Glencoe Science

Biology

Interactive Classroom

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Mc Graw Hill Glencoe

Chapter 26 Arthropods

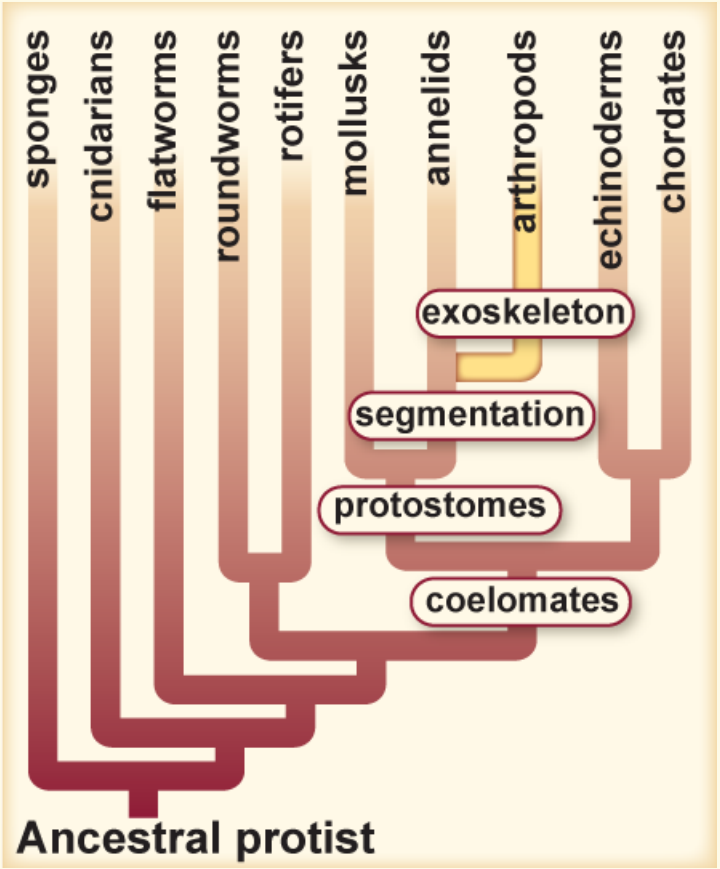
EXIT

Click on a lesson name to select.

26.1 Arthropod Characteristics

Arthropod Features

- Arthropods are segmented invertebrates with bilateral symmetry, coelomate body cavities, and protostome development.

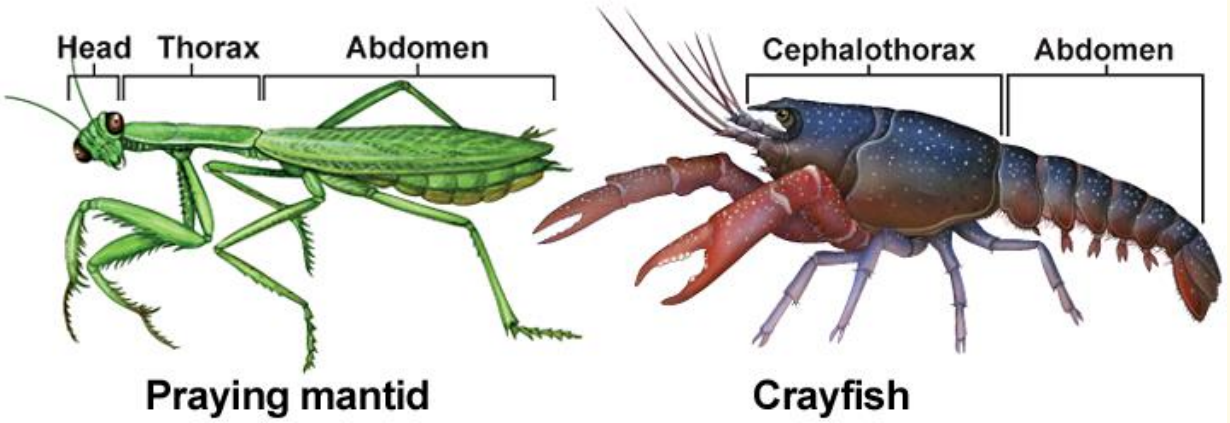


- Arthropods have exoskeletons with jointed appendages.

26.1 Arthropod Characteristics

Segmentation

- The head has mouthparts for feeding and various types of eyes.
- The thorax is the middle body region to which legs and wings are attached.



- The abdomen is the posterior end of the abdomen and bears additional legs and contains digestive structures and the reproductive organs.

26.1 Arthropod Characteristics

Exoskeleton

- Provides a framework for support
- Protects soft body tissues and slows water loss in animals that live on land
- Provides a place for muscle attachment
- Made of chitin

26.1 Arthropod Characteristics

Jointed Appendages

- Appendages of arthropods are adapted for a variety of functions, such as feeding, mating, sensing, walking, and swimming.

Flies have jointed appendages.

26.1 Arthropod Characteristics

Molting

- Arthropods must shed their outer coverings in order to grow.

26.1 Arthropod Characteristics

Feeding and Digestion

- Arthropods have a complete, one-way digestive system with a mouth, gut, and an anus, along with various glands that produce digestive enzymes.

Leafcutter ant

26.1 Arthropod Characteristics

Respiration

- Arthropods obtain oxygen by using one of three structures—gills, tracheal tubes, or book lungs.

Circulation

- Their circulatory systems transport nutrients and remove wastes.

26.1 Arthropod Characteristics

Excretion

- Cellular wastes are removed from the blood through Malpighian tubules.
- Malpighian tubules are attached to and empty into the gut, which contains the undigested food wastes to be eliminated from the body.

26.1 Arthropod Characteristics

Vision

- A compound eye has many facets, which are hexagonal in shape.
- Each facet sees part of an image.
- The brain combines the images into a mosaic.

26.1 Arthropod Characteristics

Hearing

- Many arthropods have a sense organ called a tympanum, which is a flat membrane used for hearing.
- Arthropod tympanums can be located on the forelegs, on the abdomen, or on the thorax.

26.1 Arthropod Characteristics

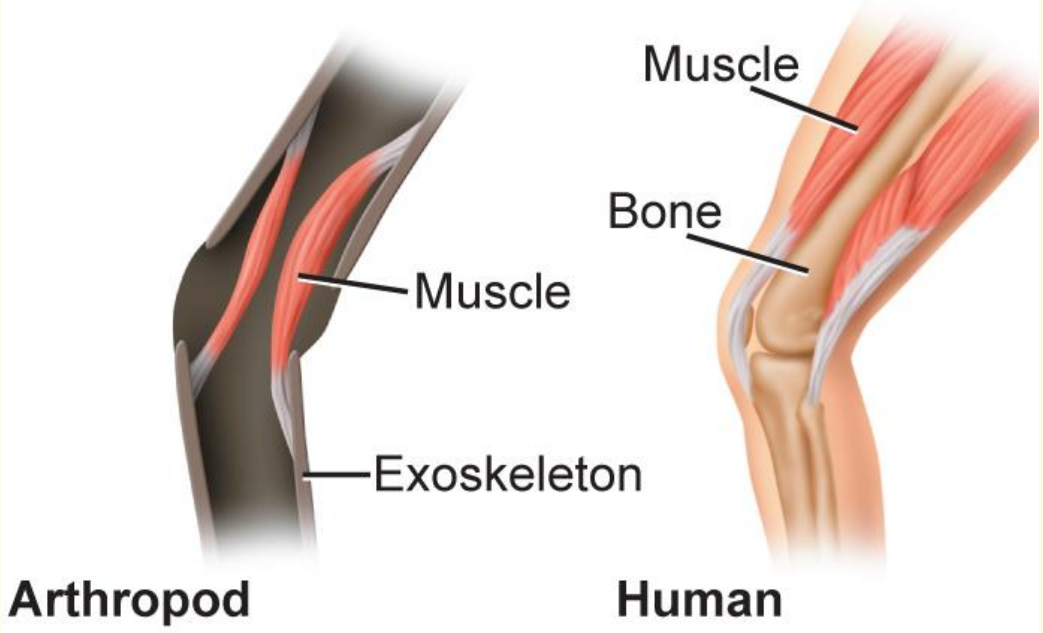
Chemicals

- Pheromones are chemicals secreted by many animal species that influence the behavior of other animals of the same species.

26.1 Arthropod Characteristics

Movement

- The muscles are attached to the inner surface of the exoskeleton on both sides of the joint.
- The strength of muscle contraction depends on the rate at which nerve impulses stimulate muscles.

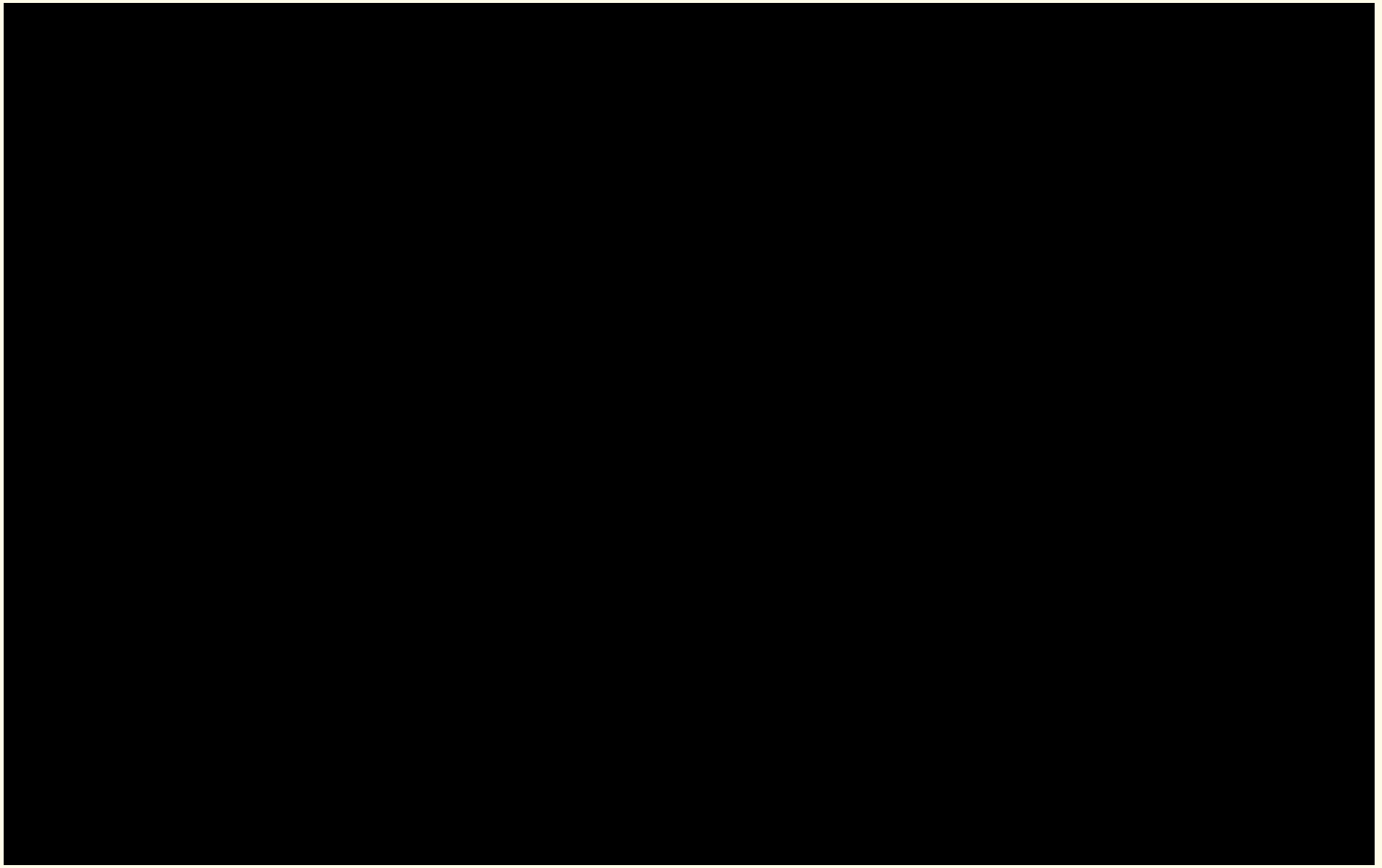


26.2 Arthropod Diversity

Arthropod Groups

- The crustaceans
- The spiders and their relatives
- The insects and their relatives

Concepts In Motion



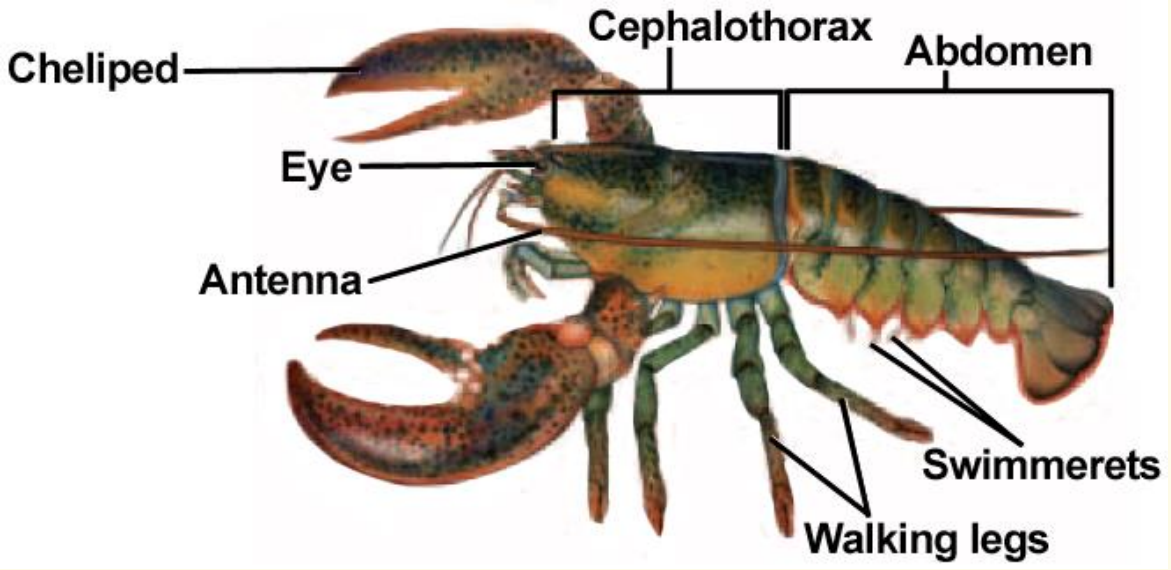
26.2 Arthropod Diversity

Crustaceans

- Most are aquatic and have two pairs of antennae, two compound eyes that can be on the tips of slender movable stalks, and mandibles for chewing.
- Crustaceans possess branched appendages and have a free-swimming larval stage.

26.2 Arthropod Diversity

- Most crustaceans, such as crayfishes, lobsters, and crabs, have five pairs of legs.



- The first pair of legs—the chelipeds—has large claws adapted to catch and crush food.
- Behind the next four pairs of walking legs are the swimmerets, appendages that are used for reproduction and as flippers during swimming.

26.2 Arthropod Diversity

Spiders and Their Relatives

- Most arachnids have two body sections—a cephalothorax and an abdomen—and six pairs of jointed appendages.
- An arachnid's most anterior pair of appendages is modified into mouthparts called chelicerae.
- The second pair of appendages is called the pedipalps.

26.2 Arthropod Diversity

Spiders

- Spiders are capable of constructing only specific kinds of webs.
- A spider secretes digestive enzymes onto its prey.
- The spider ingests the softened food.

26.2 Arthropod Diversity

- A male spider stores sperm in a cavity on his pedipalps.
- The male inserts the sperm into the female.
- The female lays her eggs in a cocoon spun of spider silk.
- There can be as many as 100 eggs in one cocoon.

26.2 Arthropod Diversity

- Other members of class Arachnida are ticks, mites, and scorpions.

Tick

Scorpion

26.2 Arthropod Diversity

Horseshoe Crabs

- Horseshoe crabs have remained unchanged since the Triassic Period more than 200 million years ago.
- The chelicerae, pedipalps, and the next three pairs of legs are used for walking and getting food from the bottom of the sea.
- They feed on annelids, mollusks, and other invertebrates.

26.2 Arthropod Diversity

- Horseshoe crabs come to shore to reproduce at high tide.

Horseshoe crab

26.3 Insects and Their Relatives

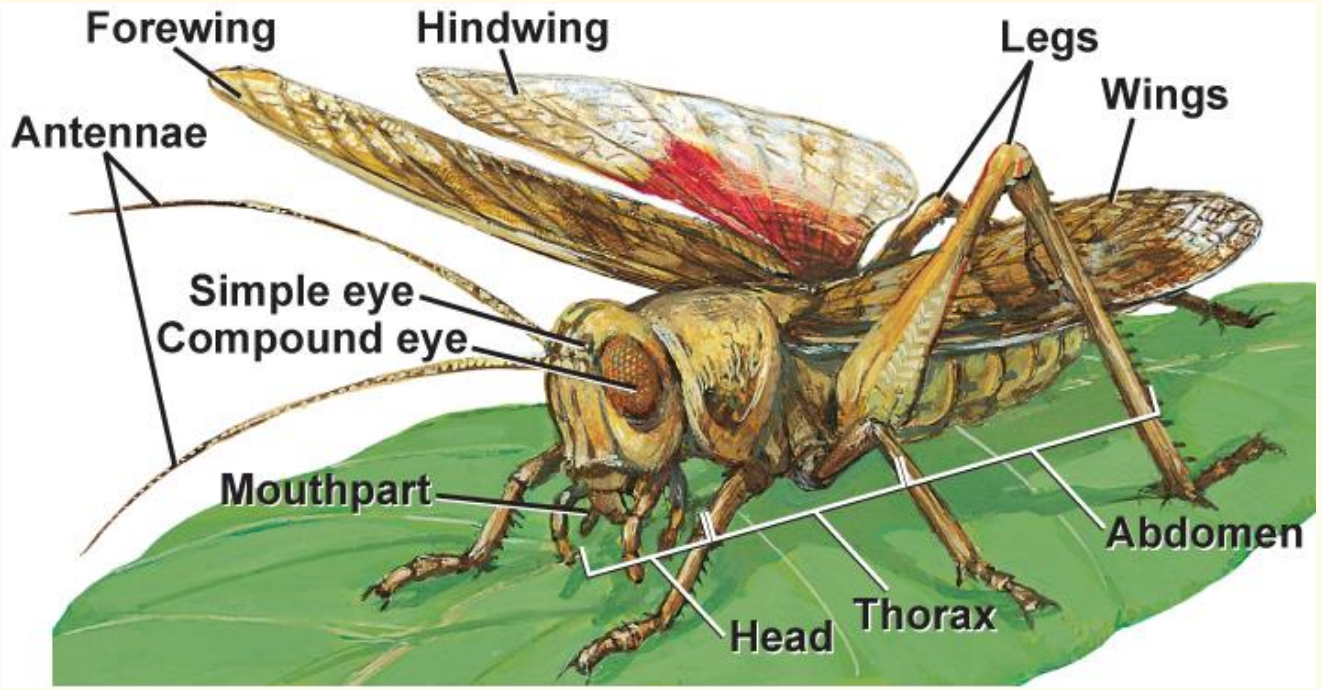
Diversity of Insects

- Arthropods make up about three-fourths of all named animal species.
- About 80 percent of arthropods are insects.

26.3 Insects and Their Relatives

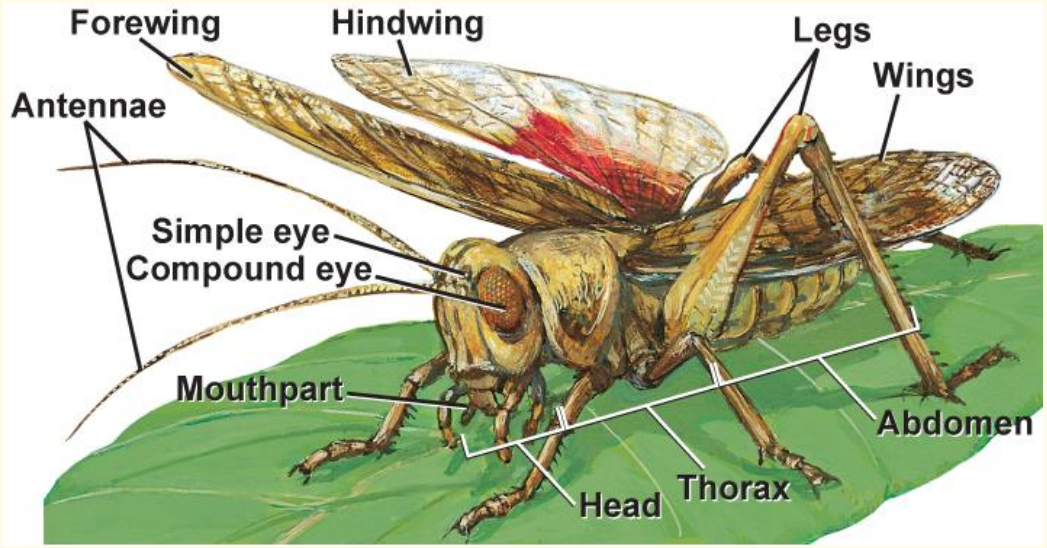
External Features

- Three body areas—the head, thorax, and abdomen

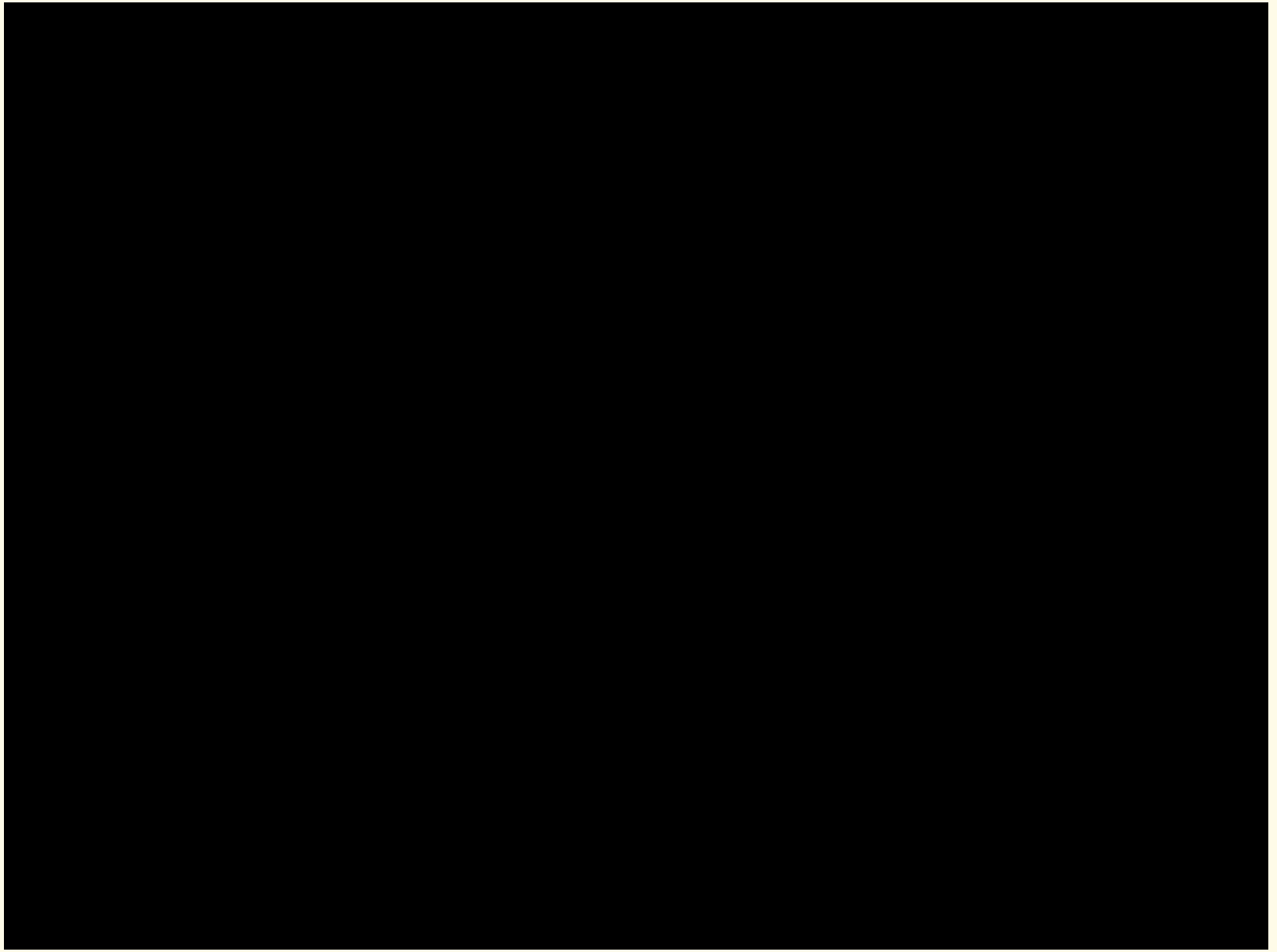


26.3 Insects and Their Relatives

- Head structures include antennae, compound eyes, simple eyes, and mouthparts.
- Insects have three pairs of legs and generally two pairs of wings on the thorax.



Concepts In Motion



26.3 Insects and Their Relatives

- Insect legs are adapted to a variety of functions.
  - Legs with claws enable beetles to dig in soil or crawl under bark.
  - Sticky pads on the ends of walking legs enable flies to walk upside down.
  - Legs adapted for collecting pollen
  - Legs adapted to jumping
  - Legs adapted to skimming over the surface of water

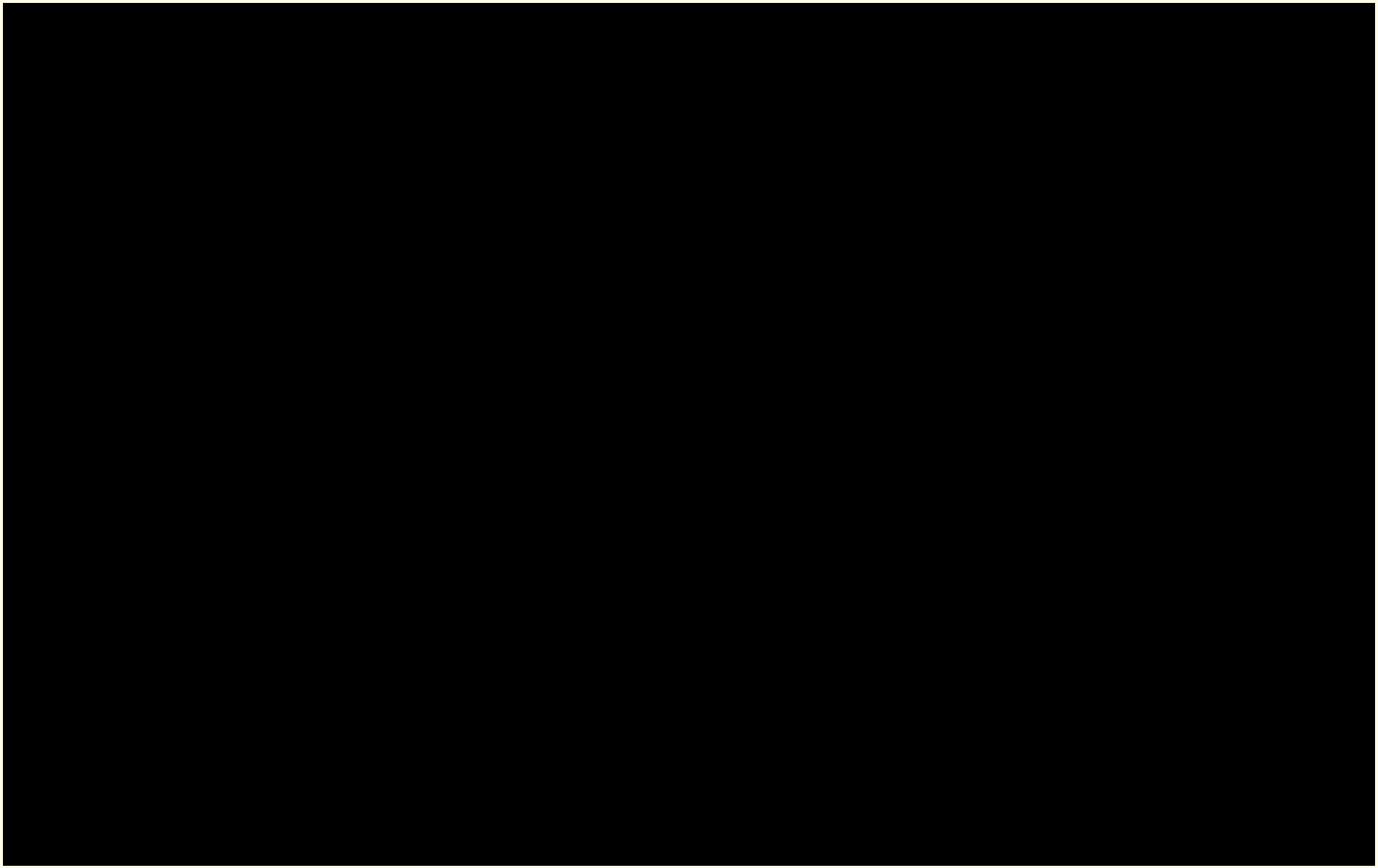
26.3 Insects and Their Relatives

- Insects' mouthparts are adapted to the food they eat.

Insect Mouthparts

Type of mouthpart	Siphoning	Sponging	Piercing/Sucking	Chewing
Example				
Function	Feeding tube is uncoiled and extended to suck liquids into the mouth.	Fleshy end of mouthpart acts like a sponge to mop up food.	A thin, needlelike tube pierces the skin or plant wall to suck liquids into the mouth.	Mandible pierces or cuts animal or plant tissue, and other mouthparts bring food to the mouth.
Insects with adaptation	Butterflies, moths	Houseflies, fruit flies	Mosquitoes, leaf-hoppers, stink bugs, fleas	Grasshoppers, beetles, ants, bees, earwigs

Concepts In Motion



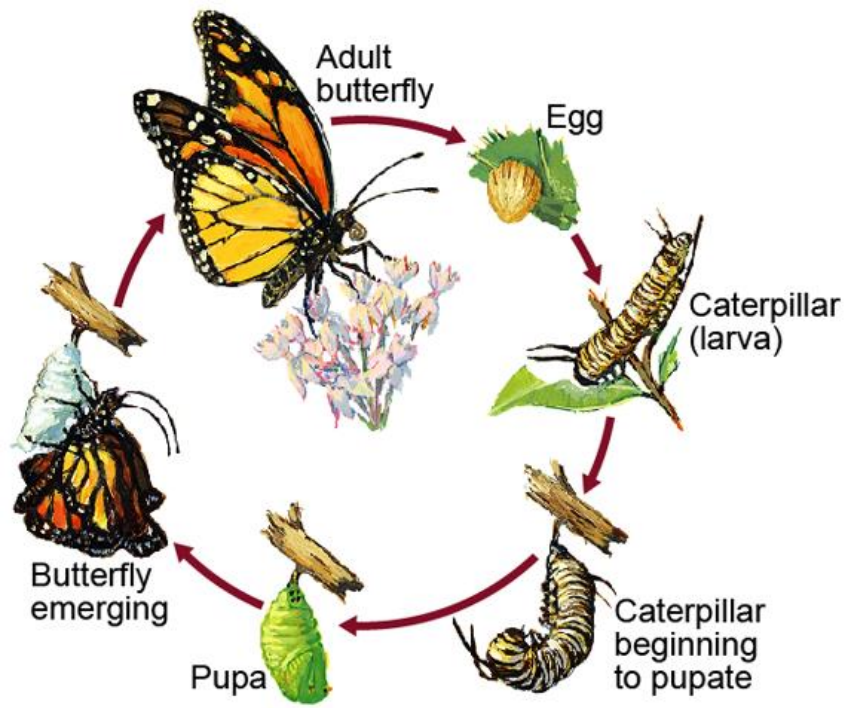
26.3 Insects and Their Relatives

- Insect wings are outgrowths of the body wall.
- Wings are formed of a thin double membrane of chitin, and they have rigid veins that give the wings strength.

26.3 Insects and Their Relatives

- Insects have a variety of adaptations in their sense organs.
  - Hairlike structures that are sensitive to touch, pressure, vibration, and odor
  - Detect airborne sounds with their tympanic organs
  - Chemical receptors for taste and smell are located on mouthparts, antennae, or legs.

26.3 Insects and Their Relatives

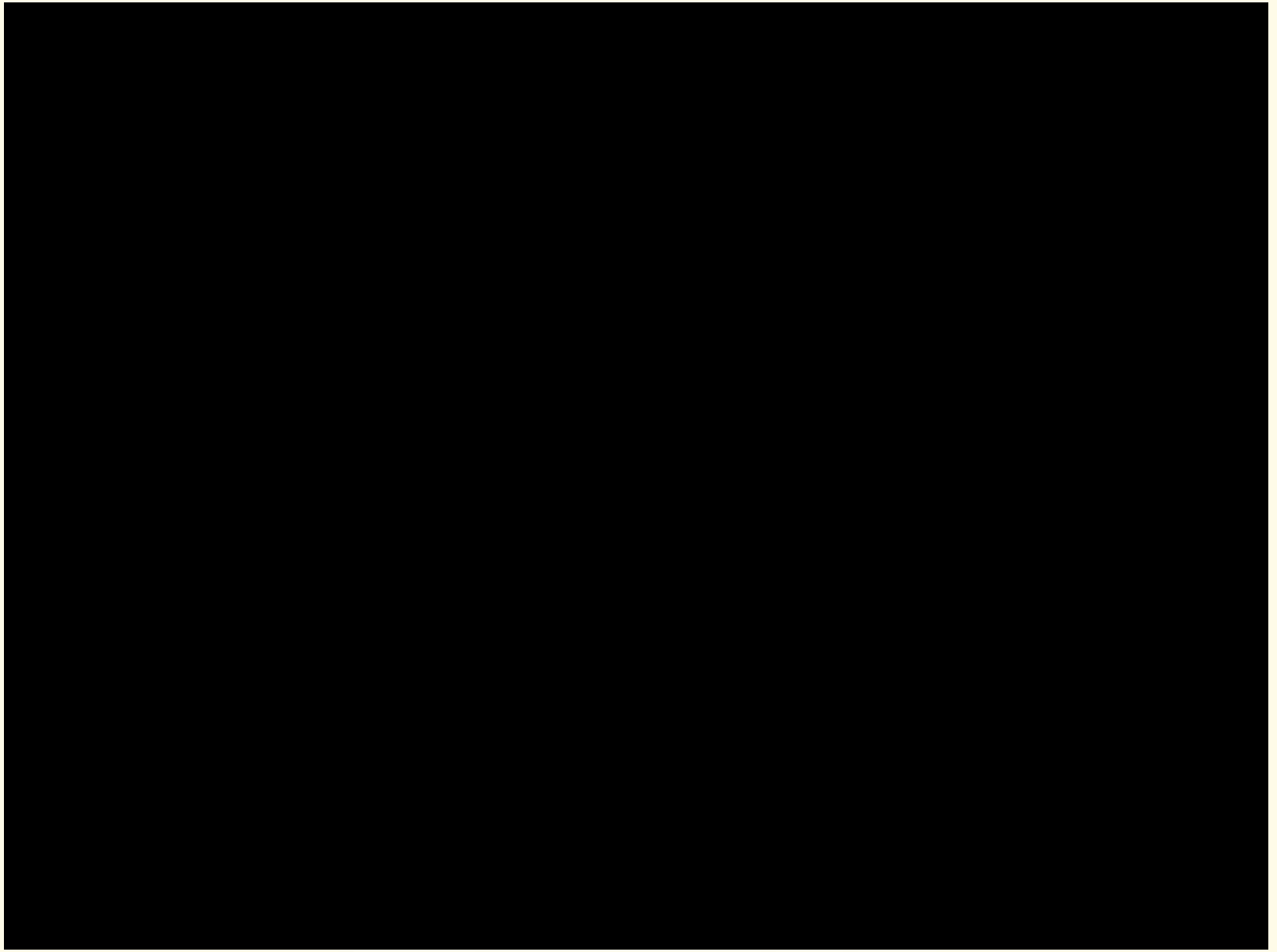


Complete metamorphosis

Complete Metamorphosis

- Most insects develop through the four stages of complete metamorphosis—egg, larva, pupa, and adult.

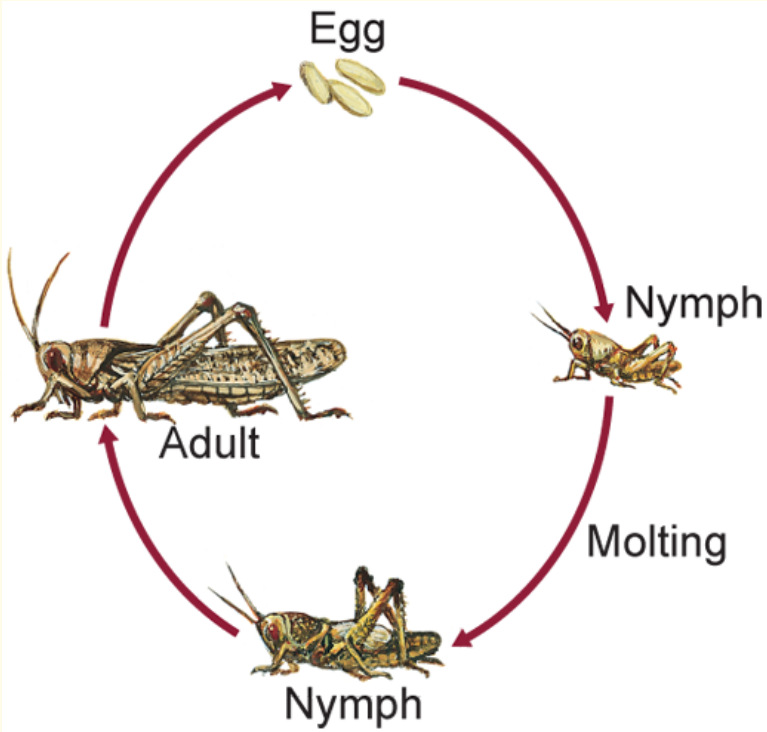
Concepts In Motion



26.3 Insects and Their Relatives

Incomplete Metamorphosis

- Insects that undergo incomplete metamorphosis hatch from eggs as nymphs.
- After several molts, young nymphs become winged adults.



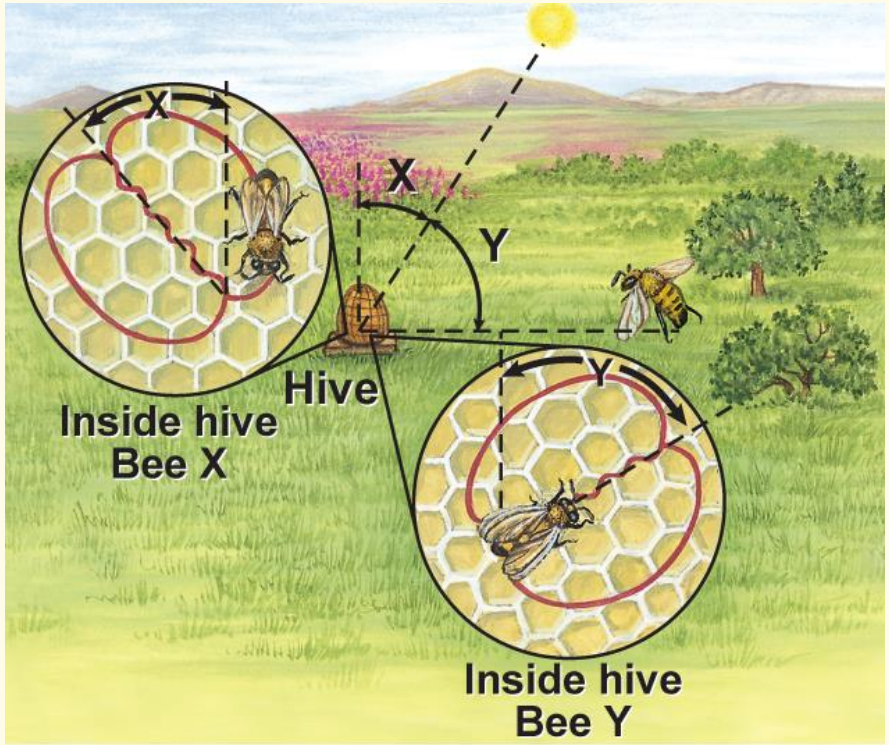
Incomplete metamorphosis

26.3 Insects and Their Relatives

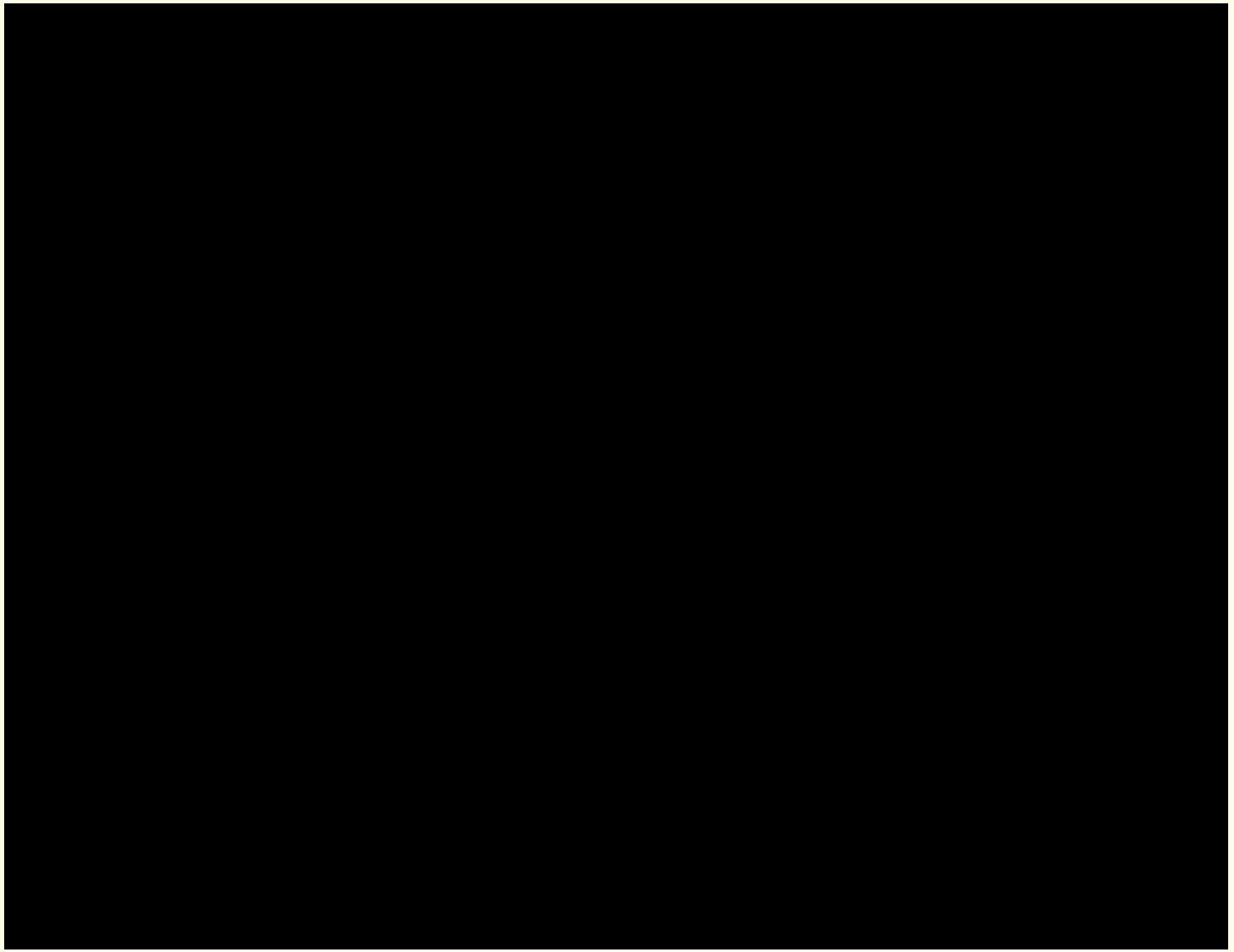
- Insects such as honeybees, ants, and termites organize into social groups and cooperate in activities necessary for their survival.
- There are only three castes in a honeybee hive.
  - Workers
  - Drones
  - The queen

26.3 Insects and Their Relatives

- Honeybees have evolved an efficient system of communication, using bodily movements to indicate the location of food sources.
  - Waggle dance
  - Round dance



Concepts In Motion



26.3 Insects and Their Relatives

- Insects pollinate most flowering plants.
- Insects also can be harmful to humans.
- Integrated pest management offers long-term control of pests.

26.3 Insects and Their Relatives

Centipedes and Millipedes

- Centipedes have long, segmented bodies, and each segment has one pair of jointed legs.
- The first pair of appendages is modified to form poison claws.

Centipede

- Most species of centipedes are not harmful to humans.

26.3 Insects and Their Relatives

- Millipedes have two pairs of appendages on their abdominal segments and one pair on their thorax.
- Walk with a slow, graceful motion
- They do not have poison claws and feed primarily on damp and decaying vegetation.

Millipede

26.3 Insects and Their Relatives

Evolution of Arthropods

- Trilobites, abundant in the mid-Cambrian, were early arthropods.
- Tardigrades also are related to arthropods.

Trilobite

Chapter Resource Menu

Click on a hyperlink to view the corresponding lesson.

Chapter Diagnostic Questions

What features do arthropods *not* share with annelids?

A. segments

B. invertebrates

C. exoskeletons

D. coelomate body cavities

Chapter Diagnostic Questions

CheckPoint

Which is *not* a body part of an arthropod?

A. head

B. tail

C. thorax

D. abdomen

Chapter Diagnostic Questions

CheckPoint

An arthropod's exoskeleton is made of what material?

A. chitin

B. silica

C. bone

D. cartilage

26.1 Formative Questions

CheckPoint

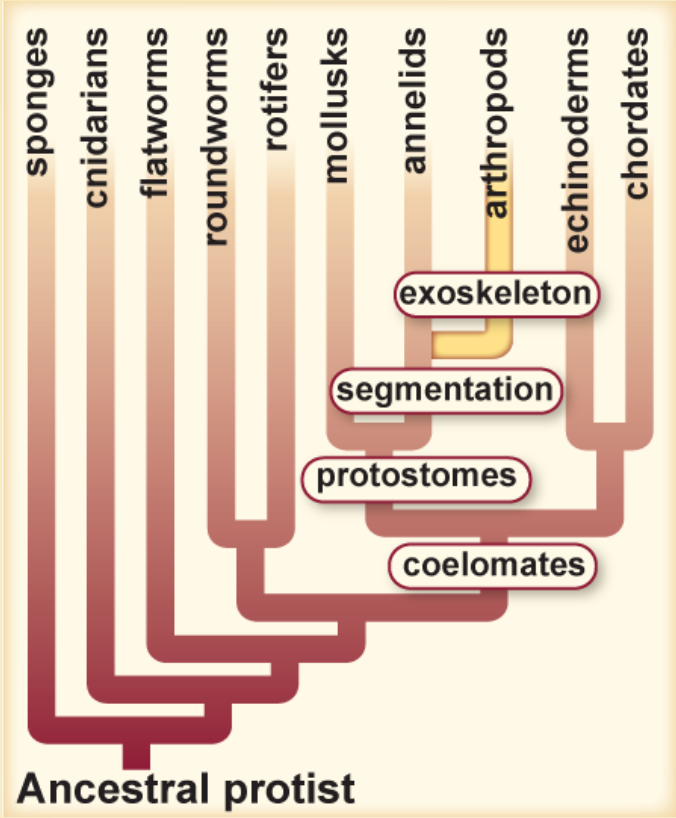
Which characteristic of arthropods distinguishes them from annelids?

A. segmentation

B. bilateral symmetry

C. coelomate body cavity

D. presence of an exoskeleton



26.1 Formative Questions

CheckPoint

What are mandibles?

A. feeding appendages

B. grasping antennae

C. pinching claws

D. respiratory openings

26.1 Formative Questions

CheckPoint

What excretory organs help terrestrial arthropods preserve water in their bodies?

A. book lungs

B. Malpighian tubules

C. spiracles

D. tracheal tubes

26.1 Formative Questions

CheckPoint

What is a tympanum used to detect?

A. chemicals

B. odors

C. movement

D. sound waves

26.2 Formative Questions

CheckPoint

Which arthropods have five pairs of legs?

A. insects

B. lobsters

C. scorpions

D. ticks

26.2 Formative Questions

CheckPoint

Which arthropods do *not* have antennae?

A. beetles

B. crayfish

C. grasshoppers

D. spiders

26.2 Formative Questions

CheckPoint

Which is a function of chelicerae?

A. chewing food

B. poisoning prey

C. secreting silk

D. sensing odors

26.2 Formative Questions

CheckPoint

Which describes a horseshoe crab?

A. a living fossil

B. an evolutionary link

C. a copepod ancestor

D. a primitive crustacean

26.3 Formative Questions

CheckPoint

What are insect wings composed of?

A. calcium

B. chitin

C. protein

D. polysaccharide

26.3 Formative Questions

CheckPoint

What structures enable insects to detect touch, pressure, vibration, or odor?

A. antennae

B. hairs

C. mouthparts

D. tympanums

26.3 Formative Questions

CheckPoint

Which word best describes metamorphosis?

A. alteration

B. growth

C. development

D. transformation

26.3 Formative Questions

CheckPoint

In honeybee and ant societies, what is the role of a female that does not reproduce?

A. drone

B. queen

C. soldier

D. worker

Chapter Assessment Questions

CheckPoint

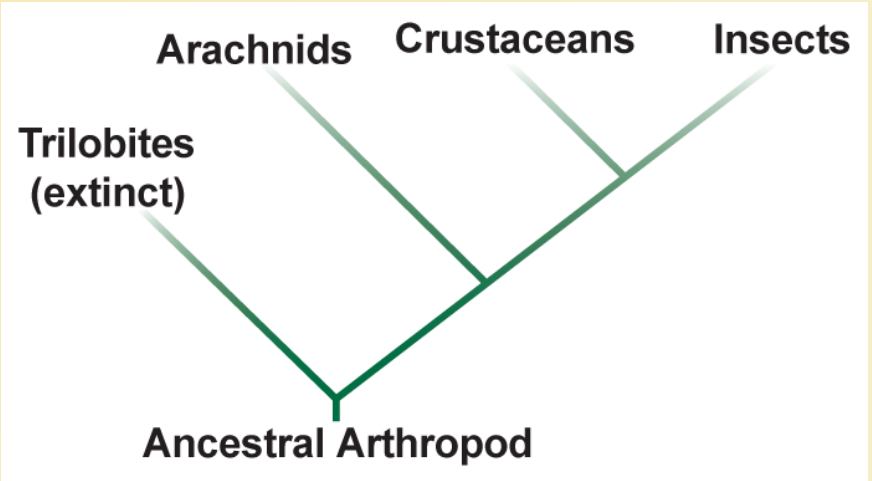
Based on this interpretation of the phylogeny of arthropods, which group developed most recently?

A. trilobites

B. insects and crustaceans

C. arachnids

D. chelicerae

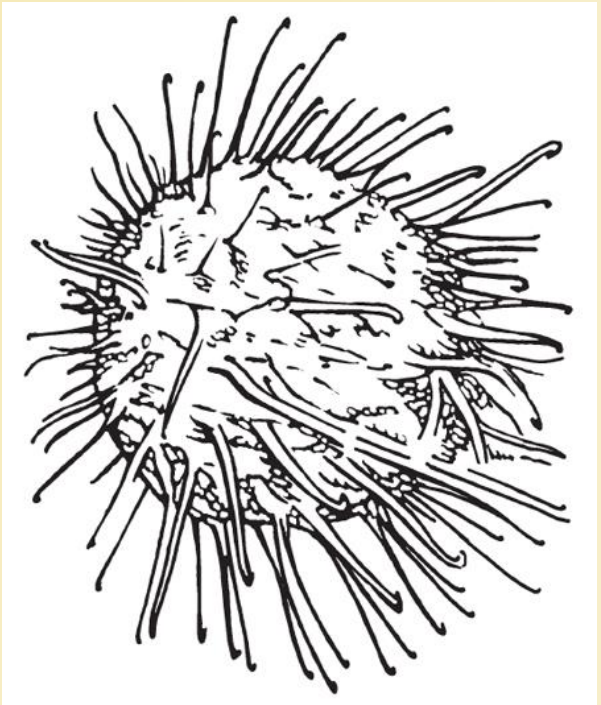


Chapter Assessment Questions

CheckPoint

Which is the method of seed dispersal for this seed?

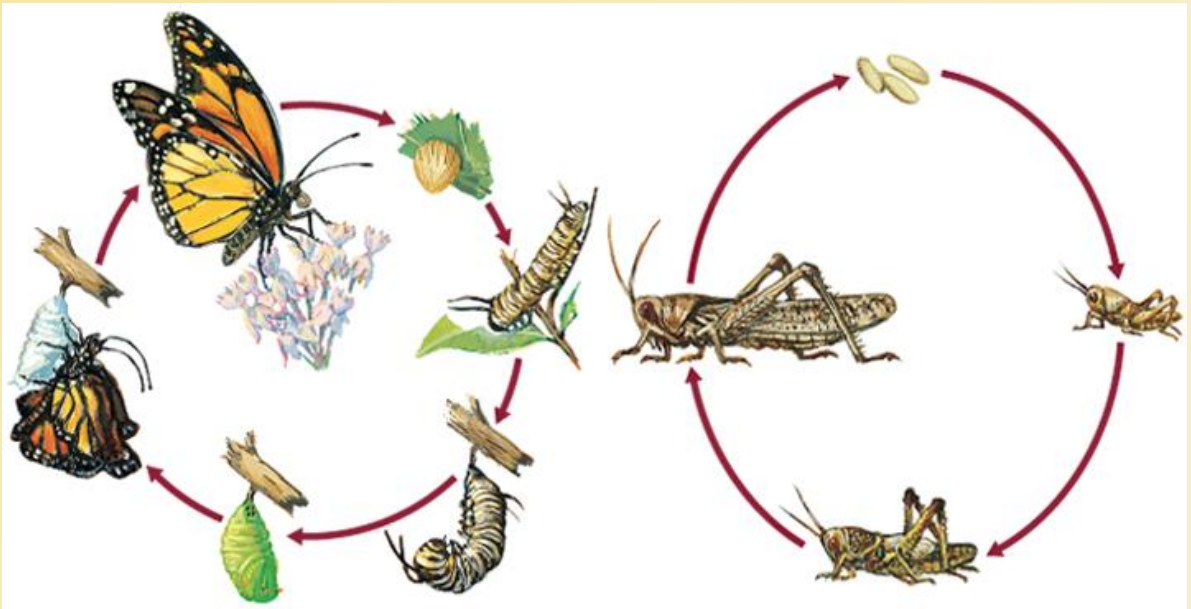
A. animals
B. gravity
C. water
D. wind



Chapter Assessment Questions

CheckPoint

Which stage is absent for insects that undergo incomplete metamorphosis?



Chapter Assessment Questions

CheckPoint

A. egg

B. pupa

C. nymph

D. adult

Standardized Test Practice

CheckPoint

Why is molting a necessary process in arthropods?

A. for growth

B. for excretion

C. for reproduction

D. for respiration

Standardized Test Practice

CheckPoint

What is the primary function of the circulatory system in most arthropods?

A. to conserve water

B. to deliver oxygen

C. to provide energy

D. to transport nutrients

Standardized Test Practice

CheckPoint

How does an arthropod with compound eyes perceive an object?

A. as a mosaic

B. as black and white

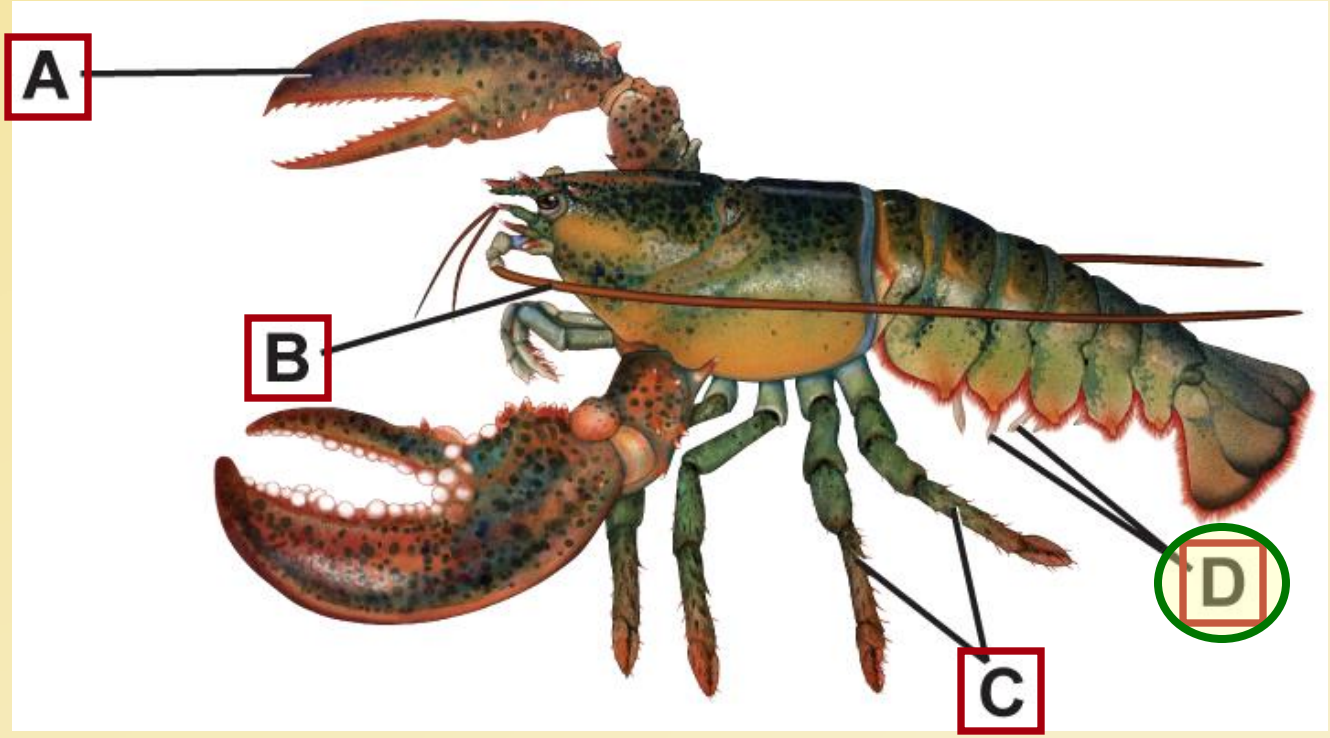
C. as a focused shape

D. as a network of lines

Standardized Test Practice

CheckPoint

Which appendages does a lobster use for swimming?



Standardized Test Practice

CheckPoint

True or False

The specific kind of web that a spider constructs is genetically programmed.

Standardized Test Practice

CheckPoint

Which is a stage of development in incomplete metamorphosis?

A. caterpillar

B. larva

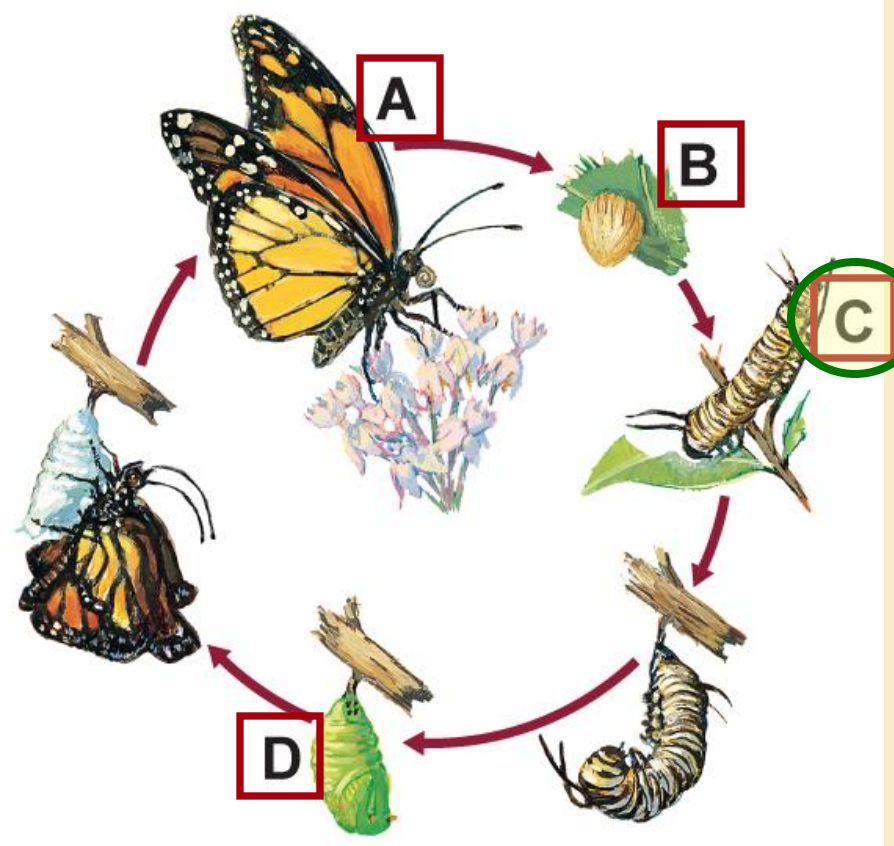
C. nymph

D. pupa

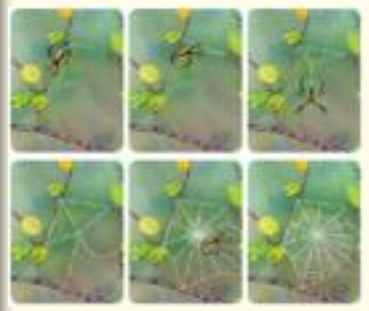
Standardized Test Practice

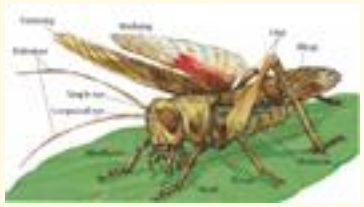
CheckPoint

At which stage of metamorphosis does this organism behave like a feeding machine?



Glencoe Biology Transparencies





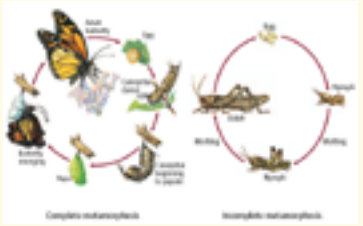
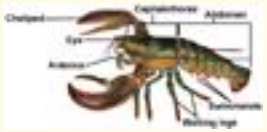
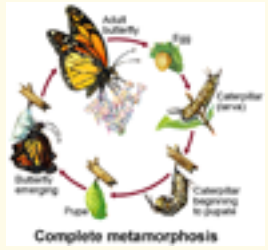


Image Bank


Ancestral protist

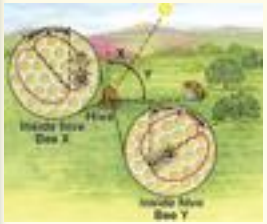

Muscle
Bone
Muscle
Exoskeleton
Arthropod
Human




Complete metamorphosis


Egg
Nymph
Adult
Molting
Nymph
Incomplete metamorphosis

Image Bank



Vocabulary

Section 1

- thorax
- abdomen
- cephalothorax
- appendage
- molting
- mandible
- tracheal tube
- book lung
- spiracle
- Malpighian tubule
- pheromone

Vocabulary

Section 2

- cheliped
- swimmeret
- chelicera
- pedipalp
- spinneret

Vocabulary

Section 3

- metamorphosis
- pupa
- nymph
- caste

Animation

Concepts In Motion

- Visualizing Respiratory Structures
- A Grasshopper
- Metamorphosis
- Bees