



Grasshopper Dissection Guide

Observe external landmarks and explore the internal organ systems.



A grasshopper is an insect with three main body parts, head, thorax and abdomen in a segmented body, jointed legs, and an **exoskeleton**. Its chewing mouthparts, powerful hind legs, and branching air tubes provide useful examples of how structure supports function.

Use this illustrated Guide with the Mr. E Science grasshopper dissection video, Pre-Lab, and Lab Write-Up. Required structures appear in bold within the text. Identify structures before moving or removing them.

Cover: grasshopper photograph #2 from the Mr. E Science Life Science Labs page. Drawings show generalized anatomy; specimen proportions and colors vary.

1 Meet the grasshopper

Classification

Kingdom Animalia • Phylum Arthropoda • Class Insecta • Order Orthoptera

Arthropoda comes from Greek roots meaning “jointed foot.” Arthropods have jointed appendages, segmented bodies, and an **exoskeleton**. Insects have three major body regions: **head**, **thorax**, and **abdomen**. The **thorax** bears three pairs of legs, and the **head** bears one pair of **antennae**.

Exoskeleton and growth

The **exoskeleton** is a cuticle secreted by living cells beneath it. It contains chitin and proteins, protects the body, reduces water loss, and provides attachment sites for locomotor muscles. A growing grasshopper molts because its hardened covering cannot expand continuously. The new covering is initially soft and expands before hardening.

Natural history

Grasshoppers occur in grasslands, fields, gardens, and other open habitats around the world. Many feed mainly on grasses and other plants. They are food for birds, reptiles, and other predators. Some species become crop pests when abundant.

Do not assign a species or native range from a generalized drawing. Use the supplier label or a verified identification. The main reference booklet discusses large lubber grasshoppers; the classroom specimen and cover photograph need not represent the same species.

Development

Grasshoppers undergo incomplete metamorphosis: egg, nymph, and adult. A nymph resembles a small adult but has immature reproductive organs and lacks fully developed adult **wings**. Some adult species also have reduced **wings** and cannot fly.

How to use the illustrations

The whole-body drawings place the **head** to the left. The enlarged **head** and abdominal-tip drawings reveal details that may be difficult to see in the video. Use position, shape, and connections to identify organs; preserved tissue rarely matches an illustration’s color exactly.

Self-check 1: Which three body regions and two appendage counts help identify a grasshopper as an insect?

2 Prepare for the dissection

Materials

Preserved grasshopper; dissecting tray; fine dissecting scissors; blunt probe; forceps; dissecting pins if directed; hand lens or dissecting microscope; gloves; eye protection; colored pencils; paper towels.

Orient the specimen

Dorsal: Toward the back or upper surface. **Ventral:** Toward the underside. **Anterior:** Toward the **head**.

Posterior: Toward the tail end of the **abdomen**. **Lateral:** Toward either side of the body.

Work safely

1. Wear gloves and eye protection. Keep hands away from your face while working.
2. Lift the **exoskeleton** gently before advancing the scissors. Use a blunt probe to separate attached tissue.
3. Keep the specimen in its tray. Report splashes, cuts, or damaged equipment immediately.
4. Dispose of the specimen and preservative as directed. Wash your hands after removing gloves.

Before making any cuts

Examine and draw the external body, leg, and abdominal tip first. Determine the sex of your specimen before cutting near the posterior end. Keep a hind leg for the leg drawing if your teacher directs its removal.

Self-check 2: Why should you lift the body wall while making a shallow incision?

3 External examination

Find the external landmark

Locate the **pronotum**, it is the external landmark. The shieldlike plate is immediately behind the **head**. It covers the dorsal surface of the prothorax, the first thoracic segment. Use it to orient the **head**, **thorax**, and segmented **abdomen**. The three thoracic segments are the prothorax, mesothorax, and metathorax.

Legs and wings

All three pairs of legs attach to the **thorax**. The hind pair is enlarged for jumping. Starting at the body, follow the **coxa**, **trochanter**, **femur**, **tibia**, and **tarsus**. The **femur** houses strong muscles, the **tibia** forms the long lower portion, and the segmented **tarsus** ends in claws. These are external leg regions, not internal bones.

A typical winged adult has two pairs of **wings**. The narrower **forewings** protect the broader, membranous **hindwings**, which fold underneath when at rest. Wing length and flight ability vary with species and maturity. Short **wings** alone do not prove that a specimen is a nymph.

Hearing and breathing

The **tympanum** is a thin membrane on each side of the first abdominal segment. Sound causes it to vibrate. It may be partly hidden by a wing or hind leg. Gently move these aside to inspect it.

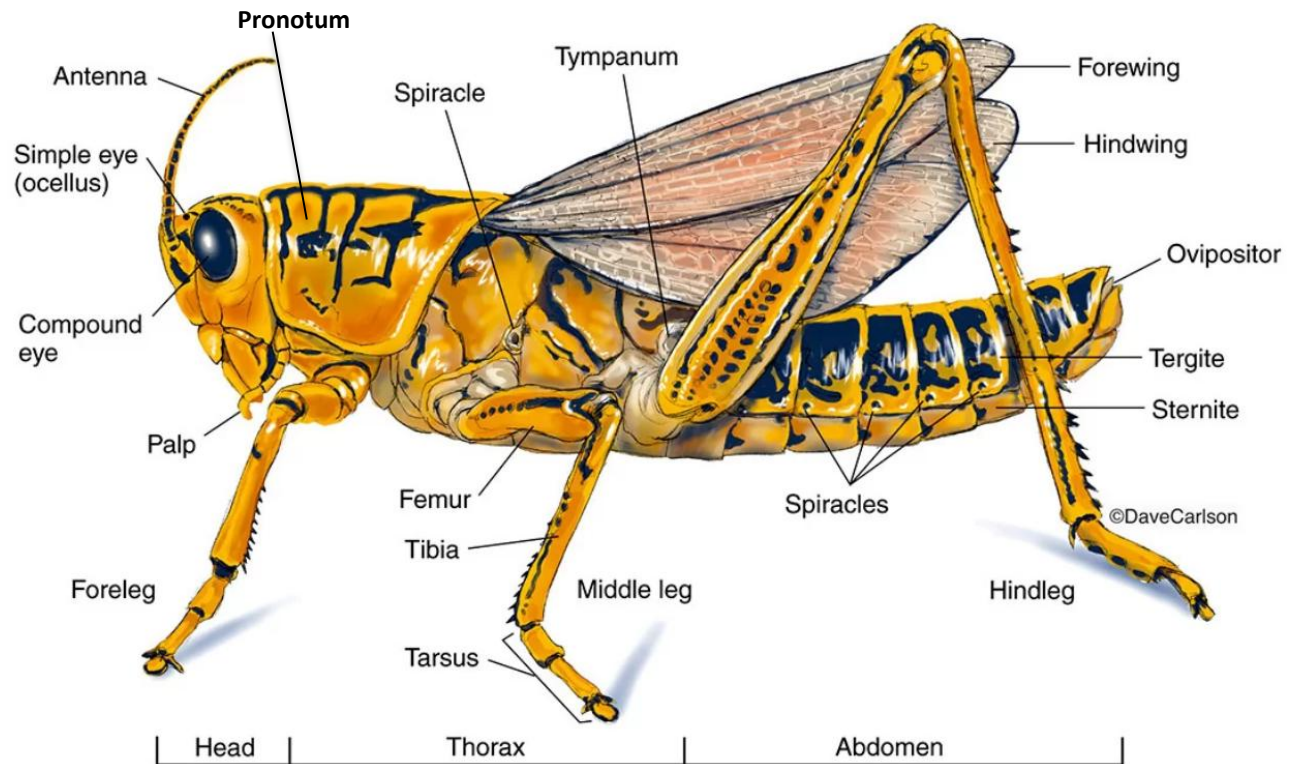
Spiracles are small paired respiratory openings on the **thorax** and **abdomen**. A typical grasshopper has two thoracic pairs and eight abdominal pairs. Do not confuse them with the much larger **tympanum**. The **spiracles** connect to the internal tracheal system.

Observe before drawing

Count the visible legs and note any missing appendages. Locate the **wings**, **tympanum**, and **spiracles** on the specimen. Record its actual condition; identify any reference-based additions separately.

Self-check 3: Which structure is the external landmark, and where is the tympanum located?

External anatomy and leg detail (figure 1)



Figures 1. Generalized lateral external view. The wing and hind leg can partly cover the first abdominal segment. Move them gently to locate the tympanum.

4 Head and sex determination

Sensory structures

The **head** has one pair of **antennae**, which detect touch and chemical signals. Each **compound eye** contains many visual units called ommatidia. Three small **ocelli** detect changes in illumination: two are near the **antenna** bases, and one lies centrally on the face. They can be difficult to see without magnification.

Chewing mouthparts

The **labrum** forms an upper lip over the mouth. Paired **mandibles** move side to side to cut and crush food. The **maxillae** help manipulate food; each bears a maxillary palp. The **labium** forms a lower lip and bears the labial **palps**. The **palps**, also called **palpi**, have sensory functions and help the insect assess food.

Use a hand lens to find the mouthparts. Gently move the **labrum** only if directed. Do not remove the mouthparts just to make the specimen resemble the drawing. The structures overlap in an intact **head**.

Female and male abdominal tips

Examine the posterior **abdomen** from the side and underside. An adult female has an **ovipositor** with paired pointed valves used to position eggs, usually in the soil. In a side view, only the nearer upper and lower valves may be obvious.

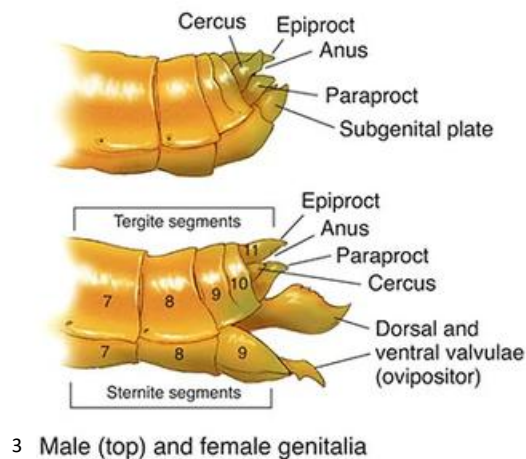
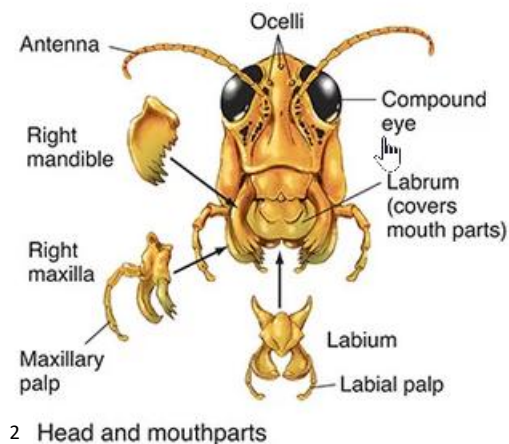
A male lacks the female's **ovipositor** valves. Its ventral terminal region includes a **subgenital plate** that is commonly rounded or upturned. Both sexes have paired sensory **cerci**, so the presence of **cerci** alone does not determine sex. Use the shape of the terminal structures rather than overall body size.

Immature, damaged, or poorly preserved specimens may be difficult to classify. Record "uncertain" and describe the evidence when necessary.

Self-check 4: How many ocelli are typical?

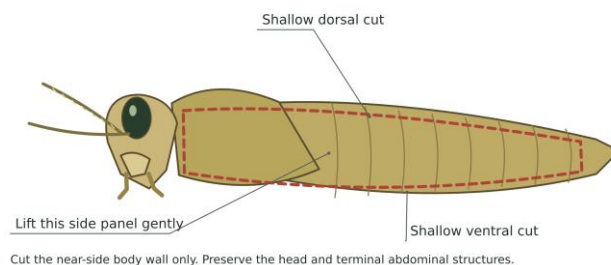
Self-check 5: Which terminal structure supports identifying an adult female?

Head and abdominal tip illustrations



Figures 2 and 3. Mouthparts are spread for visibility. The abdominal-tip comparison shows external structures; internal reproductive ducts are not exposed.

Opening the body wall

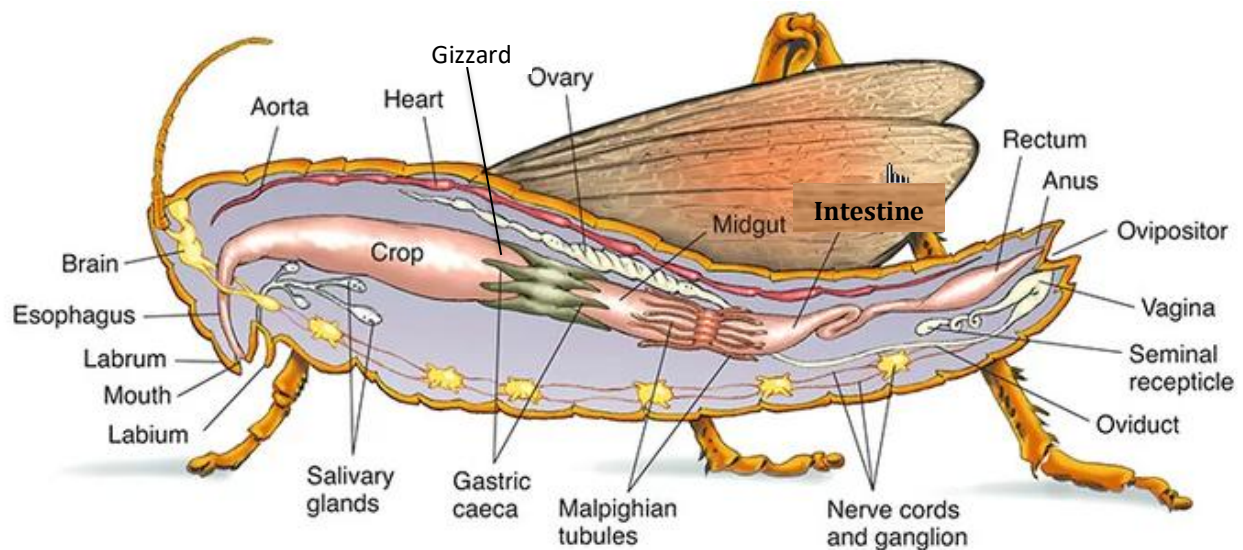


5 Open the body wall (figure #4)

1. Finish external observations. Lay the specimen on its side with the **head** to the left. Secure it as directed without piercing the digestive tract.
2. Move obstructing legs aside. Remove a leg only if directed, keeping the hind leg for your drawing.

3. Near the posterior **abdomen**, make a small opening in the near-side body wall. Stop short of the terminal reproductive structures.
4. Lift the body wall and make shallow cuts along its dorsal and ventral margins, extending forward through the thoracic wall but stopping before the **head**. Connect the cuts to free a side panel.
5. Lift the panel from the posterior end. Tease muscle attachments away with a blunt probe. Avoid pulling out the digestive tract or fine tubes.
6. Find the internal landmark: the fingerlike **gastric caeca** around the anterior **midgut**. Identify the nearby **crop** and **stomach** before moving tissues.

Internal landmarks and the incision (figure #5)



6 Digestive system

Food passes from the mouth through the pharynx and **esophagus** to the **crop**, which stores food. The **proventriculus**, or **gizzard**, lies between the **crop** and **stomach** and helps process food mechanically. Chewing with **mandibles** does not mean a grasshopper lacks a **gizzard**.

The **gastric caeca** are blind-ended pouches connected near the anterior **stomach**, or **midgut**. They help secrete digestive enzymes and absorb nutrients. The **stomach** is the main region of enzymatic digestion and nutrient absorption.

The **intestine** behind the **midgut** is part of the **hindgut**. It conducts waste and recovers water and salts. The **rectum** further conserves water and holds fecal material before elimination through the **anus**.

Pathway: mouth → pharynx → **esophagus** → **crop** → **gizzard** → **stomach (midgut)** → **intestine (hindgut)** → **rectum** → **anus**.

Self-check 6: What is the internal landmark? Self-check 7: What lies between the crop and stomach?

7 Other organ systems

Circulatory system

The dorsal **heart** pumps hemolymph forward through the **aorta** toward the **head**. Hemolymph then circulates through body spaces in an open circulatory system. **Ostia** are openings through which hemolymph enters the **heart**. Hemolymph transports nutrients, wastes, and hormones; in grasshoppers it is not the main oxygen-delivery route.

Respiratory system

Air enters through **spiracles** and travels through branching **tracheae** and fine **tracheoles** to the tissues. **Spiracles** can open and close. Abdominal movements help ventilate the system. Do not test breathing by submerging a living insect; observe the preserved specimen only.

Excretory system

Malpighian tubules are numerous thin, threadlike tubes that join the gut near the **midgut–hindgut** boundary. They remove nitrogenous wastes from the hemolymph and help regulate water and salts. Their contents enter the **hindgut** and leave with the feces. Distinguish these fine tubes from the thicker **gastric caeca** near the front of the **midgut**.

Nervous system

The **brain** is in the **head**. It connects to a **ventral nerve cord** with swellings called **ganglia**. These centers help coordinate sensory input and movement. The delicate nerve cord and dorsal **heart** may be difficult to see; do not destroy the digestive tract trying to uncover them.

Reproduction and hormonal control

Females produce eggs in paired **ovaries**; eggs pass through **oviducts** toward the genital opening. Males produce sperm in paired **testes**. These organs can be inconspicuous in immature specimens. Hormones coordinate molting and development, but endocrine glands are not required identifications in this lab.

Self-check 8: What carries air to the tissues?

Self-check 9: Where do Malpighian tubules empty?

Self-check 10: Is the main nerve cord dorsal or ventral?

8 Finish and check your understanding

Complete the Lab Write-Up

Use colored pencils for the external and internal lateral drawings. Place the anterior end to the left. Add the leg and abdominal-tip details. Use straight leader lines that end on the correct structures and keep labels outside the drawing. Identify anything added from the Guide as reference-based.

Clean up

1. Place the specimen and removed tissues in the designated container. Follow your teacher's instructions for preservative disposal.
2. Clean, dry, and return the tools and tray as directed. Wipe the work surface.
3. Remove gloves properly and wash your hands with soap and water.

Sources and illustration notes

Main anatomical reference

Hall, David H. An Illustrated Dissection Guide to the Grasshopper. User-supplied scanned booklet, guide_grasshopper.pdf. External anatomy and head: printed pages 2–6; dissection and internal anatomy: pages 7–12.

Cover photograph: image #2 on the Mr. E Science Life Science Labs page. Original photographer is not identified in the supplied materials.

https://mrescience.com/life_labs_fixed.php#grasshopper

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Printing

This 8-page document is arranged in reading order. Use a printer or PDF application's booklet setting to impose pages for center stapling. External text and illustration, head text and illustrations, and internal illustration and procedure are placed on facing page pairs.

Self-check answers

1. Head, thorax, abdomen; three pairs of legs and one pair of antennae.
2. To protect the organs immediately beneath the body wall.
3. Pronotum; the tympanum is on the first abdominal segment.
4. Three ocelli.
5. Paired pointed valves of the ovipositor.
6. The fingerlike gastric caeca at the anterior midgut.
7. The proventriculus, or gizzard.
8. The tracheal system: tracheae and tracheoles.
9. Into the gut near the midgut–hindgut junction.
10. Ventral.

These answers correspond to the Guide's self-checks. Complete the separate Pre-Lab and Lab Write-Up in your own words.