Section 3

Sponges and Cnidarians

Reading Preview

Key Concepts

- What are the main characteristics of sponges?
- What are the main characteristics of cnidarians?
- Why are coral reefs important?

Key Terms

- larva
- cnidarian
- polyp
- medusa
- colony
- coral reef

Target Reading Skill

Comparing and Contrasting

As you read, compare and contrast sponges and cnidarians by completing a table like this one.

Sponges and Cnidarians

Feature	Sponge	Cnidarian
Body structure	Hollow bag with pores	
Cell type that traps food		
Method(s) of reproduction		

Lab zone Discover Activity

How Do Natural and Synthetic Sponges Compare?

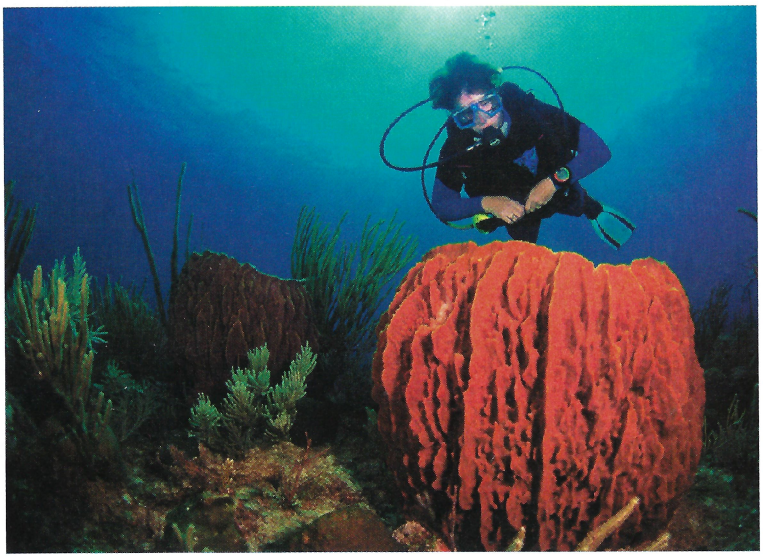
1. Examine a natural sponge, and then use a hand lens or a microscope to take a closer look. Look carefully at the holes in the sponge. Draw what you see through the lens.
2. Cut out a small piece of sponge and examine it with a hand lens. Draw what you see.
3. Repeat Steps 1 and 2 with a synthetic kitchen sponge.

Think It Over

Observing What are three ways a natural and a synthetic sponge are similar? What are three ways they are different?

Eagerly but carefully, you and the others in your group put on scuba gear as you prepare to dive into the ocean. Over the side of the boat you go. As you descend through the water, you see many kinds of fishes. When you get to the bottom, you notice other organisms, too. Some are as strange as creatures from a science fiction movie. A few of these unusual organisms may be invertebrate animals called sponges.

Sponges don't look or act like most animals you know. In fact, they are so different that for a long time, people thought that sponges were plants. Like plants, adult sponges stay in one place. But unlike most plants, sponges take food into their bodies.



◀ Diver investigating a barrel sponge

Sponges

Sponges live all over the world—mostly in oceans, but also in freshwater rivers and lakes. Adult sponges are attached to hard surfaces underwater. Water currents carry food and oxygen to them and take away their waste products. Water currents also play a role in their reproduction and help transport their young to new places to live.

Body Structure **Sponges are invertebrate animals that usually have no body symmetry and never have tissues or organs.** A sponge looks something like a hollow bag with a large opening at one end and many tiny pores covering its surface. In fact, the name of the phylum to which sponges belong—phylum Porifera—means "having pores."

Look at Figure 11. A sponge's body has different kinds of cells and structures for different functions. For example, most sponges have spikes. The network of spikes throughout the sponge supports its soft body, keeping it upright in the water. The spikes also help a sponge defend itself against an animal that might eat it, which is called a predator. The spikes can be as sharp as needles. Even so, some fish eat sponges.

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FIGURE 11
Structure of a Sponge

Structures surrounding the central cavity of a sponge are adapted for different functions.
Interpreting Diagrams *Which kind of cell in the sponge digests and distributes food?*

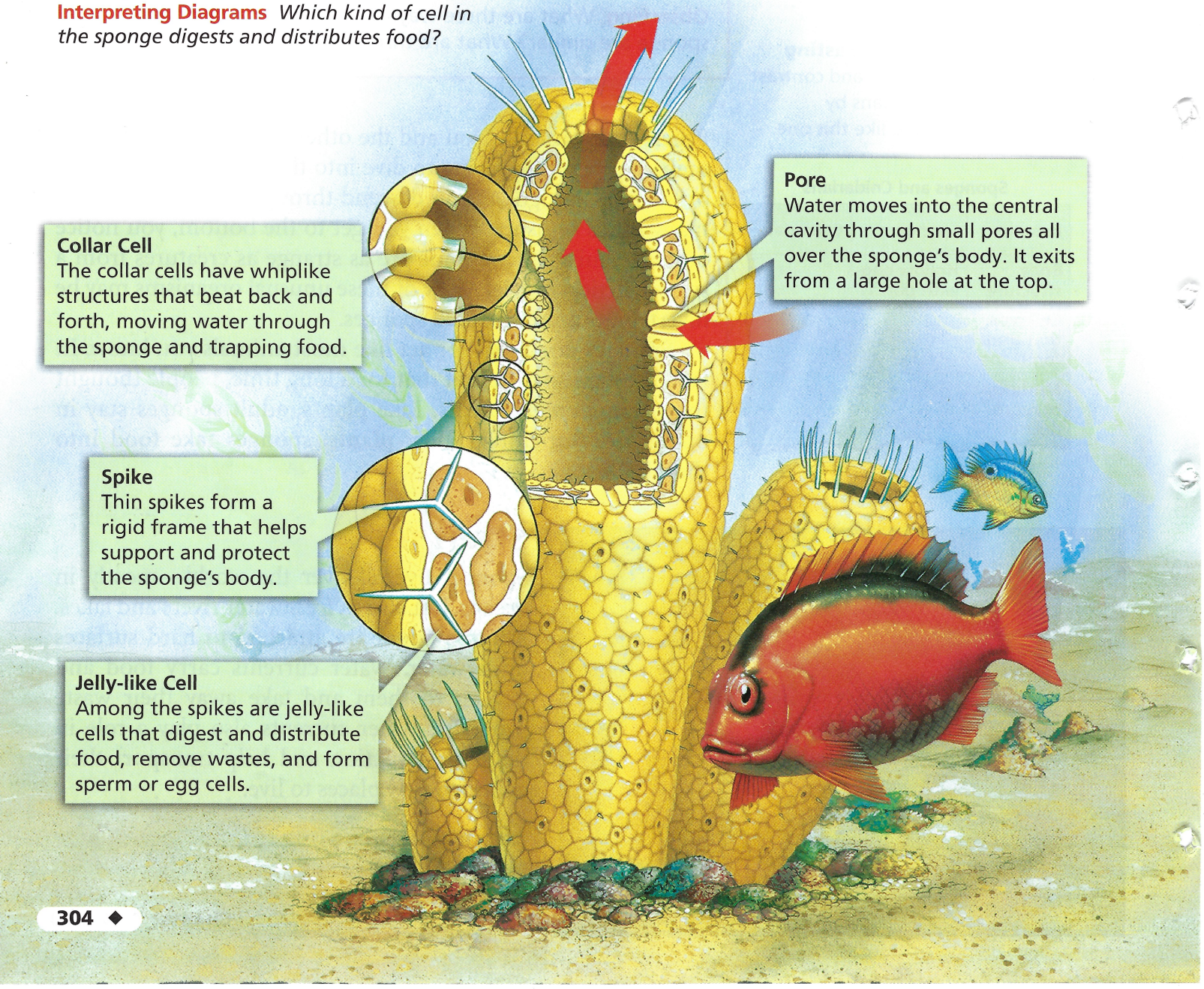
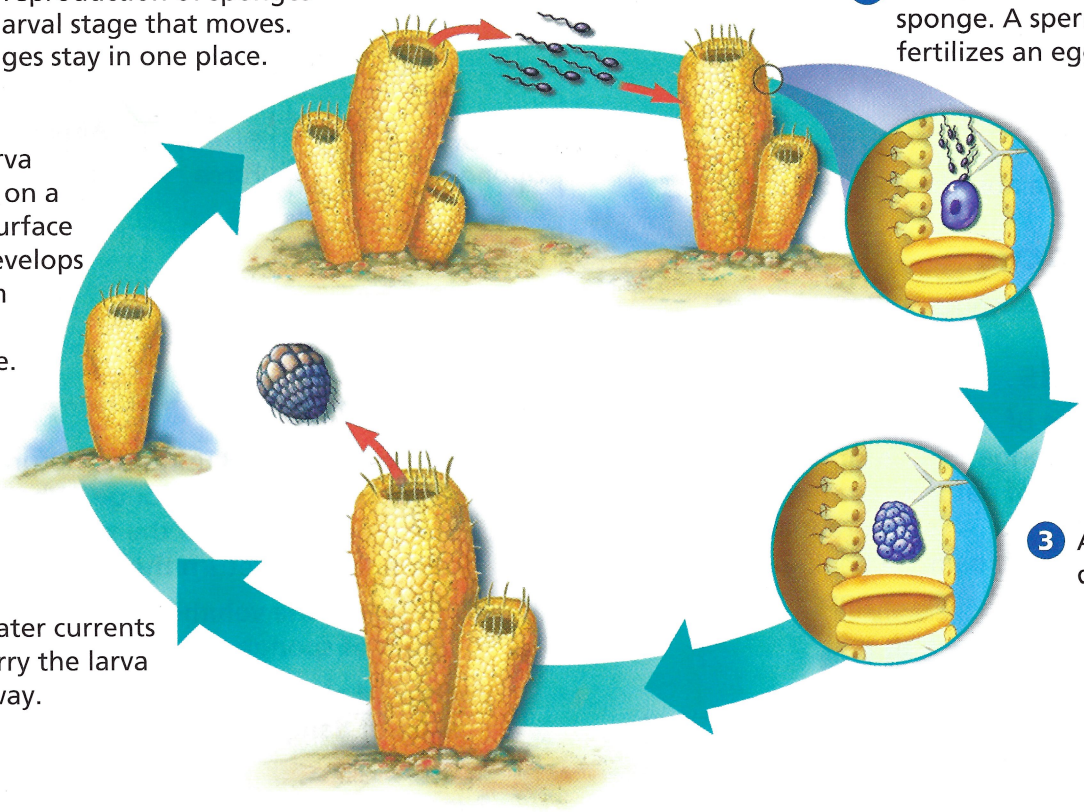


FIGURE 12

Reproduction of a Sponge

The sexual reproduction of sponges involves a larval stage that moves. Adult sponges stay in one place.



Obtaining Food and Oxygen A sponge eats tiny single-celled organisms. The sponge filters these organisms from the water moving through it. The collar cells that line the central cavity trap the tiny organisms. Jelly-like cells inside the sponge then digest, or break down, the food. Larger sponges can filter thousands of liters of water per day!

A sponge gets its oxygen from water, too. After the water moves through a sponge's pores, it passes over cells inside the sponge. Oxygen in the water then moves into the sponge's cells.

Reproduction Sponges reproduce both asexually and sexually. Budding is one form of asexual reproduction in sponges. In budding, small new sponges grow from the sides of an adult sponge. Eventually, the buds break free and begin life on their own.

Sponges reproduce sexually, too, but they do not have separate sexes. A sponge produces both sperm cells and egg cells. The sperm cells are released into the water. They enter another sponge and fertilize its eggs, as shown in Figure 12. After fertilization, a larva develops. A **larva** (plural *larvae*) is an immature form of an animal that looks very different from the adult.

Reading Checkpoint What is a larva?

Math Skills

Calculating a Rate

To calculate the rate of water flow in a sponge, divide the volume of water that the sponge filters by the time it takes the water to pass through the sponge.

$$\text{Flow rate} = \frac{\text{Volume of water}}{\text{Time}}$$

For example, a marble-sized sponge filters 15.6 liters of water in a day. How many liters does it filter per hour?

$$\frac{15.6\ \text{L}}{24\ \text{h}} = 0.65\ \text{L/h}$$

Practice Problem In 4 days, a sponge filters 1,200 L. What is its rate of water flow per day?

Cnidarians

Some other animals you might notice on an underwater dive are jellyfishes, corals, and sea anemones. These animals are **cnidarians** (ny DEHR ee unz), invertebrates that have stinging cells and take food into a central body cavity. **Cnidarians use stinging cells to capture food and defend themselves.**

Body Structure Cnidarians have two different body plans, which you can see in Figure 13. Notice that one form looks something like a vase and the other form looks like an upside-down bowl. Both body plans have radial symmetry, a central hollow cavity, and tentacles that contain stinging cells.

The vase-shaped body plan is called a **polyp** (PAHL ip). The sea anemone you see in Figure 13 is a polyp. A polyp's mouth opens at the top and its tentacles spread out from around the mouth. Most polyps are adapted for a life attached to an underwater surface.

The bowl-shaped body plan is called a **medusa** (muh DOO suh). The jellyfish you see in Figure 13 is a medusa. A medusa, unlike a polyp, is adapted for a swimming life. Medusas have mouths that open downward and tentacles that trail down. Some cnidarians go through both a polyp stage and a medusa stage during their lives. Others are either polyps or medusas for their entire lives.

Lab zone Try This Activity

Hydra Doing?

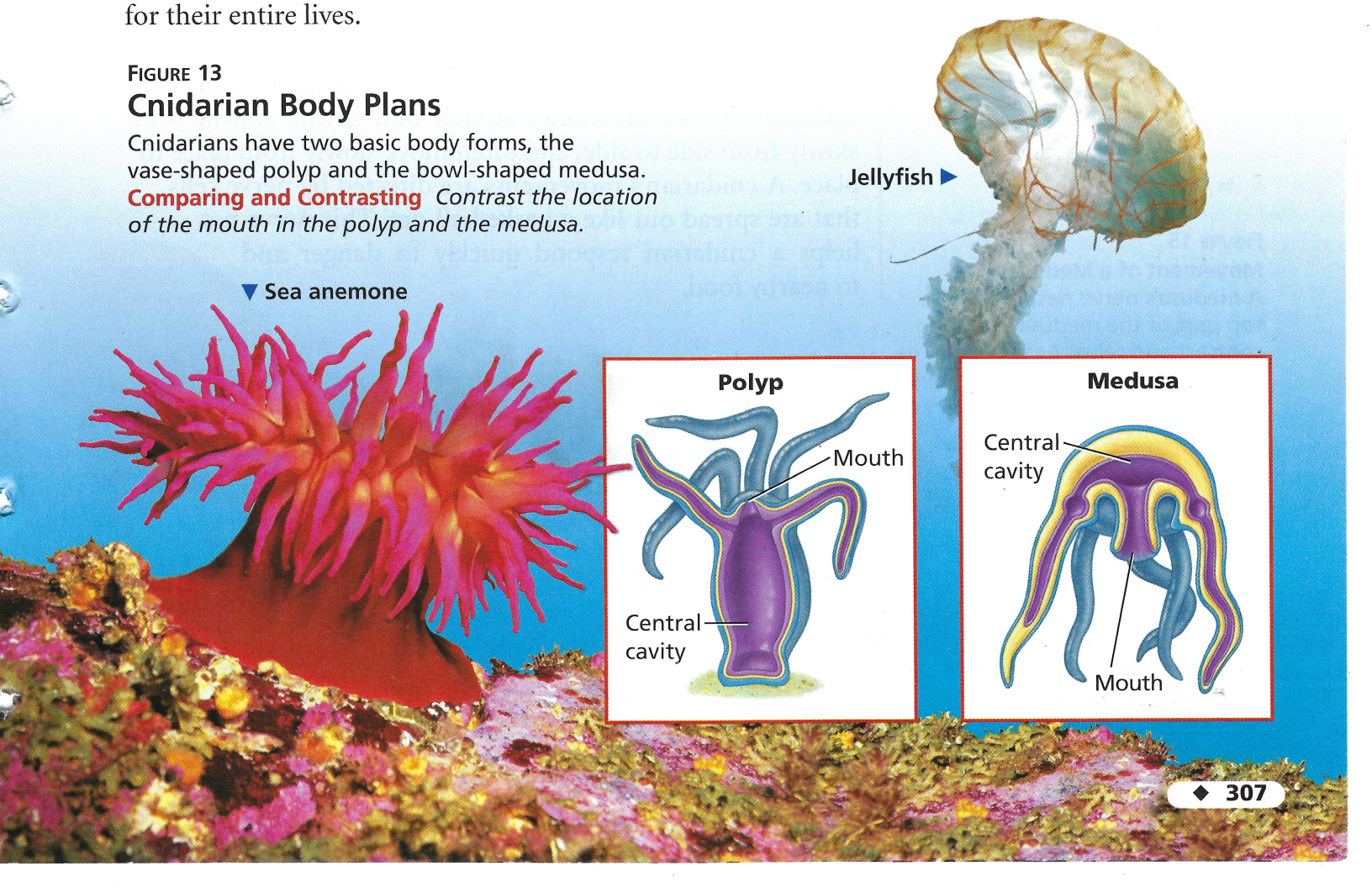
1. Put a drop of water containing hydras in a small unbreakable bowl or petri dish. Allow it to sit for about 15 minutes.
2. Use a hand lens to examine the hydras as they swim. Then gently touch the tentacles of a hydra with the end of a toothpick. Watch what happens.
3. Return the hydras to your teacher. Wash your hands.

Classifying Is a hydra a polyp or a medusa? Describe its method of movement.

FIGURE 13

Cnidarian Body Plans

Cnidarians have two basic body forms, the vase-shaped polyp and the bowl-shaped medusa.
Comparing and Contrasting *Contrast the location of the mouth in the polyp and the medusa.*



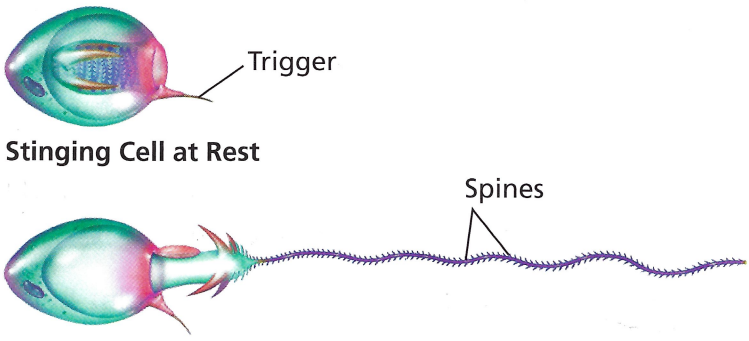


FIGURE 14
Cnidarian Attack!
A stinging cell fires when its trigger brushes against prey, such as a fish.

Obtaining Food Both polyps and medusas obtain food in the same way. Cnidarians use stinging cells to catch the animals they eat, which are called prey. You can see a stinging cell in Figure 14. The cell contains a threadlike structure, which has many sharp spines. When the stinging cell touches prey, this threadlike structure explodes out of the cell and into the prey. Some stinging cells also release venom into the prey. When the prey becomes helpless, the cnidarian uses its tentacles to pull the prey into its mouth. From there, the prey passes into a hollow central body cavity, where it is digested. Undigested food is expelled through the mouth.

Movement Unlike adult sponges, many cnidarians can move to escape danger and to obtain food. Some cnidarians have muscle-like tissues that allow them to move in different ways. Jellyfishes swim through the water, and hydras turn slow somersaults. Sea anemones stretch out, shrink down, bend slowly from side to side, and often move slowly from place to place. A cnidarian's movements are directed by nerve cells that are spread out like a basketball net. This nerve net helps a cnidarian respond quickly to danger and to nearby food.

FIGURE 15
Movement of a Medusa
A medusa's nerve net signals the top part of the medusa's body to contract and relax. As the top of its body contracts, the medusa moves upward through the water.

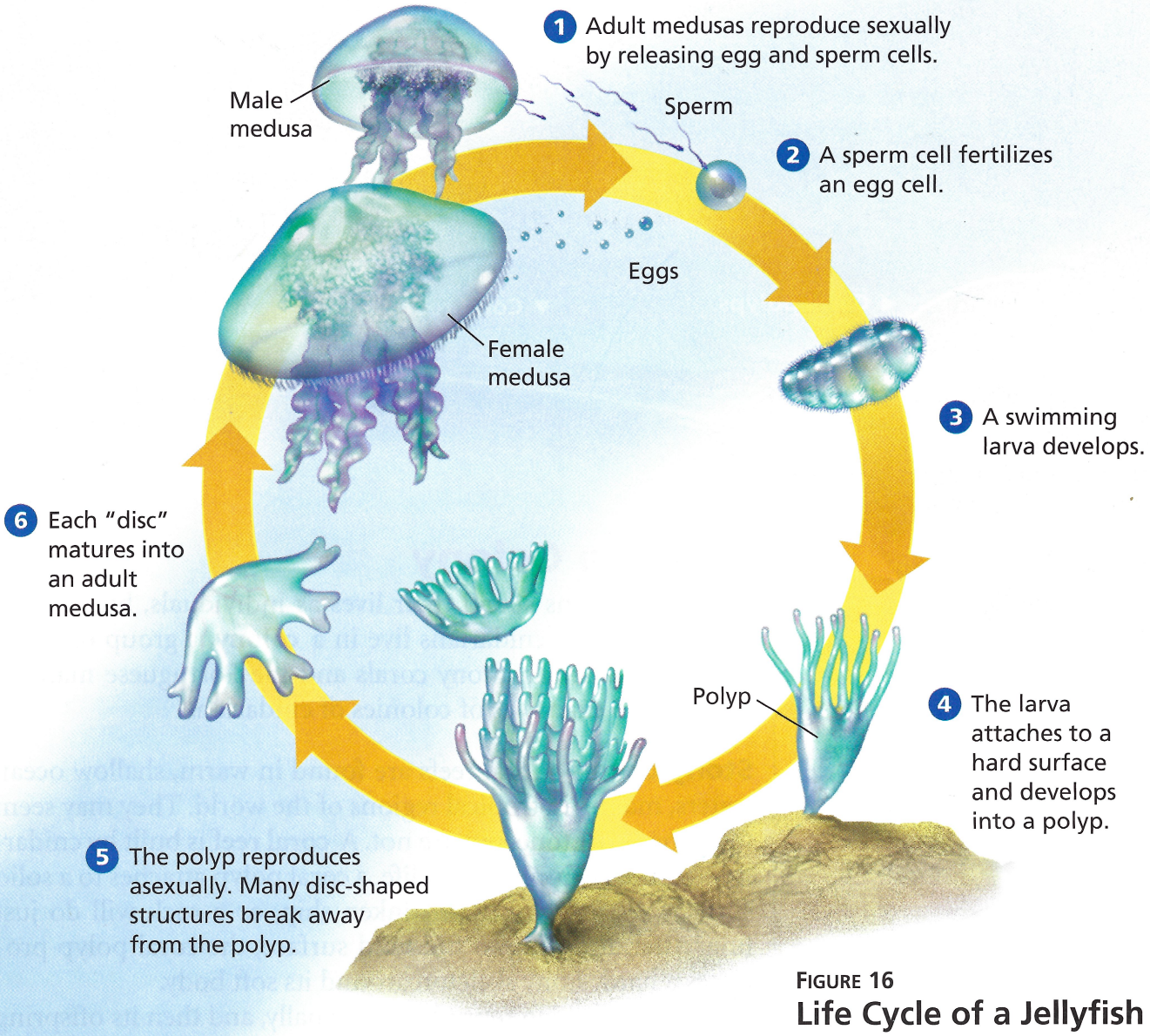


FIGURE 16

Life Cycle of a Jellyfish

The life cycle of a moon jelly has both a polyp and a medusa stage, and both asexual reproduction and sexual reproduction.

Interpreting Diagrams *Which form of the moon jelly (polyp or medusa) shows a form of asexual reproduction? Explain.*

Reproduction Cnidarians reproduce both asexually and sexually. For polyps such as hydras, corals, and sea anemones, budding is the most common form of asexual reproduction. Amazingly, some polyps just pull apart, forming two new polyps. Both kinds of asexual reproduction allow the numbers of polyps to increase rapidly in a short time.

Sexual reproduction in cnidarians occurs in a variety of ways. Some species of cnidarians have both sexes within one individual. In others, the sexes are separate individuals. Many cnidarians have life cycles, or a sequence of different stages of development. In Figure 16, you can see the life cycle of a moon jelly, which involves both asexual and sexual reproduction.

Reading Checkpoint **What are two examples of asexual reproduction seen in polyps?**

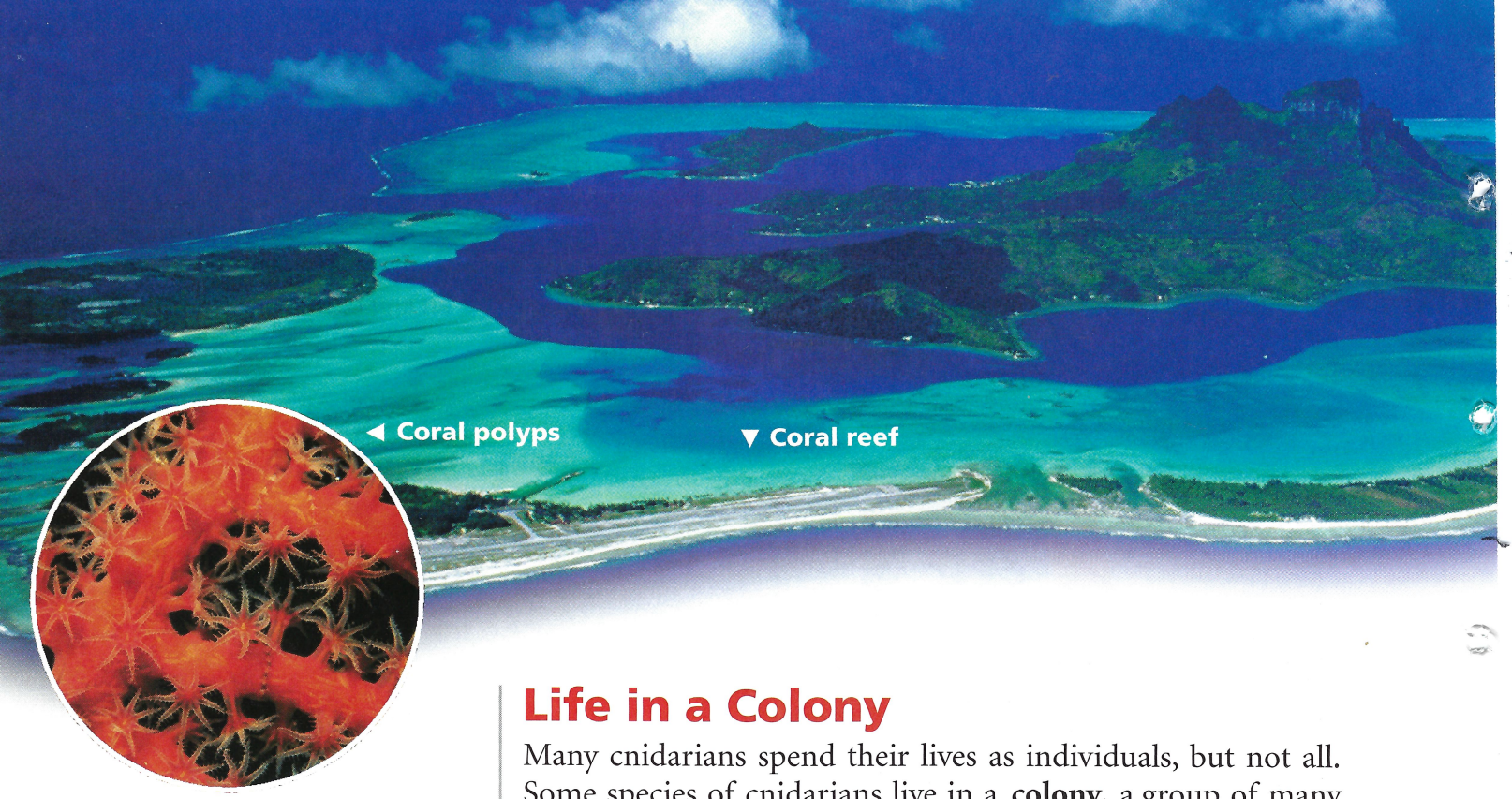


FIGURE 17
Coral Reef
The massive reef surrounding this tropical island is made from the skeletal remains of the tiny cnidarians called coral (inset).

Life in a Colony

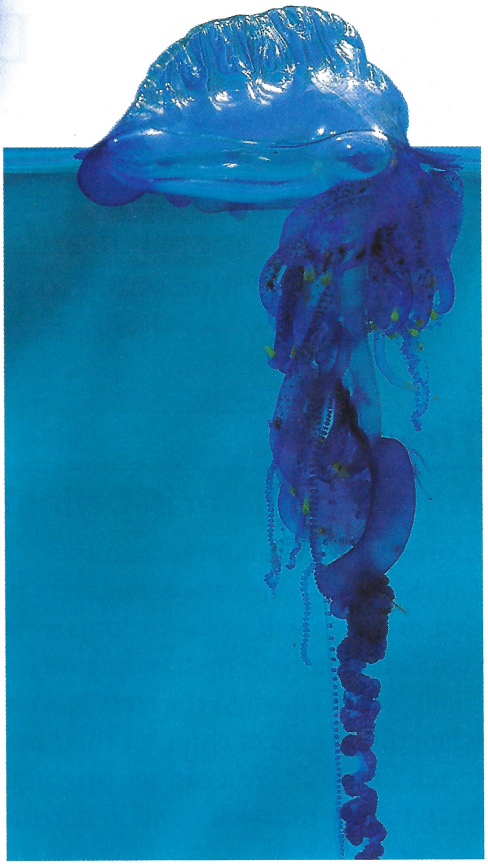
Many cnidarians spend their lives as individuals, but not all. Some species of cnidarians live in a **colony,** a group of many individual animals. Stony corals and the Portuguese man-of-war are two examples of colonies of cnidarians.

Stony Corals Coral reefs are found in warm, shallow ocean waters, mainly in tropical regions of the world. They may seem to be made of stone, but are not. A **coral reef** is built by cnidarians. At the beginning of its life, a coral polyp attaches to a solid surface. A broken shell, a sunken ship, or a rock will do just fine. After attaching to the solid surface, the coral polyp produces a hard, stony skeleton around its soft body.

The coral polyp reproduces asexually, and then its offspring reproduce asexually, too. Over time, that polyp may give rise to thousands more, each with a hard skeleton. When the polyps die, their skeletons remain behind. Over thousands of years, as live corals add their skeletons to those that have died, rocklike reefs grow up from the sea floor. The top layer of the reef is covered with hundreds of thousands of still-living coral polyps.

Coral reefs are home to more species of fishes and invertebrates than any other environment on Earth. Hundreds of sponge species live among the corals, constantly filtering water through their bodies. Worms burrow into the coral reef. Giant clams lie with their huge shells slightly open. Shrimp and crabs edge out of hiding places below the corals. At night, bright blue damselfish settle into pockets in the coral. At dawn and dusk, sea turtles, sea snakes, and sharks all visit the reef, hunting for prey. These living things interact in complex ways, creating a rich and beautiful environment.

FIGURE 18
Portuguese Man-of-War
The Portuguese man-of-war is a tightly coordinated colony of polyps and medusas.



Portuguese Man-of-War Sometimes the association of individual animals in a colony is so tight that the colony acts like a single animal. The Portuguese man-of-war contains as many as 1,000 individuals that function together as one unit.

At the top of the Portuguese man-of-war is a gas-filled chamber that allows the colony to float on the surface of the ocean. Various polyps with different functions drift below. Some polyps catch prey for the colony with stinging cells. Others digest the prey. Still other polyps are adapted for reproduction.

Reading Checkpoint **What are two examples of colonies of cnidarians?**

Section 3 Assessment

Target Reading Skill **Comparing and Contrasting** Use your table to quiz a partner about how sponges and cnidarians trap food. How do their methods for trapping food differ?

Reviewing Key Concepts

1. a. **Describing** What are the characteristics of a sponge?
   b. **Comparing and Contrasting** How are the cells of a sponge alike? How are they different?
2. a. **Identifying** What is one type of cell that all cnidarians have?
   b. **Sequencing** What steps are involved in how a cnidarian obtains food?
   c. **Inferring** How might a cnidarian protect itself?
3. a. **Identifying** What is a coral reef?
   b. **Summarizing** How is a coral reef built?
   c. **Making Judgments** Why is it important to protect coral reefs?

Math Practice

4. **Calculating a Rate** A very large sponge can filter 1,500 liters of water in a day. How much water can it filter per hour?