Chapter 11

Fishes, Amphibians, and Reptiles

Chapter Preview

Interactive Textbook

The fishes in this school are named "sweetlips."

Section 1

What Is a Vertebrate?

Reading Preview

Key Concepts

- What characterisics do chordates share?
- What characteristic do all vertebrates have?
- How do vertebrates differ in the way they control body temperature?

Key Terms

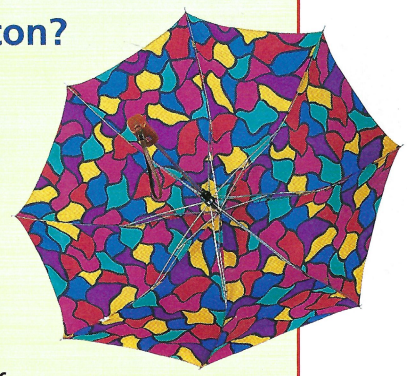
- chordate
- notochord
- vertebra
- ectotherm
- endotherm

Target Reading Skill

Building Vocabulary A definition states the meaning of a word or phrase by telling about its most important feature or function. After you read the section, reread the paragraphs that contain definitions of Key Terms. Use all the information you have learned to write a definition of each Key Term in your own words.

Lab zone **Discover Activity**

How Is an Umbrella Like a Skeleton?



1. Open an umbrella. Turn it upside down and examine how it is made.
2. Now close the umbrella and watch how the braces and ribs collapse.
3. Think of what would happen if you removed the ribs from the umbrella and then tried to use it during a rainstorm.

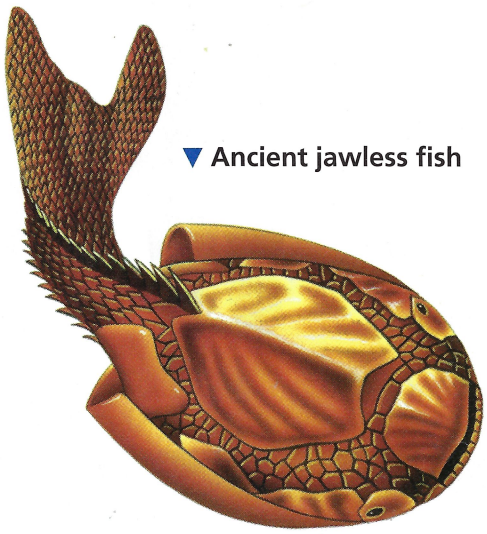
Think It Over

Inferring What is the function of the ribs of an umbrella? How are the ribs of the umbrella similar to the bones in your skeleton? How are they different?

Look backward in time, into an ocean 530 million years ago. There you see a strange-looking creature—a jawless fish—that is about as long as your index finger. The creature is swimming with a side-to-side motion, like a flag flapping in the wind. Its tail fin is broad and flat. Tiny armorlike plates cover its small body. Its eyes are set wide apart. If you could see inside the animal, you would notice that it has a backbone. You are looking at one of the earliest vertebrates at home in an ancient sea.

Characteristics of Chordates

Vertebrates like the ancient jawless fish are a subgroup in the phylum Chordata. All members of this phylum are called **chordates** (KAWR dayts). Most chordates, including fishes, amphibians, such as frogs, and reptiles, such as snakes, are vertebrates. So are birds and mammals. But a few chordates are invertebrates. **At some point in their lives, chordates will have a notochord, a nerve cord that runs down their back, and slits in their throat area.**



▼ Ancient jawless fish

Notochord The phylum name Chordata comes from the **notochord,** a flexible rod that supports a chordate's back. Some chordates, like the lancelet shown in Figure 1, have notochords all their lives. In contrast, in vertebrates, part or all of the notochord is replaced by a backbone.

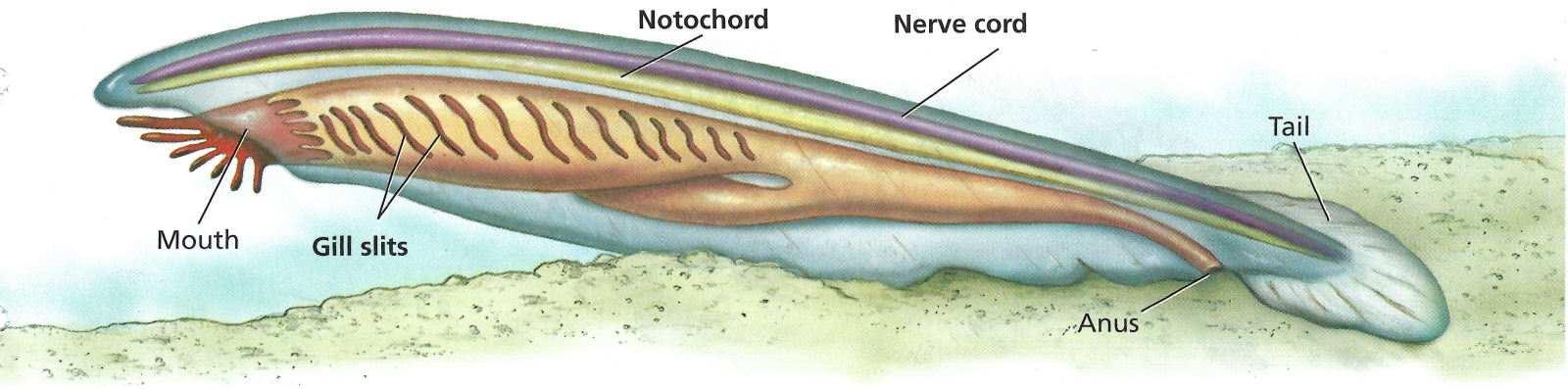


FIGURE 1
Characteristics of a Lancelet
This lancelet shows the characteristics of a chordate: a notochord that helps support its body, a nerve cord down its back, and gill slits.

Nerve Cord in Back In addition to having a notochord, all chordates have a nerve cord that runs down their back. Your spinal cord is such a nerve cord. The nerve cord is the connection between the brain and the nerves, on which messages travel back and forth. Many other groups of animals—arthropods and segmented worms, for example—have nerve cords, but their nerve cords do not run down their backs.

Slits in Throat Area At some point in their lives, chordates have slits in their throat area called pharyngeal (fuh RIN jee ul) slits, or gill slits. Some chordates, including fishes, keep these slits as part of their gills for their entire lives. But in many vertebrates, including humans, pharyngeal slits disappear before birth.

Reading Checkpoint **What is a notochord?**

Characteristics of Vertebrates

Most chordates are vertebrates. In addition to the characteristics shared by all chordates, vertebrates share certain other characteristics. **A vertebrate has a backbone that is part of an internal skeleton.** This endoskeleton supports the body and allows it to move.

Backbone A vertebrate's backbone, which is also called a spine, runs down the center of its back. You can see in Figure 2 that the backbone is formed by many similar bones called **vertebrae** (singular *vertebra*). The vertebrae are lined up in a row like beads on a string. Joints, or movable connections between the vertebrae, give the spine flexibility. You can bend over and tie your shoes because your backbone has flexibility. Each vertebra has a hole in it that allows the spinal cord to pass through it. The spinal cord fits into the vertebrae like fingers fit into rings.

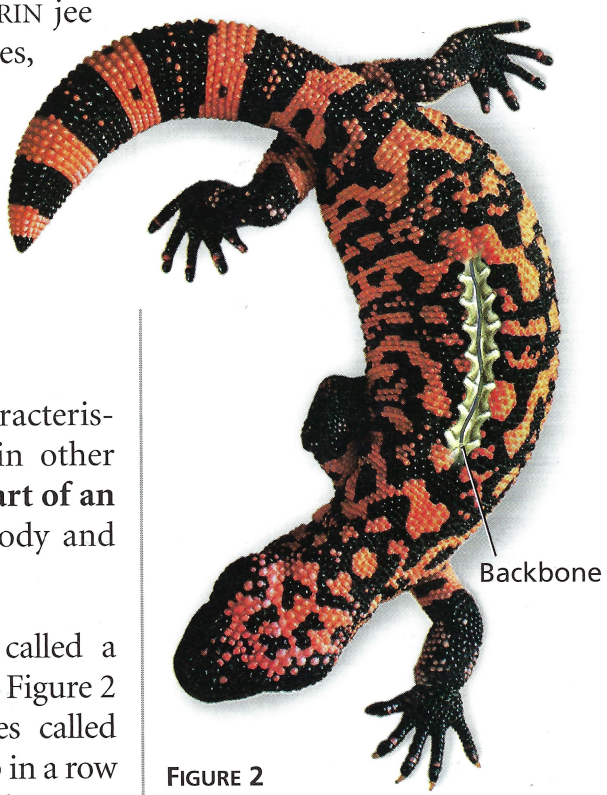


FIGURE 2
The Backbone of a Lizard
The backbone of this gila monster has flexibility. **Predicting** *Could the backbone bend if the vertebrae did not have joints?*

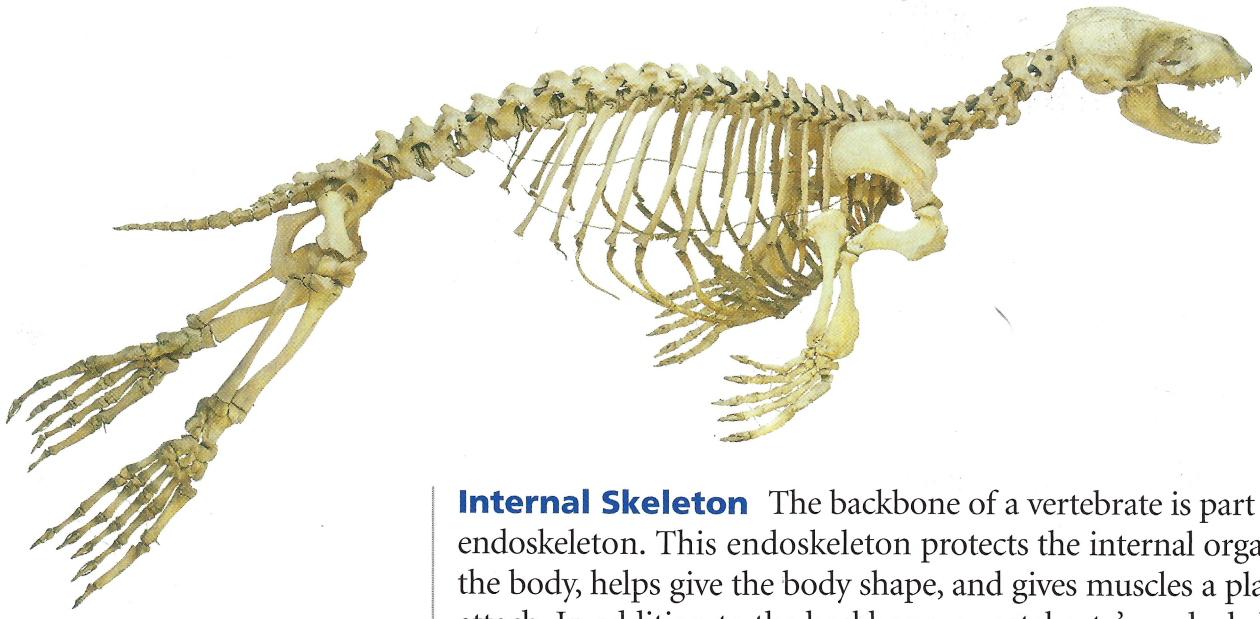


FIGURE 3
The Skeleton of a Seal
This seal's skeleton has adaptations for swimming. Long, flat bones support the flippers. The flat skull helps the seal move smoothly through the water.

Internal Skeleton The backbone of a vertebrate is part of its endoskeleton. This endoskeleton protects the internal organs of the body, helps give the body shape, and gives muscles a place to attach. In addition to the backbone, a vertebrate's endoskeleton includes the skull and ribs. The skull protects the brain. The ribs attach to the vertebrae and protect the heart, lungs, and other internal organs. Many vertebrates, like the seal shown in Figure 3, also have arm and leg bones adapted for movement.

A vertebrate's endoskeleton has several characteristics. Unlike an arthropod's exoskeleton, an endoskeleton doesn't need to be replaced as the animal grows. It also forms an internal frame that supports the body against the downward pull of gravity, while allowing easy movement. Because of these characteristics, vertebrates can grow bigger than animals with exoskeletons or no skeletons at all.

Reading Checkpoint **What does an endoskeleton protect?**

Keeping Conditions Stable

One characteristic that differs among the major groups of vertebrates is the way they control their body temperature. **The body temperature of most fishes, amphibians, and reptiles is close to the temperature of their environment. In contrast, birds and mammals have a stable body temperature that is often warmer than their environment.**

Ectotherms Fishes, amphibians, and reptiles are ectotherms. An **ectotherm** is an animal whose body does not produce much internal heat. Its body temperature changes depending on the temperature of its environment. For example, when a turtle is lying on a sunny riverbank, it has a higher body temperature than when it is swimming in a cool river. Ectotherms are sometimes called "coldblooded." This term is misleading because their blood is often quite warm.

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Woma python ▶

▼ Emperor penguins

Endotherms In contrast to a turtle, a beaver would have the same body temperature whether it is in cool water or on warm land. The beaver is an example of an **endotherm**—an animal whose body regulates its own temperature by controlling the internal heat it produces. An endotherm's body temperature usually does not change much, even when the temperature of its environment changes. Birds and mammals, such as beavers, are endotherms.

Endotherms also have other adaptations, such as sweat glands and fur or feathers, for maintaining their body temperature. On hot days, some endotherms sweat. As the sweat evaporates, the animal is cooled. On cool days, fur or feathers keep endotherms warm. Because endotherms can keep their body temperatures stable, they can live in a greater variety of environments than ectotherms can.

FIGURE 4
Temperature Regulation
On a cool, sunny morning, a woma python raises its body temperature by basking in the sun. In contrast, an emperor penguin stays warm by producing internal heat.
Inferring *Which animal is an endotherm?*

Section 1 Assessment

Target Reading Skill **Building Vocabulary** Use your definitions to help answer the questions.

Reviewing Key Concepts

1. a. **Listing** List three characteristics of chordates.
   b. **Comparing and Contrasting** In chordates, how does the notochord of a vertebrate differ from that of an invertebrate?
   c. **Explaining** An earthworm has a nerve cord that runs along its body. Is an earthworm a chordate? Explain.
2. a. **Identifying** What characteristic do only vertebrates have?
   b. **Describing** Describe a backbone.
   c. **Relating Cause and Effect** What gives a backbone flexibility?
3. a. **Summarizing** What is the difference between an ectotherm and an endotherm?
   b. **Making Generalizations** Would an ectotherm or an endotherm be more active on a cold night? Explain your answer.

Lab zone At-Home Activity

Bumpy Back Rub Have members of your family feel the tops of the vertebrae running down the center of their backs. Then have them feel the hard skull beneath the skin on their foreheads. Tell them about the functions of the backbone and skull.