in its body is ever far from water. Oxygen dissolved in water diffuses directly into the body cells, and carbon dioxide and other wastes diffuse out of the cells directly into the surrounding water.

Nervous regulation in cnidarians

Cnidarians have a simple nervous system called a nerve net. A **nerve net** conducts nerve impulses from all parts of the cnidarian's body, but there is no control center such as the brain found in other animals. The impulses from the nerve net bring about contractions of musclelike cells in the tentacles and body of a cnidarian. For example, when touched, a hydra reacts by contracting its musclelike cells.

Reproduction in cnidarians

All cnidarians have the ability to reproduce sexually and asexually. Sexual reproduction occurs in only one phase of the life cycle, usually the medusa stage, unless there is no medusa stage. Asexual reproduction may occur in either the polyp or medusa stage. Cnidarians that remain in the polyp stage, such as hydras, corals, and sea anemones, can reproduce sexually as polyps. Polyps reproduce asexually by a process known as budding, as shown in ***Figure 26.6.***

The most common form of reproduction in cnidarians can be illustrated by the life cycle of a jellyfish, shown in ***Figure 26.7*** on the next page. As you can see, the sexual medusa stage alternates with the asexual polyp stage, from generation to generation. Male medusae release sperm and female medusae release eggs into the water, where fertilization occurs. The resulting zygote develops into an embryo, and then into a larva. Recall that a larva is an intermediate stage in animal development. The free-swimming larva eventually settles and grows into a polyp, which, in turn, reproduces asexually to form new medusae. Even though these two stages alternate in a cnidarian life cycle, this form of reproduction is not alternation of generations as seen in plants because cnidarians are diploid animals in both medusa and polyp stages.

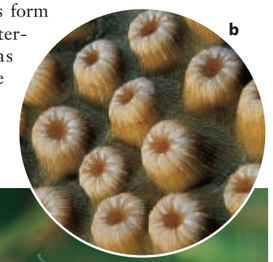


Figure 26.6
The main form of reproduction in polyps is budding. During this process, small buds grow as extensions of the body wall (a). In some species, such as corals, a colony develops as the buds break away and settle nearby (b).

Tying to Previous Knowledge

Review the Inside Story with students. Explain that larvae of cnidarians produced by sexual reproduction form in the way described in the Inside Story.

Display

Visual-Spatial Ask a group of students to prepare a bulletin board display of the life cycle of a jellyfish. Encourage them to use three-dimensional figures if possible. L2 ELL COOP LEARN

NATIONAL GEOGRAPHIC

VIDEODISC
STV: Biodiversity
Loss of Diversity
Unit 1, Side 1, 3 min. 45 sec.
Overview

Coral Reefs

Internet Address Book

internNET CONNECTION Note Internet addresses that you find useful in the space below for quick reference.

Biology Journal

Budding Hydra

Visual-Spatial Have students examine prepared slides of budding hydra under a microscope. Ask them to make scientific drawings of the hydra in their biology journals. L2 ELL

Building a Model

Kinesthetic Have student groups make clay or salt dough (one part salt, one part flour, one part water) models of the life cycle of a jellyfish. Tell them that when they are finished you will ask the group questions about the jellyfish life cycle. They will need to use their models to demonstrate their answers. Remind students to wear safety gogges and an apron when handling modeling materials. L1 ELL COOP LEARN

Reinforcement

Make a transparency of Figure 26.7 with just the figures. White out the captions before you make your transparency and number each figure. Ask students to make a list of corresponding numbers on a sheet of paper and describe each stage. L2

GLENCOE TECHNOLOGY

VIDEODISC
The Secret of Life
Life Cycle of a Jellyfish

Resource Manager

Basic Concepts Transparency 47 and Master L2 ELL
Reinforcement and Study Guide, p. 116 L2
Content Mastery, p. 130 L1
Laboratory Manual, pp. 187-188 L2

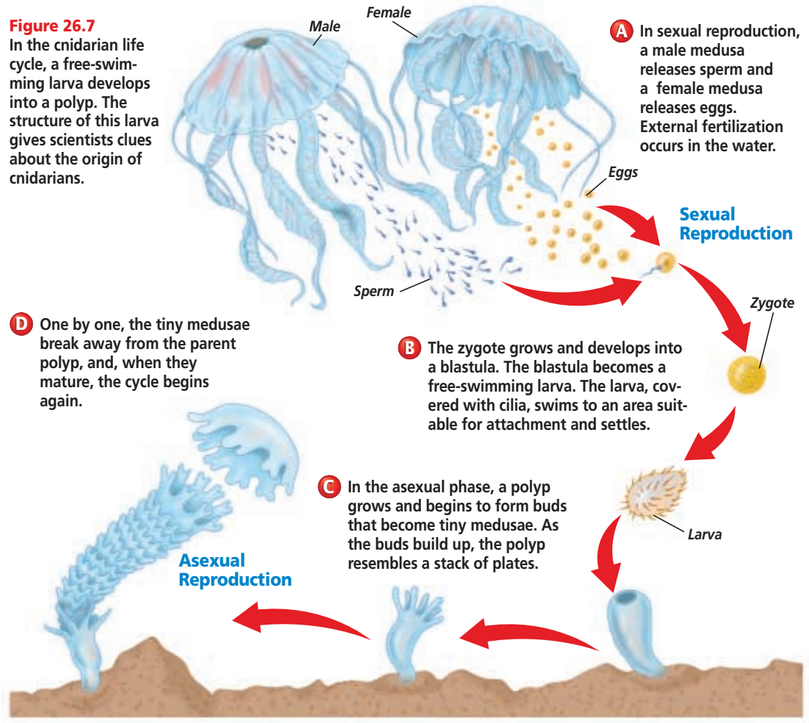


Figure 26.7
In the cnidarian life cycle, a free-swimming larva develops into a polyp. The structure of this larva gives scientists clues about the origin of cnidarians.

Diversity of Cnidarians

Most of the 9000 described species of cnidarians belong to one of three classes: Hydrozoa, Scyphozoa, and Anthozoa.

Most hydrozoans form colonies

The class Hydrozoa includes two groups—the hydroids, such as hydra, and the siphonophores, including the Portuguese man-of-war. Most hydroids consist of branching polyp colonies that have formed by budding. The siphonophores include floating colonies that drift about on the ocean's surface as well as colonies that form swimming medusae. Hydrozoans have open gastrovascular cavities with no internal divisions.

It's difficult to understand how the organism shown in ***Figure 26.8*** could be a closely associated group of individual animals. The Portuguese man-of-war, *Physalia*, is an example of a siphonophore hydrozoan colony.

Each individual in a *Physalia* colony has a different function that helps the entire organism survive. For example, just one individual forms a large, blue, gas-filled float. Regulation of the gas in the float allows the colony to dive to lower depths or rise to the surface. Other polyps hanging from the float have different functions, such as reproduction and feeding. The polyps all function together for the survival of the colony.

Scyphozoans are the jellyfishes

Have you ever seen a jellyfish like the one shown in ***Figure 26.9?*** Some jellyfishes are transparent, but others are pink, blue, or orange. The medusa stage is dominant in this class. Like other cnidarians, scyphozoans have musclelike cells in their outer cell layer that can contract. When these cells contract together, the medusa contracts, which propels the animal through the water. The fragile and sometimes luminescent bodies of jellyfishes can be beautiful, but most people know about jellyfishes more by their painful stings. Jellyfishes can be found everywhere in the oceans, from arctic to tropical waters, and have been seen as deep as 1000 m. The gastrovascular cavity of scyphozoans has four internal divisions.

Most anthozoans build coral reefs

Anthozoans are cnidarians that exhibit only the polyp form. All anthozoans have many divisions in their gastrovascular cavities.

Sea anemones are anthozoans that live as individual animals. Sea anemones are thought to live for centuries. Some tropical sea anemones may have a diameter of more than a meter. Sea anemones can be found in tropical, temperate, and arctic seas.

Corals are anthozoans that live in colonies of polyps in warm ocean waters around the world. They secrete cuplike calcium carbonate (limestone) shelters around their soft bodies for protection. Colonies of many coral species build the beautiful coral reefs that provide food and shelter for many other marine species. When a coral polyp dies, the limestone skeleton it leaves behind adds a tiny piece to the structure of the reef. The living portion of a coral reef is a thin, fragile layer that grows on top of the skeletons left behind by

Figure 26.8
***Physalia* colonies are found primarily in tropical waters, but they sometimes drift into temperate waters where they may be washed up on shore.**

Figure 26.9
The jellyfish *Chrysaora hysoscella* has the common name compass jellyfish due to the radiating brown lines on its medusa.

Assessment

Performance Ask students to make a concept map showing the different classes of cnidarians and the organisms that make up each class. Make sure they have included the classes Hydrozoa, Scyphozoa, and Anthozoa, and the following organisms: hydroids, siphonophores, jellyfishes, sea anemones, corals. L2

Reinforcement

Be sure students understand that the Portuguese man-of-war is a colonial hydrozoan.

Visual Learning

Naturalist Show students examples of a variety of preserved sponges and cnidarians. Have them make a chart listing the type of animal, structural features they used to identify the animal, and adaptations the animal has that make it suited to its environment. L1 ELL

GLENCOE TECHNOLOGY

CD-ROM
Biology: The Dynamics of Life
Video: *Ocean Cnidarians*
Disc 4
Video: *Coral Reefs*
Disc 4

NATIONAL GEOGRAPHIC

VIDEODISC
STV: Biodiversity
Coral Reef; Gulf of Aqaba
Gorgonian Corals and Fish

Portfolio

Treating Jellyfish Stings

Interpersonal Ask a group of students to contact first aid stations on public beaches where jellyfishes are common. Have them prepare a report on the treatment given to victims of the stings of these animals.

Ask students to demonstrate the first aid procedures and explain why each procedure is performed. Students should write summaries for their portfolios. L3 ELL P COOP LEARN

Meeting Individual Needs

Learning Disabled

Visual-Spatial Ask a group of students to visit a saltwater aquarium, either at a pet shop, restaurant, zoo, or marine park, and take photographs for a photo essay about sea anemones. You might also provide a preserved anemone for them to dissect. L2 ELL

Biology Journal

Coral Art

Visual-Spatial Ask students to design a postage stamp that will commemorate coral animals' importance, and beauty. Give students colored markers and plain white paper. Remind them that little can be written on a postage stamp. Provide photos of corals. Have students place their designs in their journals. L2 ELL

Problem-Solving Lab 26-2

Purpose

Students will study two graphs that show how certain abiotic factors influence the location of coral species.

Process Skills

think critically, interpret data, compare and contrast, make and use graphs

Teaching Strategies

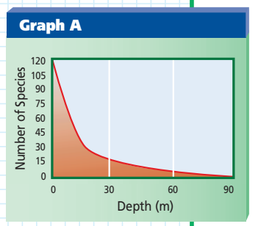
- Review the meaning of symbiosis and mutualism, abiotic and biotic factors.
- Suggest to students that they analyze each graph separately. However, point out that abiotic factors are interrelated.

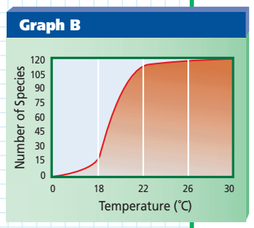
Thinking Critically

1. abiotic—ocean depth, temperature; biotic—coral
2. The number of coral species decreases rapidly until about 20 m, when it begins to level off.
3. Temperatures between 22°C and 30°C seem to be more favorable to coral diversity. Fewer species survive at temperatures below 22°C.
4. Zooxanthellae require sunlight in order to carry out photosynthesis. The corals live near the surface of the ocean. Temperature decreases as depth increases. In tropical regions, corals that live close to the surface are more likely to be exposed to high temperatures and, therefore, are more at risk for bleaching.

Problem-Solving Lab 26-2 Interpreting Data

What ocean conditions limit the number of coral species? All corals that build reefs have a mutualistic symbiotic relationship with zooxanthellae. Zooxanthellae within the coral carry on photosynthesis and provide some nutrients to the coral. Animals caught by the coral provide some nutrients to these protists.





Analysis

Graph A shows the number of species present in coral reefs at certain depths. Graph B shows the number of species present at different temperatures. All reef-building coral species have zooxanthellae. The effects of abiotic factors on organisms are usually related. For example, temperature and levels of illumination in an ocean vary with depth.

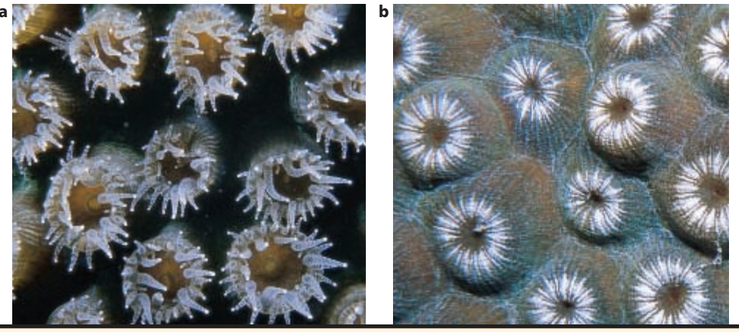
Thinking Critically

1. Identify the abiotic and biotic factors being studied in this ocean environment.
2. In Graph A, what seems to be the correlation between number of coral species present and depth? Use actual numbers from the graph in your answers.
3. In Graph B, what seems to be the correlation between number of species present and the temperature? Use actual numbers from the graph in your answer.
4. Bleaching occurs when coral polyps expel their zooxanthellae. Bleaching has been observed when water temperature exceeds 35°C. How might depth of coral be related to bleaching?

previous generations. Coral reefs grow very slowly, about 2 mm per year. It took centuries to form the reefs found today in tropical and subtropical oceans. Find out more about the fragility of coral reefs by reading the *Biology & Society* feature at the end of this chapter. Corals that form reefs are known as hard corals. Other corals are known as soft corals because they do not build such structures.

A coral polyp extends its tentacles to feed, as shown in ***Figure 26.10***. Although coral reefs are often found in relatively shallow, nutrient-poor waters, the corals thrive because they form a symbiotic relationship with tiny organisms called zooxanthellae, photosynthetic protists. The zooxanthellae (zoh oh zan THEH lee) supply oxygen and food to the corals while using carbon dioxide and waste materials produced by the corals. These protists are primarily responsible for the bright colors found in coral reefs. Because the zooxanthellae are free-swimming, they sometimes leave the corals. Corals without these protists often die. You can find out how corals respond to changing environmental conditions in the *Problem-Solving Lab*.

Figure 26.10 **Corals feed by extending their tentacles outside their limestone cups (a), but if they are threatened, they can retreat back into the cups (b) until danger has passed.**



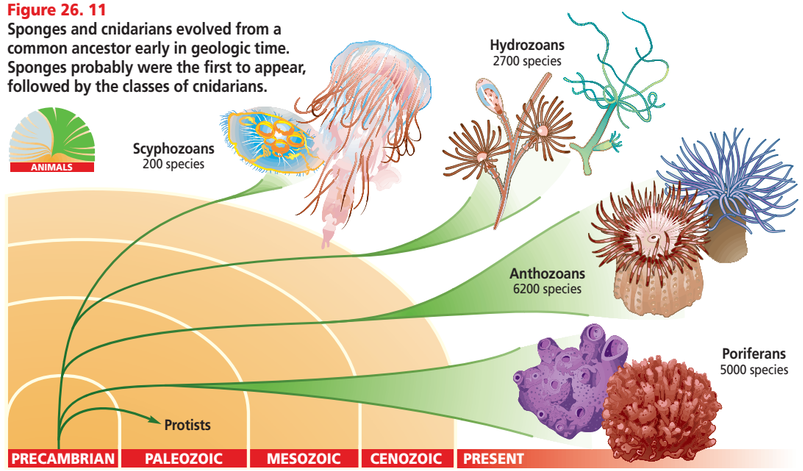
Assessment

Performance Have students research how the building of a coral skeleton may also benefit from the presence of algae. L2

GLENCOE TECHNOLOGY

VIDEODISC
The Infinite Voyage: *To the Edge of the Earth*
Exploring the Galapagos Islands (Ch. 4)

Figure 26. 11 **Sponges and cnidarians evolved from a common ancestor early in geologic time. Sponges probably were the first to appear, followed by the classes of cnidarians.**



Origins of Sponges and Cnidarians

As shown in ***Figure 26.11***, sponges represent an old animal phylum. The earliest fossil evidence for sponges dates this group to the Paleozoic Era, about 700 million years ago. Scientists infer that sponges may have evolved directly from a group of flagellated protists that today resemble the collar cells of sponges.

The earliest known cnidarians date to the Precambrian Era, about 630 million years ago. Because cnidarians are soft-bodied animals, they do not preserve well as fossils, and their origins are not well understood. The earliest coral species were not reef builders, so reefs cannot be used to date early cnidarians. The larval form of cnidarians resembles protists, and because of this, scientists consider cnidarians to have evolved from protists.

Section Assessment

Understanding Main Ideas
1. Compare the medusa and polyp forms of cnidarians.
2. Diagram the reproductive cycle of a jellyfish.
3. What are the advantages of a two-layered body in cnidarians?
4. How are corals different from other cnidarians?

Thinking Critically
5. Coral reefs are being destroyed at a rapid rate. What effect would you expect the destruction of a large coral reef to have on other ocean life?

Skill Review
6. **Making and Using Tables** In a table, distinguish the three main groups of cnidarians, list their characteristics, and give examples of a member from each group. For more help, refer to *Organizing Information* in the **Skill Handbook**.

Section Assessment

1. Polyps, the sessile stage of cnidarians, have a mouth that points upward. The medusa, the free-swimming stage, has a mouth pointing downward.
2. Make sure students follow the steps shown in Figure 26.7.
3. The cell layers of cnidarians are organized into separate tissues, which enable an animal to be more efficient in carrying out life functions.
4. Corals secrete calcium carbonate shelters around their bodies.
5. Other ocean life will be destroyed because the marine life of the area is dependent upon coral reefs.
6. Make sure students have listed the characteristics and examples of the three cnidarian groups.

3 Assess

Check for Understanding

Have students draw a hydra cross section and add arrows to show the exchange of oxygen and carbon dioxide and how food reaches all cells. L1 ELL

Reteach

Interpersonal Draw a football field on the chalkboard. Divide the class into two teams. Ask questions about cnidarians. If a student answers correctly, advance the ball 10 yards towards that team's goalpost. If the answer is not correct, the question goes to the other team. The team that reaches its goalpost first wins. L2 COOP LEARN

Extension

Have students write about the different ways that corals obtain food. Ask them to describe how each of these food-getting strategies are used during a 24-hour cycle.

Assessment

Performance Ask students to make a travel brochure for tourists who wish to see cnidarians. They should include all cnidarian groups in their brochure. Use the Performance Task Assessment List for Booklet or Pamphlet in **PASC,** p. 57. L2

4 Close

Activity

Have students observe the movements of a live hydra in a deep-well 35 mm projector slide on a slide projector. Ask them to review the adaptations of the hydra to its environment. L1

Prepare

Key Concepts

- In this section, students will study the adaptive structures of parasitic flatworms and planarians. They will learn about how these worms are adapted to their environments.

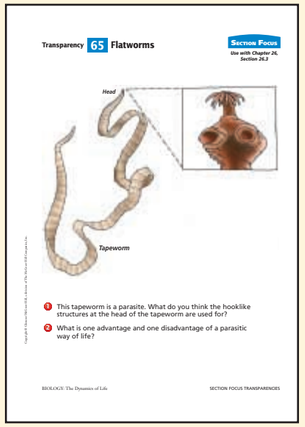
Planning

- Purchase single-edged razors and spring water for the BioLab.

1 Focus

Bellringer

Before presenting the lesson, display **Section Focus Transparency 65** on the overhead projector and have students answer the accompanying questions. L1 ELL



Resource Manager

Section Focus Transparency 65 and Master L1 ELL
Laboratory Manual, pp. 189-190 L2

SECTION PREVIEW

Objectives

Distinguish the adaptive structures of parasitic flatworms and free-living planarians.

Explain how parasitic flatworms are adapted to their way of life.

Vocabulary

pharynx
regeneration
scolex
proglottid

Section

26.3 Flatworms

Imagine the ultimate couch potato among living organisms—a worm that never has to move using its own power, is always carried by another organism, is surrounded by food that is already digested, and never has to expend much energy. This describes a parasite called a tapeworm. The parasitic way of life has many advantages.


Tapeworm scolex
Magnification: 11×


Magnification: 80×

What Is a Flatworm?

To most people, the word worm describes a long, spaghetti-shaped animal. Many animals have this general appearance, but now it is understood that many wormlike animals can be classified into different phyla. The least complex worms belong to the phylum Platyhelminthes, ***Figure 26.12.*** These flatworms are acoelomates with thin, solid bodies. The most well-known members of this phylum are the parasitic tapeworms (class Cestoda) and flukes (class Trematoda), which cause diseases in other animals, among them frogs and humans. The most commonly studied flatworms in biology classes are the free-living planarians (class Turbellaria). You can learn about the evolutionary relationships among these classes of flatworms in the *Problem-Solving Lab* on this page. Flatworms range in size from 1 mm up to several meters. There are approximately 14 500 species of flatworms found in marine and freshwater environments and in moist habitats on land.


a


b
Magnification: 30×


c
Magnification: 22×

Figure 26.12
Tapeworms are parasites that invade and live in host organisms (a). Flukes usually require two hosts in a complex life cycle (b). Planarians are not parasitic, nor do they cause diseases (c).

Feeding and digestion in planarians

A planarian feeds on dead or slow-moving organisms. It extends a tube-like, muscular organ, called the **pharynx** (FAH rinx), out of its mouth. Enzymes released by the pharynx begin digesting food outside the animal's body. Then food is sucked into the gastrovascular cavity, where food particles are broken up. Cells lining the digestive tract obtain food by phagocytosis. Food is thus digested in individual cells.

Nervous control in planarians

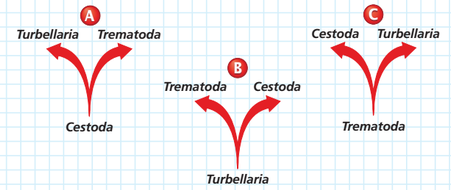
Some flatworms have a nerve net, and others have the beginnings of a central nervous system. A planarian has a nervous system that includes two nerve cords that run the length of its body, as you can see in ***Figure 26.13,*** sensory pits that detect chemicals and movement in water, and eyespots that detect light and dark. At the anterior end of the nerve cord is a small swelling called a ganglion. Located in the head, the ganglion receives messages from the eyespots and sensory pits, then communicates with the rest of the body along the nerve cords. Messages from the nerve cords trigger responses in a planarian's muscle cells. The nervous system enables a planarian to respond to the stimuli in its environment. Most of a planarian's nervous system is located in its head—a feature common to other bilaterally symmetrical animals.

Problem-Solving Lab 26-3 Predicting

Which Came First? There are three classes of flatworms. Two classes are parasitic and the third is free-living. Free-living flatworms are grouped in the class Turbellaria. Trematoda and Cestoda are parasitic classes. These two classes often have humans or some other mammal as one of their hosts.

Analysis

Diagrams A, B, and C show a possible evolutionary relationship among the three classes. The class at the bottom of each diagram can be assumed to have evolved first.



Thinking Critically

One of the three evolutionary patterns is correct. Pick the one that you consider to be correct. Defend your answer by explaining your reasoning. Include in your answer why the other two could not be correct.

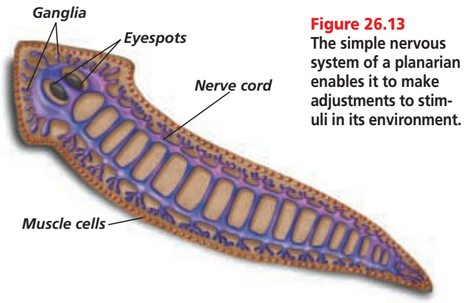


Figure 26.13
The simple nervous system of a planarian enables it to make adjustments to stimuli in its environment.

PROJECT

Planarian Behavior

Kinesthetic Have students design experiments that explore planarian behavior. They might investigate responses to food, touch, heat, cold, or other variables. Make sure they plan experiments in which there is only one variable, a control, and quantitative data to be collected. L2 ELL

Portfolio

Marine Flatworms

Linguistic Have students visit a marine aquarium, zoo, or pet store specializing in saltwater species to research marine flatworms. Have them write a summary of their findings to include in their portfolios. L2 ELL P

GLENCOE TECHNOLOGY

VIDEODISC
The Secret of Life
Flatworm Cross Section

2 Teach

Problem-Solving Lab 26-3

Purpose

Students are to determine which class of flatworms evolved first.

Process Skills

think critically, predict

Teaching Strategies

- Students may need additional help in understanding the nature of the three diagrams.
- Student groups of 2 or 3 may work well for this activity.

Thinking Critically

Diagram B is correct. Student explanations may vary but the main concept that should be explained is: Free-living classes of the flatworms evolved first. This class then evolved into the parasitic forms. It would be difficult to explain how a parasitic worm could evolve first with such a complex life cycle. If one assumes that flatworms evolved before mammals, then it would be impossible for the parasitic worms to have had any host available to them.

Assessment

Knowledge Ask students to describe those traits that flatworms do and do not share with cnidarians. Use the Performance Task Assessment List for Making Observations and Inferences in **PASC,** p. 17. L2

INSIDE STORY

Purpose

Students will study the structures and adaptations of planarians.

Teaching Strategies

- Allow students to examine live planarians or a prepared slide of a planarian. Have them make drawings of their observations. L1 ELL

Visual Learning

- Have students use the art in the feature to label the planarian they draw.
- Point out various structures of the planarian. As you mention each structure, have students identify the function of the structure.

Critical Thinking

As a swimming animal moves forward, the head encounters new information first. As most sensory organs are located in the head, this information is relayed to the rest of the animal, enabling it to react appropriately.

Quick Demo

Place a live planarian in water in a 35mm deep-well slide that can be projected through a slide projector. Ask students to observe how the worm moves. Point out that the planarian has a head area. Remind them that sponges do not have a head and ask the survival advantage of having a head area on the body. L1 ELL

INSIDE STORY

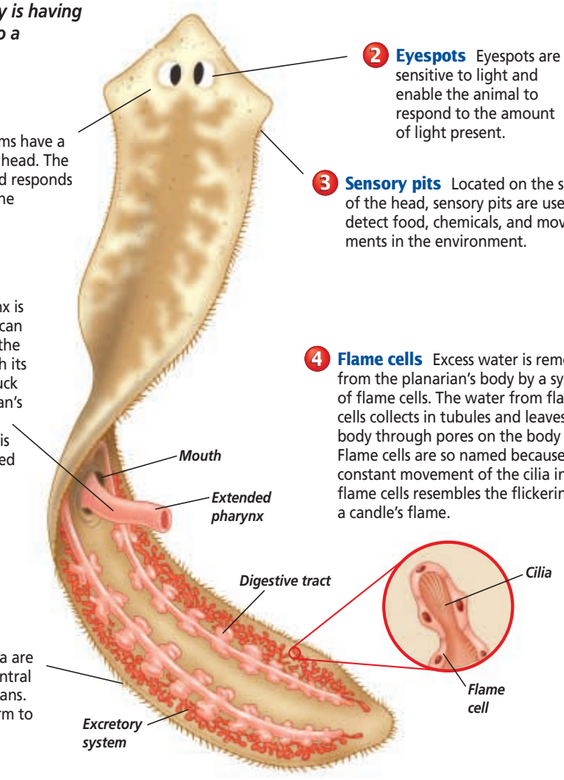
A Planarian

If you've ever waded in a shallow stream and turned over some rocks, you may have found tiny, black organisms stuck to the bottom of the rocks. These organisms were most likely planarians. Planarians have many characteristics common to all species of flatworms. The bodies of planarians are flat, with both a dorsal and a ventral surface. All flatworms have bilateral symmetry.

Magnification: 42×

Planarian

Critical Thinking ***Why is having a head an advantage to a swimming animal?***



1 Head Flatworms have a clearly defined head. The head senses and responds to changes in the environment.

2 Eyespots Eyespots are sensitive to light and enable the animal to respond to the amount of light present.

3 Sensory pits Located on the sides of the head, sensory pits are used to detect food, chemicals, and movements in the environment.

4 Flame cells Excess water is removed from the planarian's body by a system of flame cells. The water from flame cells collects in tubules and leaves the body through pores on the body surface. Flame cells are so named because the constant movement of the cilia inside flame cells resembles the flickering of a candle's flame.

5 Cilia Hairlike cilia are located on the ventral surface of planarians. Cilia help the worm to pull itself along.

6 Pharynx The pharynx is a muscular tube that can be extended outside the animal's body through its mouth. It is used to suck food into the planarian's gastrovascular cavity. Note that the mouth is a body opening located in the midsection of the planarian.

Reproduction in planarians

Study the body of a planrian in the *Inside Story*. How does a planarian reproduce? Like many of the organisms studied in this chapter, most flatworms are hermaphrodites. During sexual reproduction, individual planarians exchange sperm, which travel along special tubes to reach the eggs. Fertilization occurs internally. The zygotes are released in capsules into the water, where they hatch into tiny planarians.

Planarians can also reproduce asexually. When a planarian is damaged, it has the ability to regenerate, or regrow, new body parts. **Regeneration** is the replacement or regrowth of missing body parts. Missing body parts are replaced through mitosis. If a planarian is cut horizontally, the section containing the head will grow a new tail, and the tail section will grow a new head. Thus, a planarian that is damaged or cut into two pieces may grow into two new organisms—a form of asexual reproduction. Go to the *BioLab* at the end of this chapter to observe regeneration in planarians.

Feeding and digestion in parasitic flatworms

Although the basic structure of a parasitic flatworm is similar to that of a planarian, it is adapted to obtaining nutrients from inside the bodies of one or two hosts. Recall that a parasite is an organism that lives on or in another organism and depends upon that host organism for its food. Parasitic flatworms have mouthparts with hooks that keep the worm firmly attached to the insides of its host. Parasitic flatworms do not have complex nervous or muscular tissue. Because they are surrounded by nutrients, they do not need to move to seek out or find food.

Diversity of Flatworms

Planarians are free-living flatworms. Tapeworms and flukes are parasitic flatworms. These parasites live in the bodies of many vertebrates including dogs, cats, cattle, monkeys, and people.

Tapeworm bodies have sections

Some adult tapeworms that live in animal intestines can grow to more than 10 m in length. The body of a tapeworm is made up of a head and individual repeating sections called proglottids, shown in ***Figure 26.14***. The knob-shaped head of a tapeworm is called a **scolex** (SKOH leks). A **proglottid** (proh GLAH tihd) is a detachable section of a tapeworm that contains muscles, nerves, flame cells, and male and female reproductive organs. Each proglottid may contain up to 100 000 eggs, and some tapeworms consist of 2000 proglottids.

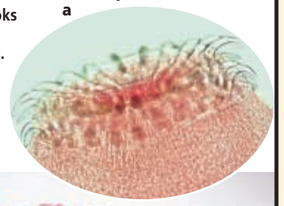
WORD *Origin*

scolex
From the Greek word *skolek*, meaning "worm."
A scolex is the knob-shaped head of a tapeworm.

Figure 26.14
The scolex is covered with hooks and suckers that attach to the intestinal lining of the host (a). Mature proglottids full of fertilized eggs are shed (b). Eggs hatch when they are eaten by a secondary host.

Magnification: 29×

a



b

Magnification: 35×

Concept Development

Display several preserved flatworms. Ask students to observe the worms and list their similarities and differences. Have them speculate which ones are parasites and ask them to explain their choices. L2 ELL

Assessment

Knowledge Ask students to explain how regeneration of missing body parts in planarians can also be a form of asexual reproduction. *Students should be able to explain that when a planarian is cut into two halves, each half can regenerate the missing half through mitosis. This results in two new worms that are genetically identical to the original worm. In asexual reproduction, a parent produces offspring that are genetically identical to the parent.*

The BioLab at the end of the chapter can be used at this point in the lesson.

INVESTIGATE BioLab

GLENCOE TECHNOLOGY

CD-ROM
Biology: The Dynamics of Life
BioQuest: *Biodiversity Park*
Discs 3, 4

3 Assess

Check for Understanding

Naturalist Ask students to make and fill out a table about flatworms with the following headings: symmetry, habitat, food-getting, nervous control, digestion, reproduction, free-living or parasitic, examples. L2

MEETING INDIVIDUAL NEEDS

Learning Disabled

Naturalist Provide students with outlines of planarians. Ask students to use one outline to show the symmetry of the planarian as well as its anterior and posterior ends and dorsal and ventral sides. Have students use the Inside Story as a model to show individual body systems of planarians. L1 ELL

GLENCOE TECHNOLOGY

VIDEODISC
The Secret of Life
Six Kingdoms

TECHPREP

Mapping Worm Parasites

Visual-Spatial Give students a blank map of the world and have them color code it for where worm parasites affect humans. Ask students to list preventive measures that could be taken to eliminate each parasite. L2 ELL

BIOLOGY JOURNAL

Flatworm Life Cycles

Visual-Spatial Have students prepare diagrams that show the life cycles of common human flatworm parasites. College-level invertebrate zoology textbooks are excellent resources for such diagrams. Ask students to put these diagrams in their journals. L2 ELL

Reteach

In their groups, have some students draw and label the structures of a planarian. Have other students diagram the life cycle of *Taenia solium* or the *Schistosoma* fluke. L2 ELL COOP LEARN

Extension

Interpersonal Ask a group of students to interview a veterinarian and report on the procedures for diagnosing and treating parasitic worms in pets. L2 ELL

Assessment

Knowledge Have students assume they are preparing an exhibit about planarians for a children's museum. Ask students to draw the worm, label its parts, and discuss its body systems in simple terms. L1 ELL

4 Close

Activity

Show students a selection of one-frame cartoons about animals by Gary Larson. Ask them to design a cartoon about planarians that is humorous and scientifically accurate. L2 ELL

Resource Manager

Reteaching Skills Transparency 39 and Master L1 ELL
Reinforcement and Study Guide, p. 117 L2
Content Mastery p. 131 L1

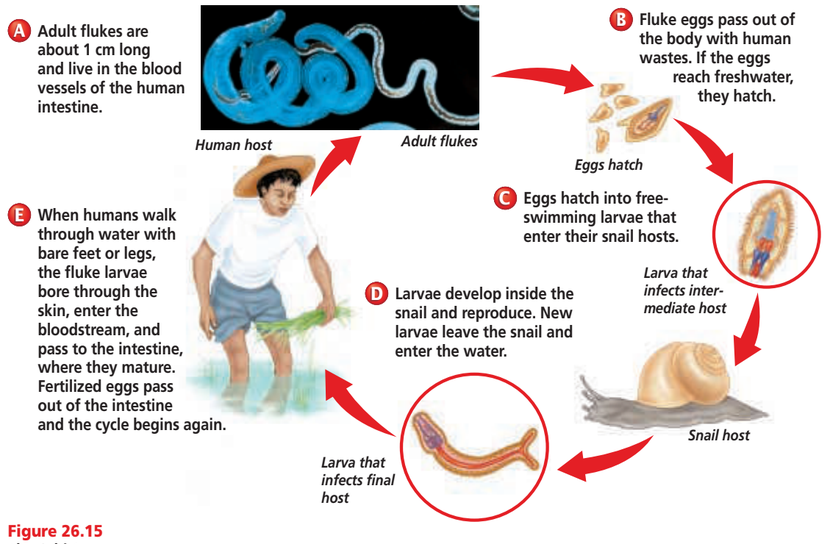


Figure 26.15 The *Schistosoma* fluke requires two hosts to complete its life cycle.

The life cycle of a fluke

A fluke is a parasitic flatworm that invades the internal organs of a vertebrate such as a human or a sheep. It obtains its nutrition by embedding itself in organs where it feeds on cells, blood, and other fluids of the host organism. Flukes have a complex life cycle that may include one, two, or more hosts.

Blood flukes of the genus *Schistosoma*, shown in ***Figure 26.15,*** cause a disease in humans known as schistosomiasis. Schistosomiasis is common in countries where farmers grow rice. Farmers must work in standing water in rice fields during planting and harvesting. Blood flukes are common where the secondary host, snails, also are found.

Section Assessment

Understanding Main Ideas

1. Diagram and label the structures of a planarian.
2. Why don't tapeworms have a digestive system?
3. What is the adaptive advantage of a nervous system to a free-living flatworm?
4. How is the body of a tapeworm different from that of a planarian?

Thinking Critically

5. Examine the life cycle of a parasitic fluke, and suggest ways to prevent infection on a rice farm.

Skill Review

6. **Observing and Inferring** What can you infer about the way of life of an organism that has no mouth or digestive system, but is equipped with a sucker? For more help, refer to *Thinking Critically* in the **Skill Handbook.**

Section

26.4 Roundworms

SECTION PREVIEW

Objectives
Compare the structural adaptations of roundworms and flatworms.
Identify the characteristics of four roundworm parasites.

Vocabulary
none

Have you ever been to the veterinarian to have your dog tested for heartworms? Perhaps you recall being warned not to eat uncooked pork products. Flatworms are not the only type of worms that can cause harm to humans and other vertebrates. It has been estimated that about one-third of the world's human population suffers from problems caused by roundworms.

Dog heartworms

What Is a Roundworm?

Roundworms belong to the phylum Nematoda. They are widely distributed, living in soil, animals, and both freshwater and saltwater environments. More than 12 000 species of roundworms are known to scientists.

Most roundworm species are free-living, but many are parasitic, including those shown in ***Figure 26.16.*** In fact, virtually all plant and animal species are affected by parasitic roundworms.

Roundworms are tapered at both ends. They have a thick outer covering that protects them from being

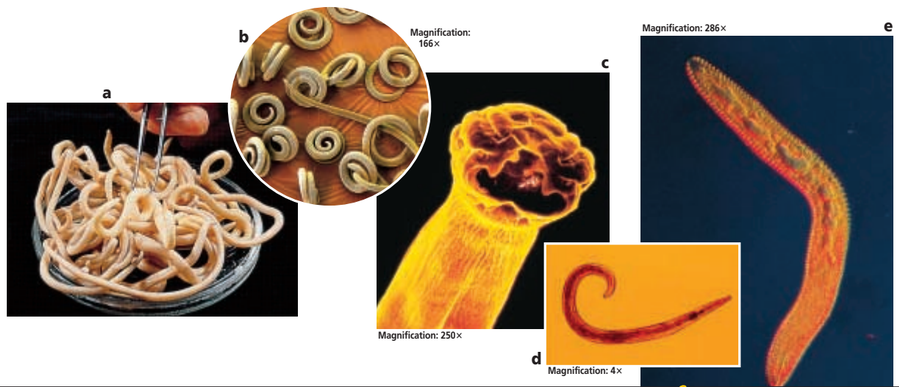


Figure 26.16 Parasitic roundworms include *Ascaris* **(a),** *Trichinella* **(b),** hookworms **(c),** pinworms **(d),** and nematodes **(e)** that affect plants.

Section Assessment

1. Make sure students have labeled the head, eyespots, sensory pits, cilia, flame cells, mouth, and pharynx.
2. They live in intestines surrounded by digested food.
3. It enables the worm to sense food and appropriate habitat as it swims.
4. Tapeworms have mouthparts with hooks while planarians have a pharynx that can extend out of the mouth. Tapeworms do not have complex nervous or muscular tissue, whereas planarians have these tissues. Tapeworms have a knob-shaped head and a body made up of segments called proglottids but have no digestive system. Planarians have a head with eyespots. They also have digestive tissues.
5. Workers could wear boots and gloves. Human wastes should be kept out of the water.
6. This organism would most likely be a parasite that attaches to its host by means of a sucker and uses food that the host has already digested.

Meeting Individual Needs

Gifted/Visually Impaired/ Learning Disabled

Kinesthetic Have gifted students make clay models of the worms studied in this section. Provide these models to students who have visual problems or learning disabilities for use in studying these organisms. L1

Portfolio

Roundwort Data Table

Naturalist Have students construct a table that lists the names of each roundworm discussed in the left column. Have students sketch the roundworm in the second column, describe its habitat in the third column, and explain how the worm affects humans in the fourth column. L2 P

Prepare

Key Concepts

Students will compare and contrast the structural adaptations of roundworms and learn about the characteristics of the roundworms *Ascaris*, *Trichinella*, hookworms, and pinworms.

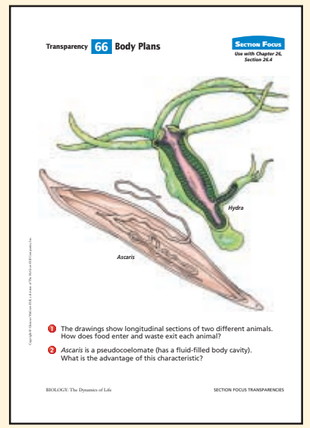
Planning

- Obtain a live vinegar eel culture for the Quick Demo.

1 Focus

Bellringer

Before presenting this lesson, display **Section Focus Transparency 66** on the overhead projector and have students answer the accompanying questions. L1 ELL



2 Teach

MiniLab 26-2

Purpose
Students will observe the larval stage of the pork worm embedded in muscle tissue of its host.

Process Skills
observe and infer, measure in SI

Teaching Strategies
- Prepared slides of pork worm are available from biological supply houses.
- Certain larvae will appear as round segments due to the plane through which the slice was made in preparing the slide.

Expected Results
Students will not be able to see pork worm larvae without the aid of a microscope. Size of the larvae will be close to 100 mm.

Analysis
1. microscopic, round, like a hot dog, spiral
2. Pork worm larvae are microscopic and cannot be identified by a visual inspection.
3. Samples of muscle tissue can be taken and viewed under a microscope.

Assessment
Portfolio Have students put their diagrams in their portfolios. Use the Performance Task Assessment List for Science Portfolio in **PASC**, p. 105. L1 P

Problem-Solving Lab 26-4

Purpose
Students will study a diagram of the pork worm life cycle.

Process Skills
- apply concepts, think critically, interpret scientific diagrams

Teaching Strategies
- Show photographs of the pork worm adult to your students.

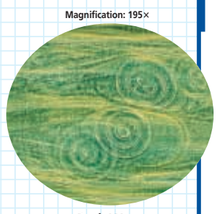
digested by their host organisms. On a flat surface, roundworms look like tiny, wriggling bits of sewing thread. They lack circular muscles but have pairs of lengthwise muscles. As one muscle of a pair contracts, the other muscle relaxes. This alternating contraction and relaxation of muscles causes roundworms to move in a thrashing fashion.

Roundworms have a pseudocoelom and are the simplest animals with a tubelike digestive system. Recall that a pseudocoelom is a body cavity partly lined with mesoderm. Unlike flatworms, roundworms have two body openings—a mouth and an anus. The free-living species have well-developed sense organs, such as eyespots, although these are reduced in parasitic forms.

Word Origin
Trichinella
From the Greek word *trichinos*, meaning "made of hair." *Trichinella* species are slender, hairlike, roundworms.

MiniLab 26-2 Observing

Observing the Larval Stage of a Pork Worm You can observe the larval stage of a pork worm (*Trichinella spiralis*) embedded within the muscle tissue of its host. It will look like a curled up hot dog surrounded by muscle tissue.



Pork Worm

Procedure
1. Examine a prepared slide of pork worm larvae under the low-power magnification of your microscope.
2. Locate several larvae by looking for "spiral worms enclosed in a sac." All other tissue is muscle.
3. Estimate the size of the larva in µm.
4. Diagram one larva. Indicate its size on the diagram.

Analysis
1. Describe the appearance of a pork worm larva.
2. Why might it be difficult to find larva embedded in muscle when meat inspectors use visual checking methods in packing houses to screen for pork worm contamination?
3. Suggest what inspectors might do to help detect pork worm larvae.

Diversity of Roundworms

Roundworms are found as parasites in most organisms on Earth. Approximately half of the described roundworm species are parasites, and about 50 species infect humans.

Roundworm parasites invade humans through a variety of methods

Ascaris mainly infects children who swallow eggs when they put their soiled hands into their mouths or eat vegetables that have not been washed. The eggs hatch in the intestines, move to the bloodstream, and then to the lungs, where they are coughed up and swallowed to begin the cycle again.

Hookworms commonly infect humans in warm climates where people walk on contaminated soil in bare feet. Hookworms cause people to feel weak and tired due to blood loss.

Pinworms are the most common parasites in children. Pinworms invade the intestinal tract when children eat something that has come in contact with contaminated soil. Female pinworms lay eggs near the anus, and reinfection is common because the worms cause itching.

Trichinella worms cause a disease called trichinosis. These worms enter the body in undercooked pork. Find out what these roundworms look like in the *MiniLab* on this page. Trichinosis is not as common in the United States as it once was because of stricter meat inspection standards. However, *Trichinella* worms are microscopic and may not be seen during a visual inspection. Trichinosis can be controlled by cooking pork long enough to kill any worms that may be present. You can learn more about controlling trichinosis in the *Problem-Solving Lab* on the next page.

Roundworm parasites of other organisms

Nematodes can infect and kill pine trees, cereal crops, and food plants such as potatoes. They are particularly attracted to plant roots. About 1200 species of nematodes cause diseases in plants. They also infect fungi and form symbiotic associations with bacteria. Soil nematodes invade roots of plants grown for food, as you can see in ***Figure 26.17***, and cause a slow decline of the plant.

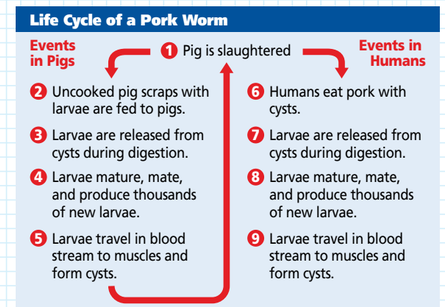
Figure 26.17
Roundworms that are plant parasites usually enter the roots, forming cysts that affect the plant's ability to absorb water.

Problem-Solving Lab 26-4 Interpreting Scientific Illustrations

How can the pork worm parasite be controlled?
Trichinella spiralis, the pork worm, is contracted when humans eat raw or undercooked pork products.

Analysis
This diagram shows the life cycle of the pork worm. A cyst is a protective covering that encloses the dormant larval stage.

Life Cycle of a Pork Worm



Thinking Critically
1. Would it be practical or impractical to disrupt the pork worm life cycle: At step 2? At step 4? At step 6? At step 9? Explain your answers.
2. Why doesn't the arrow return to the top of the diagram after step 9 as it does after step 5?

Section Assessment

Understanding Main Ideas
1. Compare the body structures of roundworms and flatworms.
2. Why do parents teach children to wash their hands before eating?
3. Describe the method of infection of one human roundworm parasite.
4. Compare how *Ascaris* and *Trichinella* are contracted.

Thinking Critically
5. An infection of pinworms is spreading to children who attend the same preschool. Make a list of precautions that could be taken to help prevent its continued spread.

Skill Review
6. **Making and Using Tables** Make a table of the characteristics of four roundworm parasites, indicating the name of the worm, how it is contracted, the action of the parasite in the body, and means of prevention. For more help, refer to *Organizing Information* in the **Skill Handbook.**

Thinking Critically
1. impractical, unless there is a drug that can be given to the pig to destroy the adult worm; practical, make sure all scraps are cooked before feeding them to a pig; practical, advise consumers about proper cooking of pork; practical, the cycle ends here.
2. The cycle ends here in humans. Any larvae in human muscle tissue remains there.

Assessment
Skill Ask students to describe any differences in the life cycle of the pork worm when in a pig host compared with its life cycle when in a human host. *They are essentially alike.* L2

Section Assessment

1. Roundworms have a pseudocoelom and two body openings. Flatworms are acoelomate with only one body opening.
2. It is important to wash hands before eating to prevent infection by parasitic worms and bacteria.
3. Roundworms can be contracted by eating improperly cooked pork and unwashed vegetables, walking barefoot, and by lack of good hygiene.
4. *Ascaris* is contracted by eating food contaminated by *Ascaris*. *Trichinella* is contracted by eating contaminated pork.
5. good personal hygiene such as washing hands, clothing, and bedding
6. Make sure students' tables include information from pages 731-733.

Biology Journal

Roundworm Symmetry

Visual-Spatial Provide students with an outline drawing of a roundworm. Have students add a line to the diagram to show the bilateral symmetry of the worm. Ask students to label the worm's anterior, posterior, dorsal, and ventral areas. L1 ELL

3 Assess

Check for Understanding

Have students write true or false questions relating to roundworms. Review and explain the correct answers. L2

Reteach

Have students play bingo with a 16-square card with the name of a worm in each square. Read a list of statements and have students play bingo. L2

Extension

Ask students to do a videotape report on parasitic roundworms in humans. L3

Assessment
Portfolio Ask students to write a paragraph to explain how the roundworm diseases they studied might be prevented. L2 P

4 Close

Activity

Set up stations around the classroom with photos or slides of the roundworms studied. Have students identify each worm. L2 ELL

INVESTIGATE BioLab

Time Allotment

30 minutes the first day, 10 minutes every day for 2 weeks

Process Skills

collect data, experiment, think critically, observe and infer, organize data

Safety Precautions

Make sure students work very carefully with razor blades. Remind students to use razor blades carefully to avoid injury. Caution them to always cut in a direction away from the body. Remind students they are working with live animals and to treat them gently. Have students wash their hands after working with planarians.

Preparation

- Order planarians so that they arrive a day or two before they will be needed. Planarians are available from biological supply houses. Ask for the species, *Dugesia tigrina*.
- DO NOT use tap water, distilled water, or spring water purchased from a grocery store. Purchase spring water from a biological supply house only.

Alternative Materials

- Use a hand lens if binocular microscopes are not available.
- A dropper or plastic pipette may be substituted for the camel hair brush.

INVESTIGATE BioLab

Observing Planarian Regeneration

Certain animals have the ability to replace lost body parts through regeneration. In regeneration, organisms regrow parts that were lost. This process occurs in a number of different phyla throughout the animal kingdom. Examples of animals that can regenerate include sponges, hydra, mudworms, sea stars, and reptiles. In this activity, you will observe regeneration in planarians. Planarians are able to form two new animals when one has been cut in half.

Preparation

Problem

How can you determine if the flatworm *Dugesia* is capable of regeneration?

Objectives

In this BioLab, you will:

- **Observe** the flatworm, *Dugesia*.
- **Conduct** an experiment to determine if planarians are capable of regeneration.

Materials

planarians
petri dish
springwater
camel hair brush
chilled glass slide
binocular microscope
marking pencil or labels
single-edged razor blade

Safety Precautions

Always wear goggles in the lab. Use extreme caution when cutting with a razor blade. Wash your hands both before and after working with planarians.

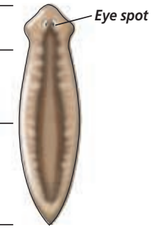
Skill Handbook

Use the **Skill Handbook** if you need additional help with this lab.

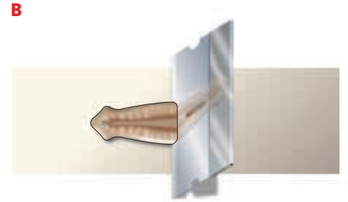
Procedure

1. Obtain a planarian and place it in a petri dish containing a small amount of springwater. You can pick up a planarian easily with a small camel hair brush.
2. Use a binocular microscope to observe the planarian. Locate the animal's head and tail region and its "eyes." Use diagram **A** as a guide.
3. Place the animal on a chilled glass slide. This will cause it to stretch out.
4. Place the slide onto the microscope stage. While observing the worm through the microscope, use a single-edged razor to cut the animal in half across the midsection. Use diagram **B** as a guide.

A



B



5. Remove the head end and place it in a petri dish filled with springwater. Label the dish with the date, your name, and the word "head."
6. Add the tail section to a different petri dish and label it as in step 5, marking this dish "tail."
7. Repeat steps 3-6 with a second flatworm and add the correct pieces to the proper petri dishes.
8. Place the petri dishes in an area designated by your teacher.
9. Prepare a data table that will allow you to record the appearance of your flatworms every other day for two weeks. Include diagrams and the number of days since starting the experiment in your data table.
10. Observe your animals under a binocular microscope and record observations and diagrams in your data table.

Analyze and Conclude

1. **Knowledge** To what phylum do flatworms belong? Are planarians free living or parasitic? What is your evidence?
2. **Observing** What new part did each original head piece regenerate? What new part did each original tail piece regenerate?
3. **Observing** Which section, head or tail, regenerated new parts faster?
4. **Interpreting** Are planarians able to regenerate new parts? Would regeneration be by mitosis or meiosis? Explain.
5. **Thinking Critically** What might be the advantage for an animal that can grow new body parts through regeneration?
6. **Thinking Critically** Would the term "clone" be suitable in reference to the newly formed planarians? Explain your answer.

Going Further

Project Design and carry out an experiment that would test this hypothesis: If regenerating planarians are placed in a warmer environment, then the time needed for new parts to form would decrease.

interNET CONNECTION To find out more about regeneration, visit the Glencoe Science Web Site.
www.glencoe.com/sec/science

Procedure

Teaching Strategies

- Have students work in groups of 2 or 3.
- Do not feed the planarians while they are undergoing regeneration. Replace any springwater lost through evaporation.
- Store the regenerating pieces in a cool area (around 20°C) of the classroom and in subdued light.

Resource Manager

Section Focus Transparency 66 and Master L1 ELL
BioLab and MiniLab Worksheets pp. 118-119 L2
Reinforcement and Study Guide p. 118 L2
Content Mastery, pp. 129, 132 L1

Data and Observations

Students will observe the flatworms and will be able to see those structures shown in Figure A. Data table design will vary from student to student. Encourage students to diagram their observations. At the end of two weeks, students will observe that a new head has formed on the original tail section, and a new tail on the original head section.

Internet Address Book

interNET CONNECTION Note Internet addresses that you find useful in the space below for quick reference.

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INVESTIGATE BioLab

Analyze and Conclude

1. Planarians belong to the phylum Playthelminthes. They are free-living and can be found in ponds and streams living on their own.
2. The head regenerated a new tail, and the tail regenerated a new head.
3. The head section regenerated a new tail faster.
4. Yes, planarians can regenerate new body parts. Regeneration occurs through mitosis; no sexual reproduction or formation of gametes was needed.
5. Answers may vary; there is no need to find a mate, able to replace lost body parts, faster than sexual reproduction, identical genetic makeup as original animal
6. Yes, clones may be formed asexually by mitosis. Regeneration in planarians is a type of cloning.

Assessment

Portfolio Have students write a report on their experimental findings. Be sure to have them include their data table with recorded results. Use the Performance Task Assessment List for Lab Report in **PASC,** p. 47. L2

Going Further

Have students redesign the experiment by making different types of cuts and/or making cuts at different locations on the animals' bodies.

Biology & SOCIETY

Purpose

Students learn about the importance of coral reefs, discover how they can be damaged, and explore methods for preventing damage.

Background

Corals contain zooxanthellae that have chlorophyll and carry out photosynthesis. During the day, most corals withdraw into the safety of their limestone cups and let the zooxanthellae make food for them. At night, corals use their tentacles and nematocysts to capture planktonic organisms that drift by.

Teaching Strategies

- Point out to students that, since most coral reefs lie in shallow waters near the shoreline, they are easily affected by coastal activities. The clearing of coastal land for development may increase erosion. Siltation clouds the water and reduces the amount of sunlight available, limiting photosynthesis by zooxanthellae. Silt can also clog the tiny mouth opening of the coral polyps, affecting their ability to feed at night.

Investigating the Issue

Because coral reefs offer an enormous array of protected living spaces, the destruction of a reef would remove habitats needed by many species. Organisms that prey on any of those species would lose a food source. Coral reefs also absorb wave energy, so the destruction of a reef could leave the shore subject to erosion from wind and wave action.

Biology & SOCIETY

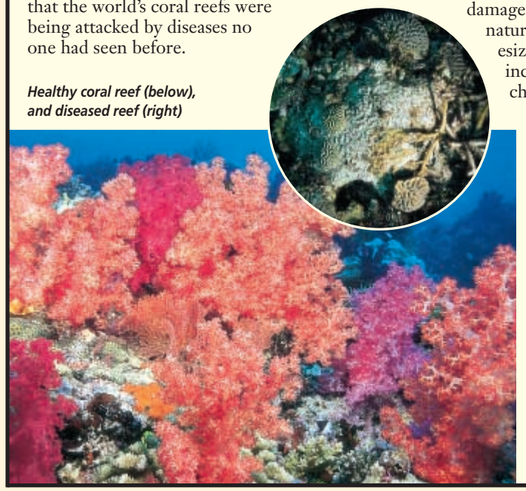
Why are the corals dying?

Coral reefs are some of Earth's most spectacularly beautiful and productive ecosystems. A reef is composed of hundreds of corals that together create a structure of brightly colored shapes and patterns. In the reef's cracks and crevices live a dazzling array of fishes and invertebrates.

Coral reefs protect nearby shore areas from erosion by breaking up the energy of incoming waves. But worldwide, coral reefs are increasingly being damaged and destroyed.

Physical Damage to Coral Reefs Hurricanes cause serious damage to coral reefs, as do large ships that run aground on reefs. Coral reefs lie close to the water's surface, and make attractive anchoring sites for boats. But when an anchor is pulled up, it may rip away a piece of the reef. In some parts of the world, explosives are used to mine coral limestone for building materials and fertilizers. Tropical aquarium fishes are sometimes collected by poisoning with cyanide, which stuns fishes and makes them easier to collect, but also kills corals. Collectors take pieces of coral for jewelry and souvenirs.

Damage from Disease In the 1970s, marine scientists began to realize that the world's coral reefs were being attacked by diseases no one had seen before.



Healthy coral reef (below), and diseased reef (right)

Black-band disease is caused by several species of cyanobacteria that combine to form a band of black filaments. This invading community slowly moves across the coral. White-band disease causes the living tissue of a coral to peel away from its skeleton; this may be caused by bacteria. Rapid-wasting disease, possibly caused by a fungus, forms white patches that consume not only the living tissue but also the top layers of the coral skeleton.

Many of the world's coral reefs are losing their beautiful colors in a process called bleaching. The corals become gray or white in color. Some scientists hypothesize that coral bleaching is the result of a loss of zooxanthellae, the symbiotic protists that live in coral and give it much of its color as well as nutrients.

Different Viewpoints

It is not easy to tell whether microorganisms are causing the diseases or are attacking already damaged or ailing corals that have lost their natural defenses. Most researchers hypothesize that coral diseases are on the increase because environmental changes, such as pollution in coastal runoff, higher water levels, or changes in ocean temperatures, make corals more vulnerable to opportunistic diseases.

Investigating the Issue

Analyzing the Issue What effects might the death of a coral reef have on nearby ocean and coastal life?

internet CONNECTION To find out more about coral reefs, visit the Glencoe Science Web Site. **www.glencoe.com/sec/science**

Going Further

Intrapersonal A great deal of research on methods for protecting and restoring coral reefs goes on in the Florida Keys. Invite students to use their Internet skills to find out about some of the problems and solutions scientists are exploring.

Internet Address Book

internet CONNECTION Note Internet addresses that you find useful in the space below for quick reference.

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Chapter 26 Assessment

Summary

Section 26.1

Sponges

Main Ideas

- A sponge is an aquatic, sessile, asymmetrical, filter-feeding invertebrate.
- Sponges are made of four types of cells. Each cell type contributes to the survival of the organism.
- Most sponges are hermaphroditic with free-swimming larvae.

Vocabulary

external fertilization (p. 716)
filter feeding (p. 713)
hermaphrodite (p. 716)
internal fertilization (p. 716)

Section 26.2

Cnidarians

Main Ideas

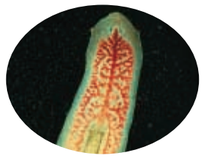
- All cnidarians are radially symmetrical, aquatic invertebrates that display two basic forms: medusa and polyp.
- Cnidarians feed by stinging or entangling their prey with cells called nematocysts, usually located at the ends of their tentacles.
- The three primary classes of cnidarians include the hydrozoans, hydras; scyphozoans, jellyfishes; and anthozoans, corals and anemones.

Vocabulary

gastrovascular cavity (p. 719)
medusa (p. 719)
nematocyst (p. 719)
nerve net (p. 721)
polyp (p. 719)

Section 26.3

Flatworms



Main Ideas

- Flatworms are acoelomates with thin, solid bodies belonging to the phylum Platyhelminthes. They are grouped into three classes: free-living planarians, parasitic flukes, and tapeworms.
- Planarians have well-developed nervous and muscular systems. These systems are reduced in parasitic flatworms. Flukes and tapeworms have other structures adapted to their parasitic existence.

Vocabulary

pharynx (p. 727)
proglottid (p. 729)
regeneration (p. 729)
scolex (p. 729)

Section 26.4

Roundworms

Main Ideas

- Roundworms are pseudocoelomate, cylindrical worms with lengthwise muscles, relatively complex digestive systems, and two body openings.
- Roundworm parasites include parasites of plants, fungi, and animals, including humans. *Ascaris*, hookworms, *Trichinella*, and pinworms are roundworm parasites of humans.

Vocabulary

none

GLENCOE TECHNOLOGY

VIDEOTAPE
MindJogger Videoquizzes
Chapter 26: *Sponges, Cnidarians, Flatworms and Roundworms*
Have students work in groups as they play the videoquiz game to review key chapter concepts.

Resource Manager

Chapter Assessment, pp. 151-156
MindJogger Videoquizzes
Computer Test Bank
BDOL Interactive CD-ROM, Chapter 26 quiz

Main Ideas

Summary statements can be used by students to review the major concepts of the chapter.

Using the Vocabulary

To reinforce chapter vocabulary, use the Content Mastery Booklet and the activities in the Interactive Tutor for Biology: The Dynamics of Life on the Glencoe Science Web Site.
www.glencoe.com/sec/science

THE PRINCETON REVIEW

All Chapter Assessment questions and answers have been validated for accuracy and suitability by The Princeton Review.

Understanding Main Ideas

1. a
2. c
3. b
4. c
5. c
6. d
7. a
8. d
9. b
10. b
11. b
12. hermaphrodite
13. head
14. hooks
15. fluke
16. a
17. cnidarians
18. Eyespots, planarian
19. planarian, regenerate
20. internal fertilization

Chapter 26 Assessment

Understanding Main Ideas

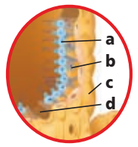
1. Which of these is a type of cell found in sponges?
   a. epithelial cell **c.** stinging cell
   b. flame cell **d.** nematocyst
2. An individual sponge is a hermaphrodite because it _____.
   a. reproduces by budding
   b. can regenerate lost body parts
   c. can produce both eggs and sperm
   d. has both pore cells and stinging cells
3. Which of the following organisms obtain food by filter feeding?
   a. jellyfish **c.** pinworm
   b. sponge **d.** tapeworm
4. To what phylum do marine invertebrates with radial symmetry and two body layers belong?
   a. Porifera **c.** Cnidaria
   b. Platyhelminthes **d.** Cestoda
5. Both sponges and planarians have _____ larvae.
   a. sessile **c.** free-swimming
   b. polyp **d.** budding
6. In cnidarians, medusae reproduce sexually to produce polyps, which in turn reproduce asexually to form _____.
   a. buds **c.** hermaphrodites
   b. larvae **d.** new medusae
7. Sea anemones exhibit only the _____ type of body form.
   a. polyp **c.** bud
   b. medusa **d.** colony

Test-Taking Tip

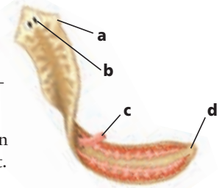
Ignore Everyone

While you take a test, pay absolutely no attention to anyone else in the room. Don't worry if your friends finish a test before you do. If someone tries to talk with you during a test, don't answer. You run the risk of the teacher thinking you were cheating—even if you weren't.

8. Two basic body forms are found in _____.
   a. sponges **c.** roundworms
   b. flatworms **d.** cnidarians
9. Acoelomate worms called _____ have thin, solid bodies.
   a. roundworms **c.** nematodes
   b. flatworms **d.** hookworms
10. Of the following, which is a pseudocoelomate animal?
    a. fluke **c.** tapeworm
    b. roundworm **d.** planarian
11. Examine the diagram. The cell labeled _____ forms eggs and sperm.



12. A _____ is an organism that has both male and female reproductive organs.
13. Unlike sponges and cnidarians, flatworms have a clearly defined _____.
14. Parasitic worms have mouthparts with _____.
15. A _____ is a parasitic worm that uses a snail as an intermediate host and has a larval stage that can bore through the skin of humans.
16. Examine the diagram. The structure labeled _____ is used to detect food, chemicals, and movement in the environment.



17. Hydrozoans and anthozoans are classes of _____.
18. _____, located on the head of a _____, are sensitive to light.
19. If a(n) _____ is cut accidentally, it can _____ lost tissue.
20. In _____, eggs and sperm meet inside an animal's body.

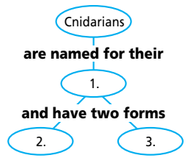
Chapter 26 Assessment

Applying Main Ideas

21. In what ways are cnidarians more complex than sponges?
22. You are examining a wormlike animal found in the intestine of a sheep. It has a head with tiny hooks. What kind of worm is it?
23. Of what advantage is hermaphroditism to a sessile animal?
24. Describe the features that would be important for a predator of jellyfishes.

Thinking Critically

25. **Observing and Inferring** While examining soil from the bottom of a pond, you notice tiny red worms wriggling aimlessly in your petri dish. What kind of worms are they?
26. **Recognizing Cause and Effect** At what points could the life cycle of a blood fluke be interrupted so that disease would be prevented?
27. **Observing and Inferring** Why is the phylogeny of cnidarians so little understood?
28. **Comparing and Contrasting** Both sponges and hydras are sessile organisms that cannot pursue prey. Compare their methods of obtaining food.
29. **Concept Mapping** Complete the concept map by using the following vocabulary terms: medusa, nematocyst, polyp.

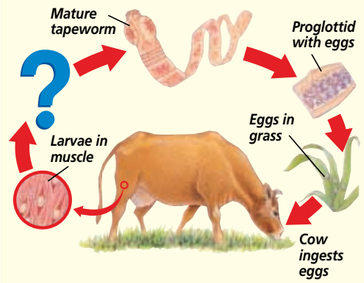


CD-ROM

For additional review, use the assessment options for this chapter found on the ***Biology: The Dynamics of Life Interactive CD-ROM*** and on the Glencoe Science Web Site.
www.glencoe.com/sec/science

Assessing Knowledge & Skills

The diagram shows the life cycle for a beef tapeworm.



Interpreting Scientific Illustrations
Use the diagram to answer the following questions.

1. Which part of the life cycle for a beef tapeworm is missing?
   a. infection of the cow
   b. infection of the grass
   c. infection of the human host
   d. infection of the tapeworm
2. How do the tapeworm eggs get into the grass?
   a. from rainwater
   b. from feces of infected cattle
   c. from snails
   d. from dead cows
3. Beef tapeworm larvae get into human hosts when humans _____.
   a. eat beef **c.** walk barefoot
   b. eat pork **d.** go swimming
4. **Completing a Diagram** By making a diagram similar to the tapeworm life cycle on this page, trace the steps of a *Trichinella* infection.

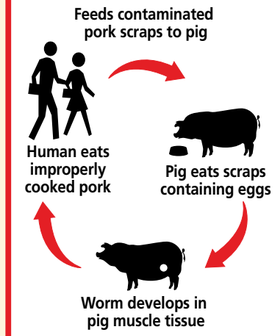
Chapter 26 Assessment

Thinking Critically

25. They are roundworms. Roundworms move with a wriggling motion because they have no circular muscles as do earthworms.
26. Human wastes may be disposed of in such as way as to prevent fluke eggs from coming in contact with snails, or humans can avoid contact with water in which snails live.
27. Cnidarians are soft-bodied animals that do not preserve well as fossils. In corals, their calcium carbonate homes become fossils, showing where corals once lived, but the animals themselves are not fossilized.
28. Sponges are filter feeders. They pull water in through pores and filter out small particles of food. Hydras are cnidarians. They use nematocysts on long tentacles. When a waving tentacle touches a prey organism, the nematocyst discharges, and the tentacles bring the captured food to the hydra's mouth for digestion.
29. 1. Nematocysts; 2. Medusa; 3. Polyp

Assessing Knowledge & Skills

1. c
2. b
3. a
4. **Life Cycle of *Trichinella***



Applying Main Ideas

21. The two cell layers of cnidarians are organized into tissues with specific functions. They have simple nervous systems, cells that can contract like muscles, nematocysts that are used to capture prey, and a gastrovascular cavity in which digestion occurs.
22. It is a parasitic flatworm. A head with hooks is characteristic of parasitic flatworms.
23. Animals that are sessile are unable to move and search for mates. If they are hermaphroditic, any individual can be a mate for any other individual of the same species.
24. Predators of jellyfishes must be immune to the toxins in jellyfishes, or have a protective covering such as mucus on the body that could absorb the nematocysts' toxins.