

**Chapter 28 Arthropods and Echinoderms**

# Examining the External Anatomy of the Grasshopper

## Introduction

Grasshoppers are members of the phylum Arthropoda. Grasshoppers belong to the group of arthropods known as insects. There are more than one million species of insects. They are mainly land animals and they live in almost every environment on land. Unlike other land invertebrates, most insects have wings that help them find food and escape from predators.

Insects have an exoskeleton made of chitin. They have three pairs of jointed legs and three different body regions. These regions are the head, thorax, and abdomen. Usually, two pairs of wings are attached to the thorax. As insects, grasshoppers have one pair of antennae and one pair of large compound eyes. They have a respiratory system that provides their muscles with oxygen for rapid movement. Because they produce many offspring in a short period of time, grasshoppers increase their populations quickly.

In this investigation, you will observe the behavior and movement of a live grasshopper. You will also examine the external features of the grasshopper and identify parts of its anatomy that help it adapt to its environment.

## Problem

What are some parts of a grasshopper that help it to live on land?

## Pre-Lab Discussion

Read the entire investigation. Then, work with your group to answer the following questions.

1. What will you look at in Part A of this investigation?

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2. Name three movements you will observe in the live grasshopper.

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3. What are the three main regions of a grasshopper's body?

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4. On which region of the body will you find the grasshopper's legs and wings?

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5. How will you know if your grasshopper is male or female?

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## Materials (per group)

live grasshopper in a glass jar  
preserved grasshopper  
paper towels  
dissecting tray

dissecting probe  
waterproof marker  
hand lens  
lettuce

## Safety

For Part B of this investigation, put on safety goggles. Put on a laboratory apron and disposable plastic gloves. Treat the preserved animal, preservation solution, and all equipment that touches the organism as potential hazards. Do not touch your eyes or your mouth with your hands. Return or dispose of all materials according to the instructions of your teacher. Wash your hands with soap and warm water after carrying out this investigation. Note all safety alert symbols next to the steps in the Procedure and review the meaning of each symbol by referring to Safety Symbols on page 8.

## Procedure

### Part A. Observing the Reactions of a Live Grasshopper

1. Work in a group throughout this investigation, and write what you observe in the spaces provided on page 183. Look at a live grasshopper in a glass jar. **CAUTION:** *Be careful to avoid breakage when working with glassware.* Use Figure 1 to help you locate the head, thorax, abdomen, three pairs of legs, and two pairs of wings. Observe the grasshopper for several minutes without disturbing it. Notice how the grasshopper moves and note which legs it uses when walking. Gently tap the side of the jar to make the grasshopper jump. Observe which legs are used in jumping.

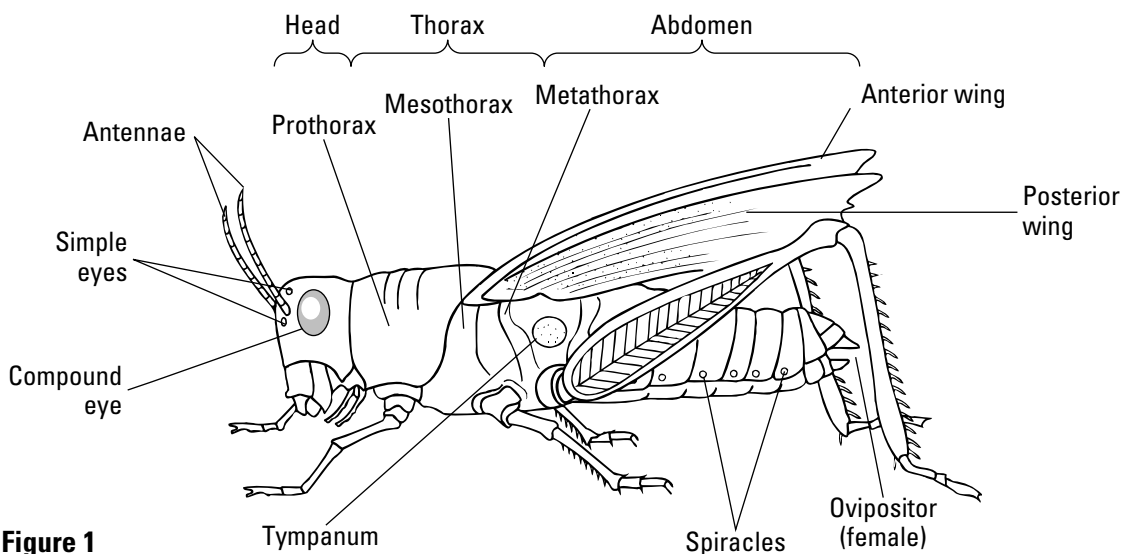


Figure 1

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General Observations:

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Color:

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Movement (of legs, abdomen, mouthparts):

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2. Look at the position and movements of the grasshopper when it is at rest. Use the hand lens to observe the movements of the abdomen that are associated with respiration, or breathing.
3. Tear off a small piece of lettuce and offer it to the grasshopper. Notice how the animal eats. Closely observe the movement of the mouthparts.
4. In the spaces provided, write down what you noticed about the grasshopper's appearance and movements. Return the grasshopper to your teacher when you have completed your notes.

**Part B. Observing the External Anatomy of the Grasshopper**



1. Obtain a preserved grasshopper from your teacher. Rinse the grasshopper with water to remove some of the preservative. Place the grasshopper in a dissecting tray. Touch the exoskeleton and apply gentle pressure. In the spaces provided on page 184, write what you notice about the grasshopper's exoskeleton. **CAUTION:** *The preservative used on the grasshopper may irritate your skin. Wear your safety goggles, laboratory apron, and disposable gloves. Avoid touching your eyes or mouth while working with the preserved grasshopper.*
2. Locate the three body segments of the grasshopper: the head, the thorax, and the abdomen. Refer to Figure 1, if necessary. Use the hand lens to examine the head. Notice two long antennae—the sensory organs for touch—located at the front top of the head. Closely examine the antennae with a hand lens. Three simple eyes are located in the head: one at the base of each antenna and one in the center front of the head. The head also contains two compound eyes: one located on each side of the head. Simple and compound eyes are sensory organs for vision. Write your observations in the spaces provided on page 184.

Exoskeleton:

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Head (antennae, eyes):

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Thorax (legs, wings):

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Abdomen (eardrum, spiracles, last segment):

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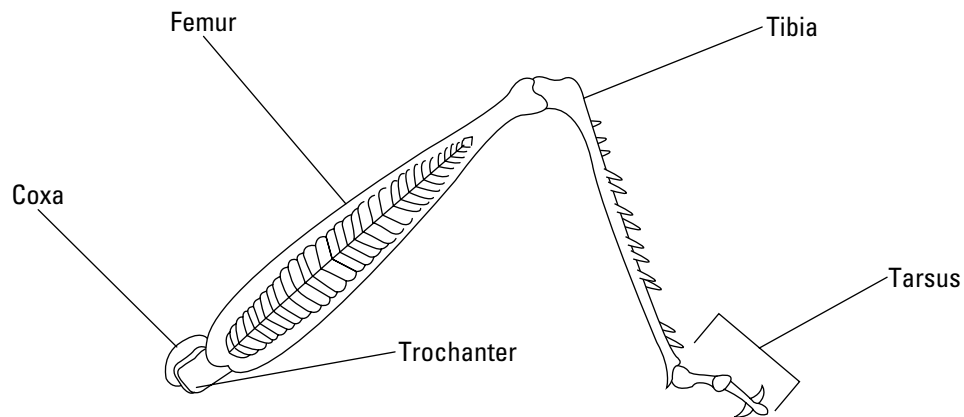
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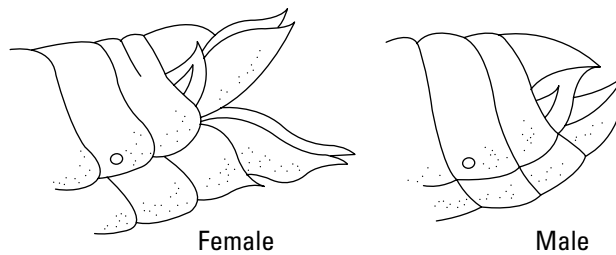
3. Locate the thorax. Notice that the thorax is divided into three segments. One pair of legs is attached to each segment. Observe the two front legs, or forelegs, and the third and largest pair of legs, the jumping legs, or hind legs. Notice that each leg is composed of the femur, tibia, and tarsus, as shown in Figure 2.




**Figure 2**

4. Observe the two pairs of wings. Use your fingers to gently spread open the wings. Notice the difference between the forewings and the hindwings. The leathery forewings protect the delicate hindwings, which are used for flying. Write notes about the grasshopper's thorax in the spaces provided.

5. Locate the abdomen and notice its segments. On the first segment of the abdomen, locate the drum-shaped tympanum, or eardrum. The eardrum is the sensory organ for sound. On the sides of each segment of the abdomen, locate the small openings called spiracles. The spiracles are openings in the grasshopper's respiratory system that allow it to breathe.
6. Note that the last segment of the abdomen is different in males and females. In females, the last segment is a clawlike structure with four points used to dig a hole where eggs are laid. The female's abdomen is longer than the male's. In males, the last segment is blunt and curved upward. See Figure 3. Decide if your grasshopper is male or female. Write your observations about the abdomen in the spaces provided on page 184.



**Figure 3**

7.  When you have finished your examination, dispose of the grasshopper as instructed by your teacher. **CAUTION:** Wash your hands with soap and water after working with the preserved grasshopper.

### Analysis and Conclusions

1. **Observing** Of the three body regions of the grasshopper, which one is specialized for movement?

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2. **Analyzing Data** What are three ways that the grasshopper can sense moving objects in its environment?

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3. **Inferring** How might the grasshopper's color help it to avoid being eaten by a predator?

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4. **Predicting** Can you drown a grasshopper by holding its head under water? Explain your answer.

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5. **Drawing Conclusions** What are three structures of the grasshopper that help it live on dry land? Explain your answer.

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### **Going Further**

Obtain preserved specimens from as many of the classes of arthropods as possible. Compare the characteristics of each, such as the number of body regions, number of legs, types of mouthparts, and types of respiratory organs. Record your observations in a data table. Use your data table to identify the organs that are most important in explaining the great diversity of arthropods.