

37 Smart Notes: Insects

Section 1 The Insect World Section 2 Insect Behavior

37-1 Insect Behavior Objectives

- Relate** the major characteristics of insects to insects' biological success.
- List** both harmful and beneficial effects of insects on human society.
- Describe** the external structure and organ systems of a grasshopper.
- Compare** incomplete and complete metamorphosis in insects.
- Describe** defensive adaptations in insects.

Characteristics and Classification of Insects

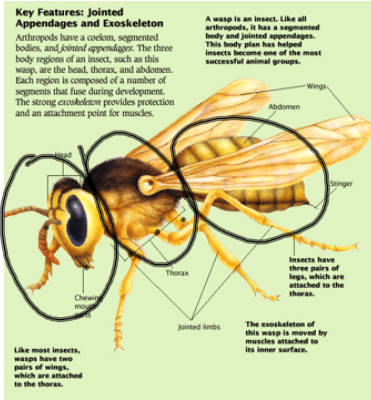
The insect body is divided into three tagmata:

- The **head** has mandibles and one pair of unbranched antennae.
- The **thorax** has three pairs of jointed legs and, in many species, one or two pairs of wings.
- The **abdomen** has 9 to 11 segments but neither wings nor legs in adults.



Insect Characteristics

Exploration of an Insect



Comparison of Crustaceans and Insects

Characteristic	Crustaceans	Insects
Nature of appendages	Most are branched at the end	Unbranched at the end
Antennae	Two pairs	One pair
Chewing appendages	Usually three pairs	One pair
Location of appendages	Cephalothorax and abdomen	Head and thorax
Respiration	Gills	Tracheal system

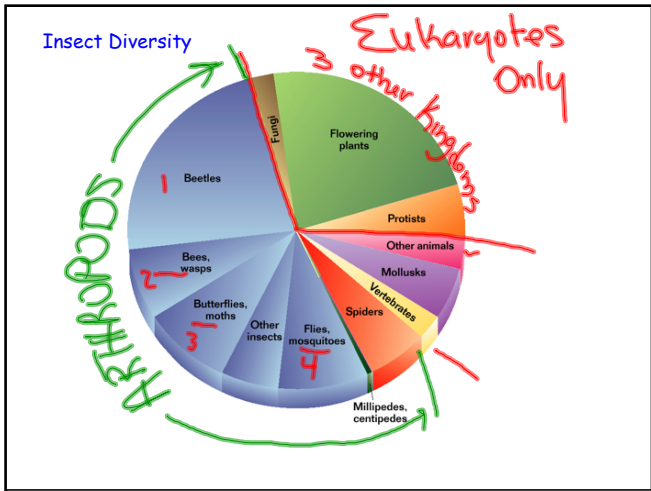
Characteristics and Classification of Insects

The study of insects and other terrestrial arthropods is called **entomology**, and the scientists who engage in it are known as entomologists.

Entomologists classify insects into more than 25 orders based on characteristics such as:

- structure of mouthparts
- number of wings
- type of development

field



Common Insect Orders

Order	Approximate number of species	Characteristics	Type of mouthparts	Typical prey
Blattellid (Cockroach)	35,000	flat body	Incomplete	chewing insects
Dermaptera (Earwig)	20,000	slender body, large pincers	Incomplete	chewing insects
Hymenoptera ("True wing")	2,000	four pairs of wings, narrow membrane	Incomplete	chewing insects
Orthoptera ("True wing")	8,000	thick body, long hind legs for jumping	Incomplete	chewing insects
Orthoptera ("True wing")	30,000	thick body, long hind legs for jumping	Incomplete	chewing insects
Orthoptera ("True wing")	400,000	small body, long antennae	Complete	chewing insects
Diptera ("True wing")	110,000	one pair of wings	Complete	chewing insects
Hymenoptera ("True wing")	160,000	two pairs of wings	Complete	chewing insects
Lepidoptera ("True wing")	140,000	four pairs of wings	Complete	chewing insects

**hemiptera
homoptera
Isoptera
Odonata
Orthoptera
Coleoptera
Diptera
hymenoptera
Lepidoptera**

Characteristics and Classification of Insects, continued

The Success of Insects

Insects live in almost every terrestrial and freshwater environment. Factors responsible for their success include:

- ability to fly
- exoskeleton
- jointed appendages
- small size
- short life span

Characteristics and Classification of Insects,
continued

Insects and People

Insects negatively affect humans by:

- competing for food
- transmitting diseases
- destroying buildings and other manufactured products

Insects benefit humans by:

- serving as food for other animals
- pollinating flowers
- making valuable products such as honey
- recycling nutrients in ecosystems

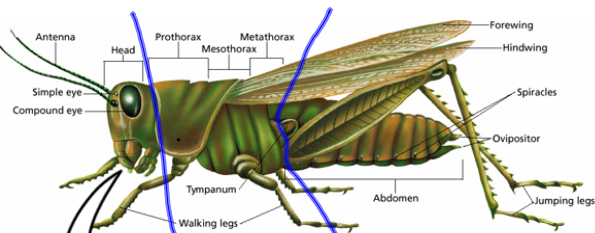
The Grasshopper

External Structure

The body of a grasshopper has three tagmata:

- The **head** bears the mouthparts, a pair of unbranched antennae, and pairs of simple and compound eyes.
- The **thorax** is composed of the **prothorax**, the **mesothorax**, and the **metathorax**.
- The **abdomen** has upper and lower plates.
- The rigid **exoskeleton** and its waxy **cuticle** covering are adaptations for a terrestrial life.

External Anatomy of a Grasshopper



you'll have to
label me!




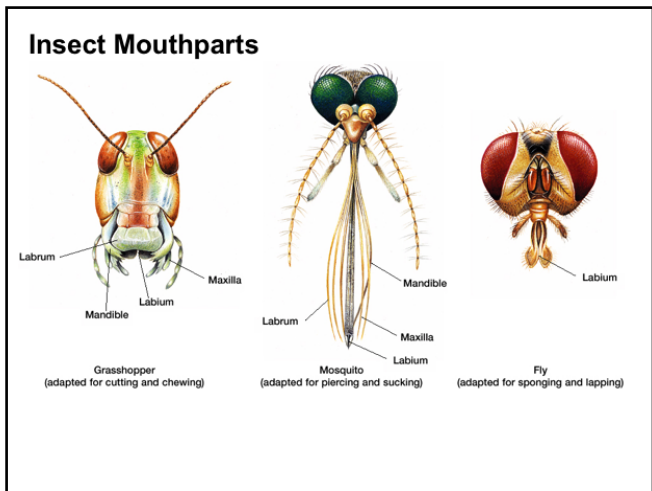
The Grasshopper, *continued*

Feeding and Digestion

Insect mouthparts are adapted for different functions in different species.
Grasshoppers feed on plants, and their mouthparts are modified for cutting and chewing leaves and blades of grass.
The **labrum** and **labium** are mouthparts that function like upper and lower lips, respectively.

 [Feeding Habits of Grasshoppers](#)

 [Parts of an Insect Mouth](#)



The Grasshopper, *continued*

Circulation, Respiration, and Excretion

Insects have an open circulatory system that transports nutrients through the body.
Gas exchange occurs by means of air-filled tracheae that reach deep into the body.
Malpighian tubules remove cellular wastes from the hemolymph while conserving water.

 [Grasshopper Circulatory and Respiratory](#)

Insect Development

Most insects go through metamorphosis.

In **incomplete metamorphosis**, a **nymph** hatches from an egg and resembles the adult but has undeveloped reproductive organs and no wings. The nymph molts several times to become an adult.

In **complete metamorphosis**, a wormlike larva called a *caterpillar*, *maggot*, *grub*, *wax worm*, *spikes* hatches from an egg and molts several times before becoming a **pupa**. The pupa molts to produce the adult, which resembles neither the larva nor the pupa.

Types of Insects that undergo complete Metamorphosis



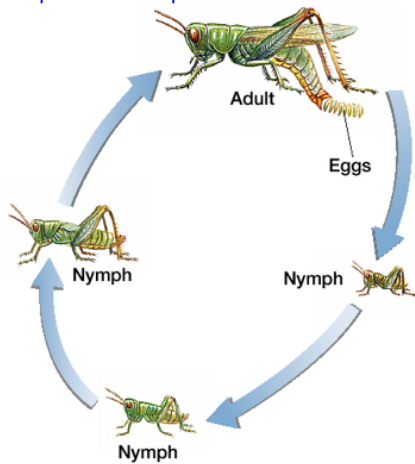
complete Metamorphosis

Types of Insects that undergo complete Metamorphosis



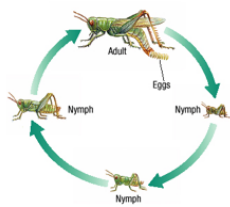
complete Metamorphosis

Incomplete metamorphosis

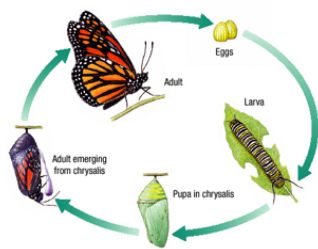


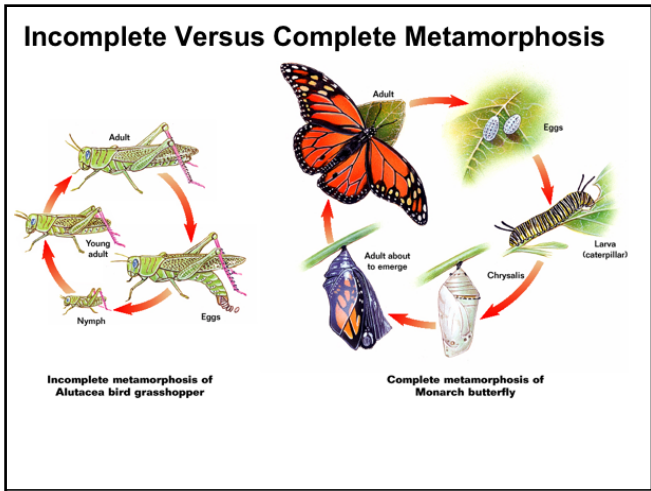
Comparison:

Incomplete Metamorphosis



Complete Metamorphosis





Insect Development, *continued*

Importance of Metamorphosis

Complete metamorphosis allows larvae and adults of the same species to **avoid competing** for space and food.

Metamorphosis also allows insects to survive periods of harsh weather or scant resources.

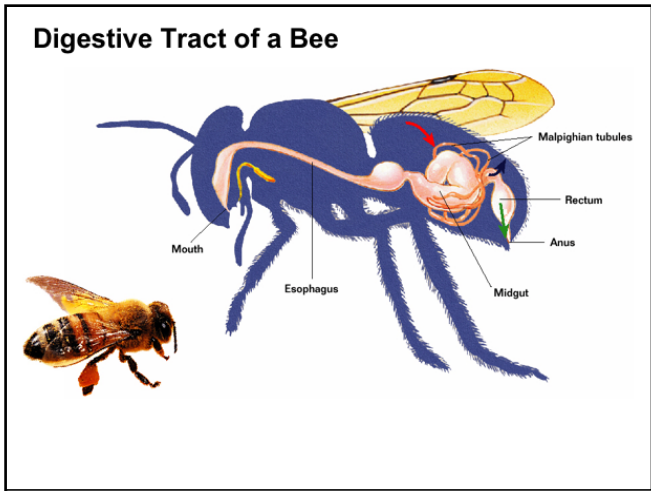
Insect Defense

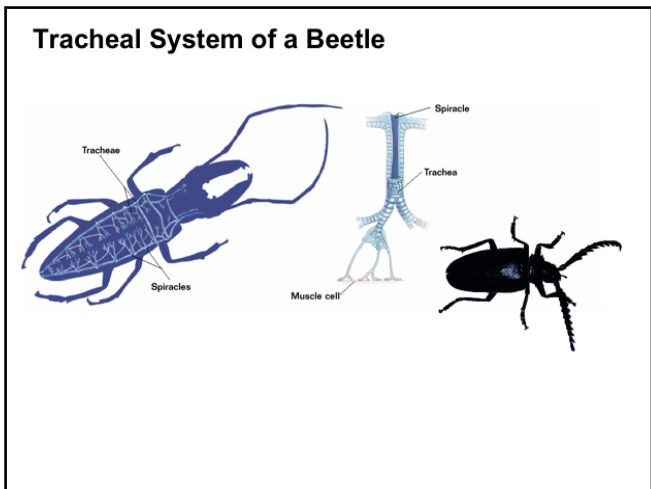
Insects may defend themselves by:

- stinging
- using camouflage
- releasing noxious chemicals

Insects that are dangerous or taste bad often have **warning coloration** that makes them recognizable to predators.

The warning coloration of a dangerous species may be **mimicked** by harmless species.





37-2 Insect Behavior

Objectives:

- Identify** three ways that insects communicate, and give an example of each.
- Describe** the social organization of honeybees.
- Explain** how honeybees communicate information about the location of food.

Communication

Insects communicate by behaviors such as:

- releasing **pheromones**
- producing sounds
- producing flashes of light



Behavior in Honey Bees

Social insects live in complex groups or colonies.



The division of labor among social insects creates interdependence and a need for communication.


The social behavior of these insects is genetically determined behavior, or **innate behavior**.


Honeybee colonies consist mostly of female **worker bees**. They perform all duties but they do not produce their own offspring.

Reproduction in each colony is the exclusive function of one **queen bee** and a few hundred male **drones**.




Behavior in Honey Bees, continued

Worker bees perform many functions during their lifetime, which lasts about six weeks. 

At one stage, worker bees are called **nurse bees** and secrete **royal jelly**, which they feed to the queen and youngest larvae. 

The queen bee develops when selected larvae are fed a continuous diet of **royal jelly**. 

As a new queen matures, she secretes **queen factor**, which prevents other female larvae from developing into queens. 



Behavior in Honey Bees, *continued*

Altruistic Behavior 

In defending the colony, worker bees show **altruistic behavior** toward their close relatives in the colony.

By working for the colony, the worker bees increase the propagation of their own genes.