

CHAPTER 14 Introduction to Animals
SECTION 3 **Invertebrates**

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- What structures and systems perform basic life functions in invertebrates?
- How do invertebrates reproduce and develop?



California Science Standards

7.2.a, 7.5.a, 7.5.b, 7.5.g

What Are the Characteristics of Invertebrates?

Invertebrates are animals without backbones. They can be found in almost every environment on Earth. Invertebrates come in many different shapes and sizes. Some invertebrates have heads, and others do not. Some invertebrates eat food through their mouths. Others absorb food particles through their tissues.



Underline As you read, underline the characteristics of invertebrates.

BODY SYMMETRY

Invertebrates have one of three basic body plans: irregular, radial, or bilateral. Sponges have irregular shapes. They are asymmetrical. Sea anemones have radial symmetry. That means that body parts extend from a central point. Animals with radial symmetry have only a top and a bottom that are very different from each other.

Most invertebrates have bilateral symmetry. This means the body can be divided into two mirror-image halves by one straight line. Animals with bilateral symmetry have a top and bottom that differ, as well as a front end and a back end that differ. The development of a head is seen only in organisms with bilateral symmetry.



Critical Thinking

1. Predict Would you expect a sea anemone to have a head? Explain your answer.

TAKE A LOOK

2. Identify What type of symmetry does the sea hare have?

SECTION 3 Invertebrates *continued*

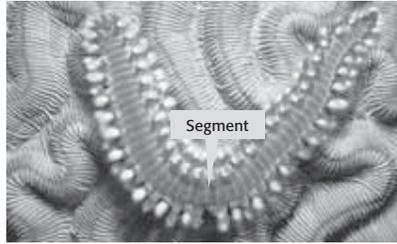
SEGMENTATION

The bodies of many animals are divided into **segments**, or sections. Segmentation in the body has many advantages. For example, each segment in an earthworm has a set of muscles that help the earthworm push through soil.

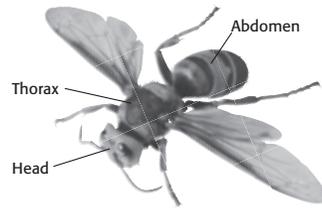
Segmentation in Invertebrate Bodies

TAKE A LOOK

3. List What are the three segments of an insect's body?



The body of a marine worm has many segments that are almost equal in size.



The body of an insect has three unequal segments: a head, a thorax, and an abdomen.

SUPPORT OF THE BODY

Invertebrate bodies need support and protection. Some invertebrates, like jellyfish and anemones, are supported by the water they live in. Others have structures in or on their bodies that support and protect them. The figure below shows the outer coverings of different invertebrates. Muscles attached to outer coverings in some invertebrates contract and relax to help the animals move.

Support in Invertebrate Bodies

TAKE A LOOK

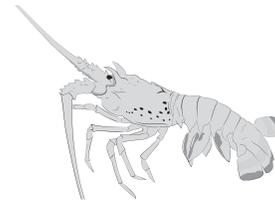
4. List What are three types of support in invertebrate bodies?



A sponge is supported by jelly-like material and tiny glassy structures.



Some invertebrates, such as this roundworm, have thick skin as a tough outer covering.

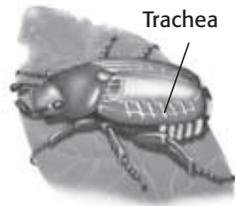


Other invertebrates have tough outer coverings called exoskeletons.

SECTION 3 Invertebrates *continued***RESPIRATION AND CIRCULATION**

All animals take in oxygen and release carbon dioxide through respiration. Respiration is performed by the *respiratory system*. Different invertebrates have different structures for respiration. For example, lobsters have gills. Respiration in insects, however, is through a network of tubes, called *tracheae*, inside the body. ✓

Oxygen, carbon dioxide, and nutrients must circulate, or move around, within the body. The *circulatory system* moves these materials with blood through the body. Some invertebrates have an **open circulatory system**. In open circulatory systems, blood moves through open spaces in the body. Others have a **closed circulatory system**. In closed circulatory systems, blood moves through tubes that form a closed loop.



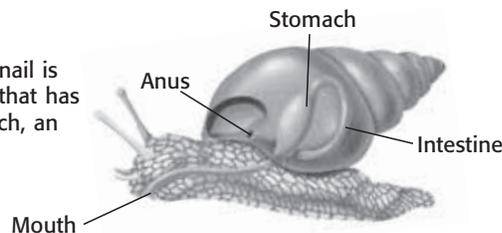
This beetle moves air into and out of its body through small holes along the sides of its body.

DIGESTION AND EXCRETION

Animals get the energy they need by digesting food. Food is broken down and nutrients are absorbed by the *digestive system*. Invertebrates have relatively simple digestive systems. The mouth and anus form two ends of a tube called a *digestive tract*. Any material that is eaten but not digested is sent out of the body as waste. ✓

As cells in the body use up nutrients, another kind of waste forms. In many invertebrates, the digestive tract eliminates this kind of waste as well. Other invertebrates have a separate system, called the *excretory system*, that remove excess water and waste from cells.

The digestive system in the snail is made up of a digestive tract that has four parts: a mouth, a stomach, an intestine, and an anus.

**READING CHECK**

5. Identify Which body system takes in oxygen and releases carbon dioxide?

READING CHECK

6. Identify Which body system breaks down food?

SECTION 3 Invertebrates *continued*

NERVOUS SYSTEM

The nervous system receives and sends electrical signals that control the body. The figure below shows the nervous systems of three invertebrates. The simplest invertebrates have only nerve cells. More complex invertebrates have brains and sense organs, such as eyes.

READING CHECK

7. Describe What is the function of the nervous system?

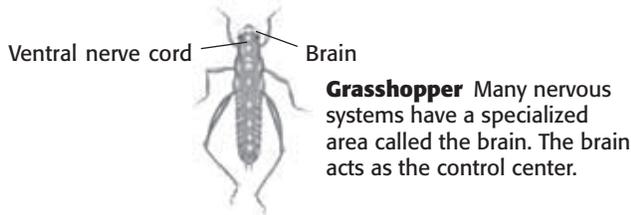
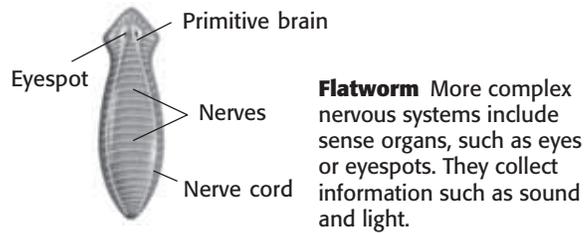
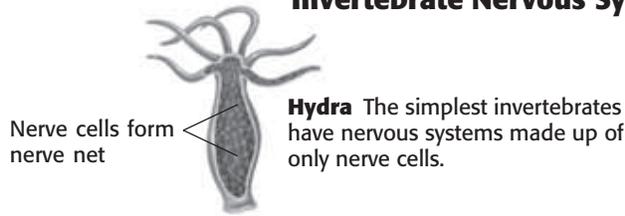
TAKE A LOOK

8. Compare How do the nervous systems of a hydra and a grasshopper differ?

Critical Thinking

9. Apply Concepts Are offspring produced in asexual reproduction genetically different from their parents? Explain your answer.

Invertebrate Nervous Systems



REPRODUCTION

Many invertebrates can reproduce both asexually and sexually. A hydra, for example, can reproduce asexually by budding. Budding happens when a part of the parent organism develops into a new organism. Other invertebrates can reproduce asexually by fragmentation. In fragmentation, parts of an organism break off and then develop into new individuals.

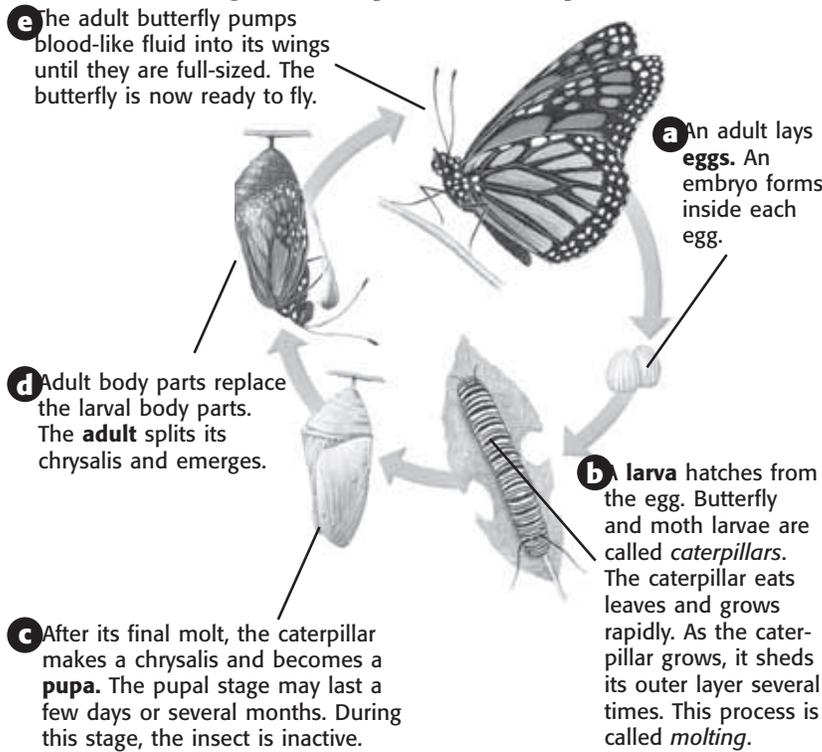


SECTION 3 Invertebrates *continued*

DEVELOPMENT

Some invertebrates, such as insects, change form as they develop. This change is called **metamorphosis**. Most insects, including butterflies, beetles, flies, bees, and ants, go through a complex change called *complete metamorphosis*.

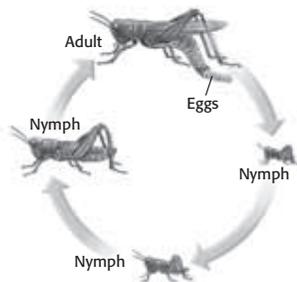
Stages of Complete Metamorphosis



TAKE A LOOK

10. List What are the four stages of complete metamorphosis?

Stages of Incomplete Metamorphosis



Some insects, such as grasshoppers and cockroaches, go through *incomplete metamorphosis*. Incomplete metamorphosis has three stages: egg, nymph, and adult.

Some nymphs shed their exoskeletons several times as they grow into adults. This shedding is called *molting*. In incomplete metamorphosis, nymphs look very much like small adults. ✓

TAKE A LOOK

11. Compare In which type of metamorphosis do more changes take place as the young develop?

READING CHECK

12. List What are the three stages of incomplete metamorphosis?

Section 3 Review

7.2.a, 7.5.a, 7.5.b, 7.5.g 

SECTION VOCABULARY

closed circulatory system a circulatory system in which the heart circulates blood through a network of vessels that form a closed loop

metamorphosis a process in the life cycle of many animals during which a rapid change from the immature form of an organism to the adult form takes place

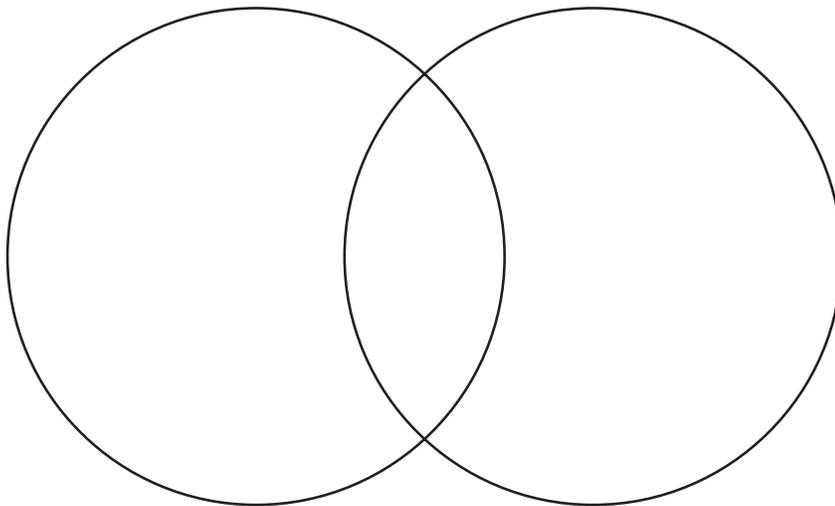
open circulatory system a type of circulatory system in which the circulatory fluid is not contained entirely within vessels

segment any part of a larger structure, such as the body of an organism, that is set off by natural arbitrary boundaries

1. Explain What is the difference between open and closed circulatory systems?

2. Compare How is the life cycle of a butterfly different from the life cycle of a hydra?

3. Compare Use a Venn Diagram to compare complete metamorphosis and incomplete metamorphosis.



4. Explain Why are outer coverings important for movement in many invertebrates?
