28–2 Groups of Arthropods

Arthropods are classified based on the **number and structure of their body segments and appendages**—particularly their mouthparts.

The three major groups of arthropods are:

- **crustaceans**
- **spiders and their relatives (chelicerates)**
- **insects and their relatives (uniramians)**

Crustaceans

- This subphylum includes crabs, shrimps, lobsters, crayfishes, and barnacles.
- Crustaceans are primarily aquatic.
- Only a few are living on land, such as woodlouse.

Spiders and Their Relatives (Chelicerates)

Chelicerates are divided into two main classes.

- **Merostomata** includes horseshoe crabs.
- **Arachnida**, or arachnids, includes spiders, mites, ticks, and scorpions.

Insects and Their Relatives (Uniramians)

Centipedes, millipedes, and insects are **uniramians**.

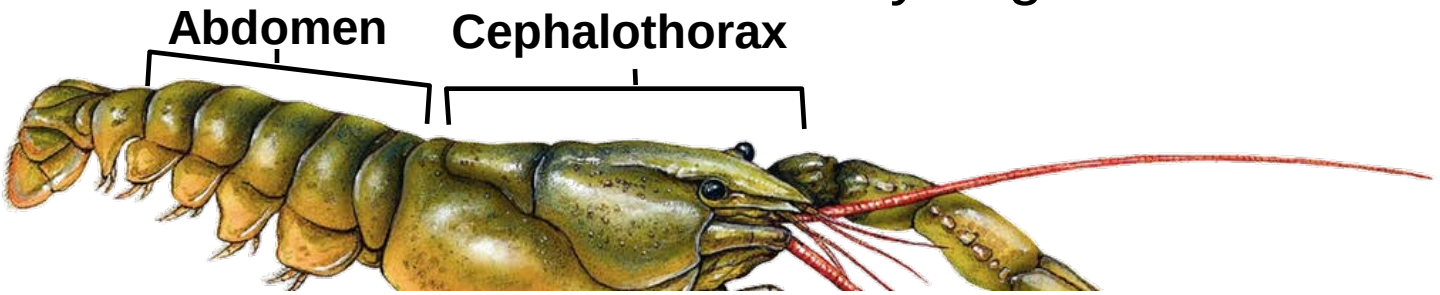
Uniramians have jaws, one pair of antennae, and unbranched appendages.

Arthropods have:

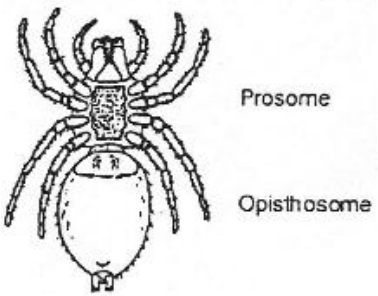
- **Segmented body**
- **Though exoskeleton**
- **Appendages**

Segmented Body

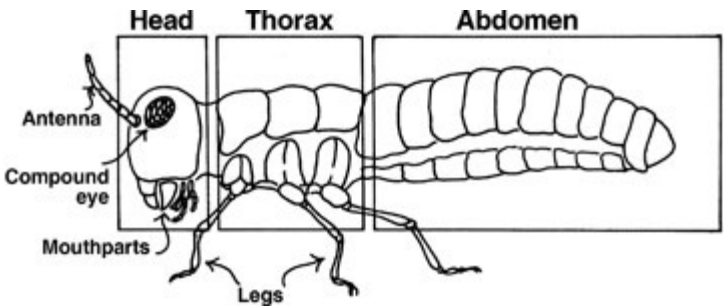
- **Crustaceans – two or three** body segments.



- **Chelicerates – two body** segments (cephalothorax/prosome and abdomen/opisthosome)



- **Uniramians – three body** segments (head, thorax, abdomen)



Exoskeleton

- The exoskeleton is made of protein and carbohydrate chitin
- It protects and supports the body of the arthropod
- It vary in size, shape and toughness.

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Appendages

- Appendages are structures such as legs and antennae that extend from the body wall.

- Appendages are jointed – “arthron” means “joint” in Greek, “podos” means “foot”

- **Crustaceans** – **two pairs of antennae**, number of walking legs varies (5 in crayfish).

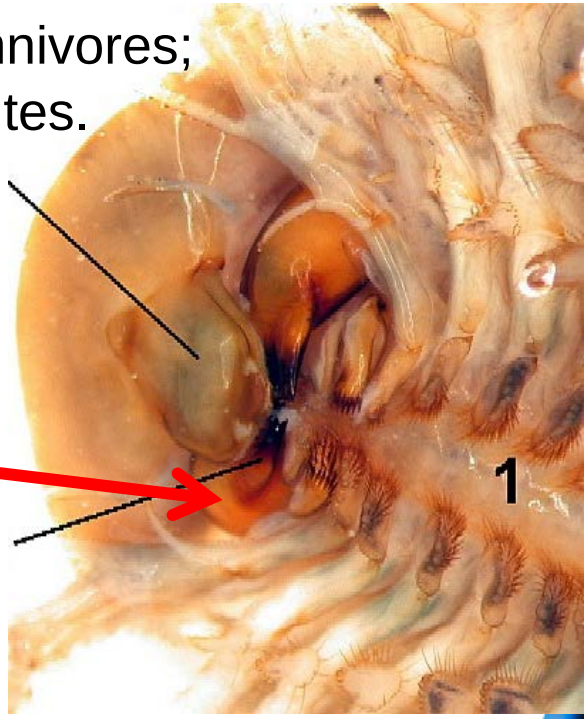
- **Chelicerates** – most have **four pairs of walking legs**, **no** antennae.

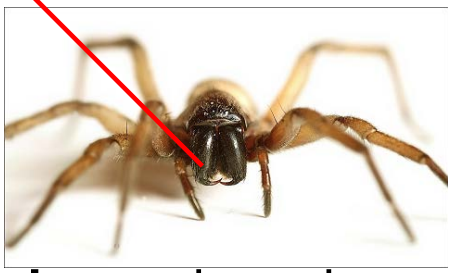
- **Uniramians** – **one pair of antennae** and **3 pairs** of unbranched (uniramous) **appendages**

Form and Function in Arthropods

Feeding

- Arthropods include herbivores, carnivores and omnivores; bloodsuckers, filter feeders, detritivores and parasites.
- Mouthparts range from pincers or fangs to jaws.
  - **Crustaceans –** chewing mouth parts called **mandibles**.
  - **Chelicerates** – mouth parts are called **chelicerae**: paralyze preys**.**
  - **Uniramians** – have jaws.





Examples of Feeding

- Spiders capture and feed on animals ranging from other arthropods to small birds.
- Crabs and other crustaceans use there powerful chelipeds to open bivalves and eat the soft part.
- Barnacles are filter feeders.

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Examples of Feeding

- Mites and ticks are small arachnids that are often parasitic.
  - Their chelicerae and pedipalps are specialized for digging into a host's tissues and sucking out blood or plant fluids.

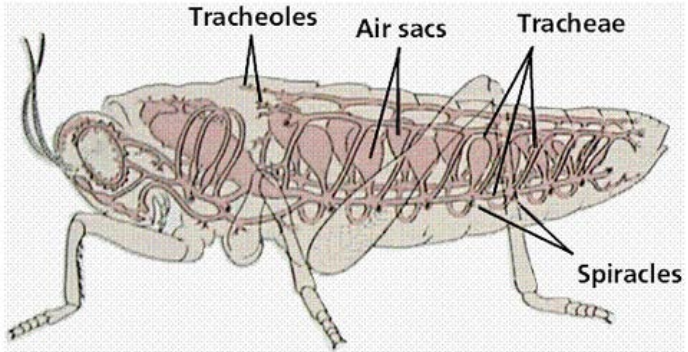
Respiration

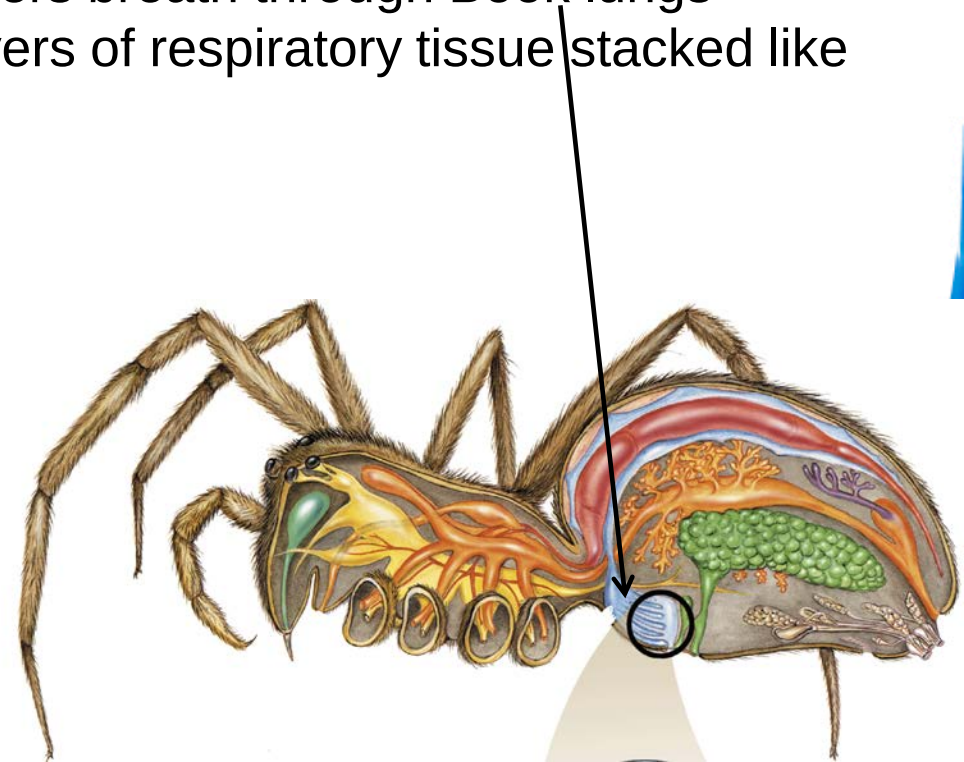
Terrestrial arthropods

- Most breath through a **network of branching tracheal tubes** that extend throughout the body. Air enters and leaves the tracheal tubes through spiracles which are small openings located along the side of the body.
- Some arthropods such as spiders breath through Book lungs which are organs that have layers of respiratory tissue stacked like the pages of a book.

Aquatic arthropods

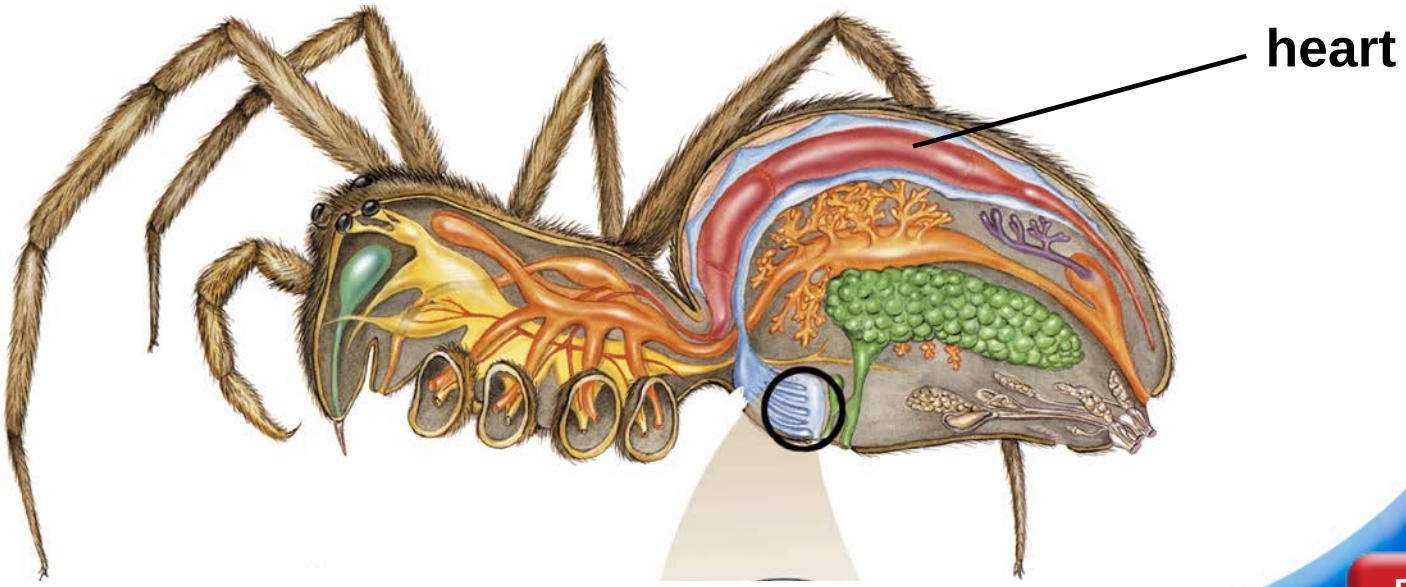
- such as lobster, crabs, respire through **gills**.





Circulation

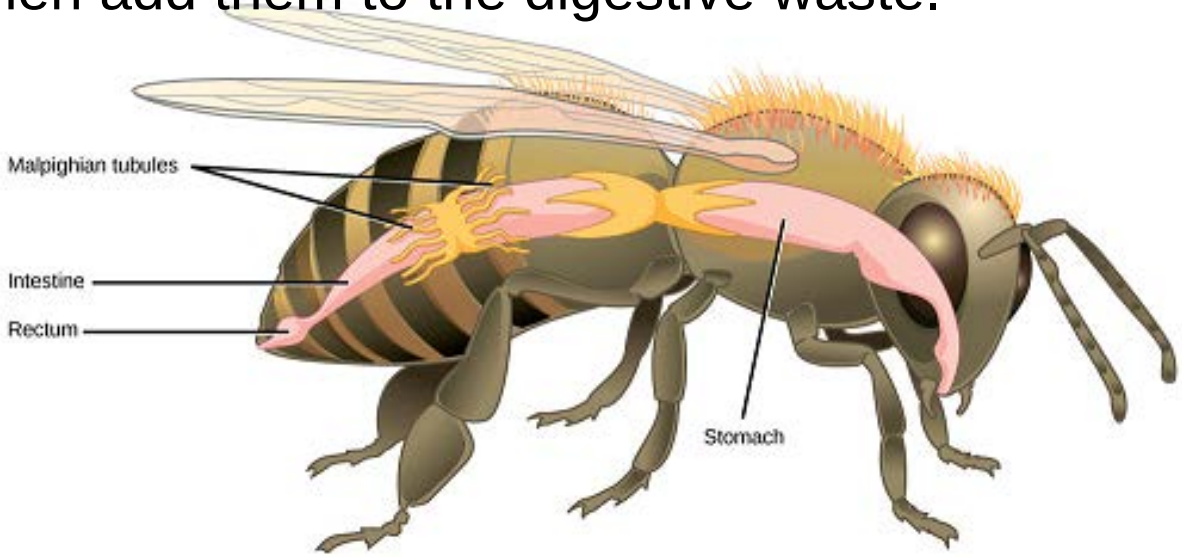
- **Open circulatory system**
- well developed **heart pumps** blood through arteries that branch and enter tissues. Blood leaves the vessels and moves through sinuses. The blood then collects in a large sinus surrounding the heart and re-enters the heart and is again pumped through the body.



Excretion

Terrestrial arthropods

- Dispose of **nitrogenous wastes** using **Malpighian tubules** which are sac like organs that extract wastes from the blood and then add them to the digestive waste.

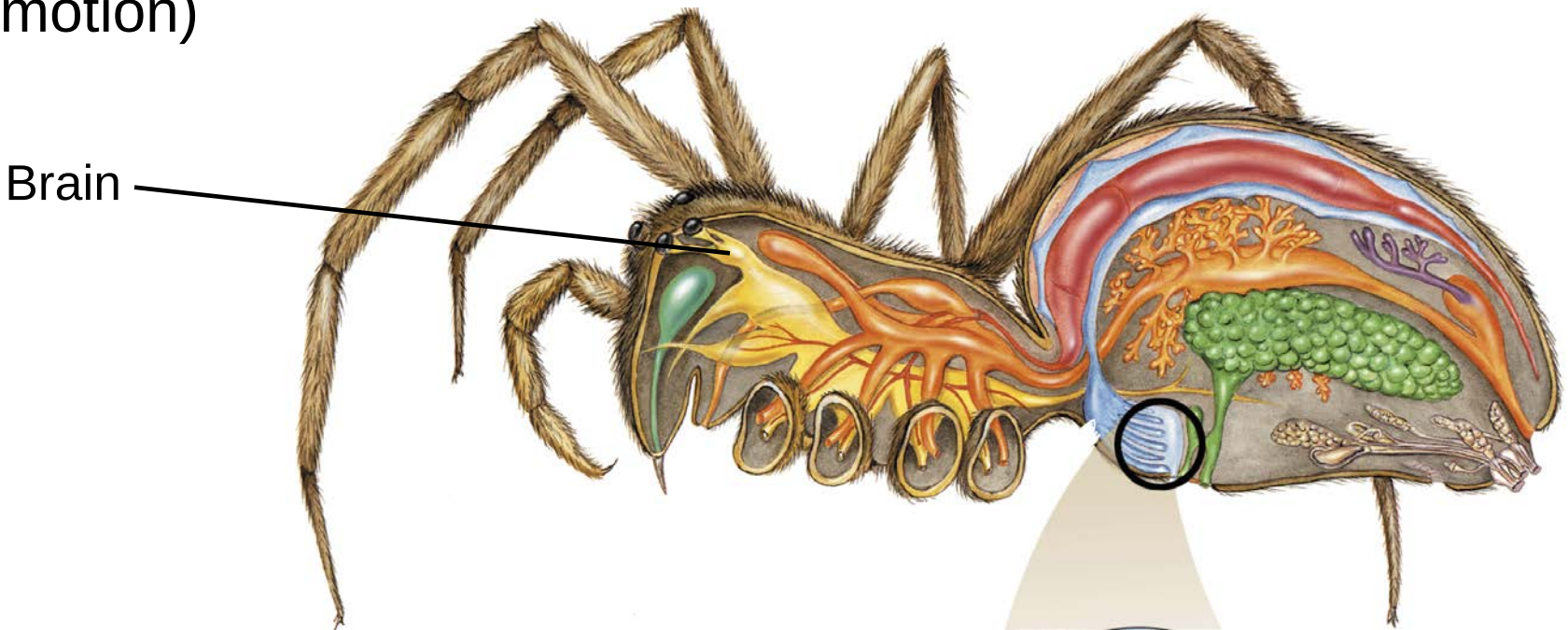


Aquatic arthropods

- **Diffusion** moves cellular wastes from the animals body into the surrounding water.

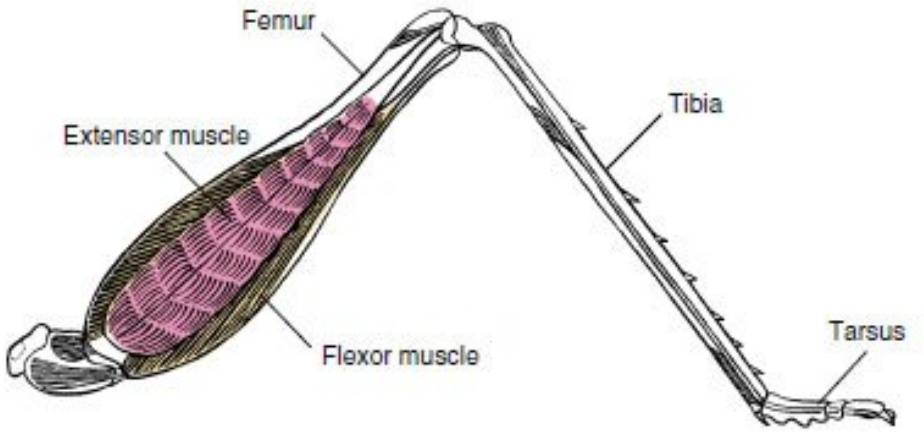
Response

- Most arthropods have a **well developed nervous system**;
- all have a **brain**;
- most have sense organs – ex. **Compound eyes** (may have more than 2000 different lenses – can detect color and motion)



Movement

- Move by using well developed groups of muscles that are controlled by the nervous system. Muscle cells can contract, they generate force by contracting and then pulling on the exoskeleton
- At each body joint, different muscles either flex (bend) or extend (straighten) the joint.



Reproduction

Terrestrial arthropods

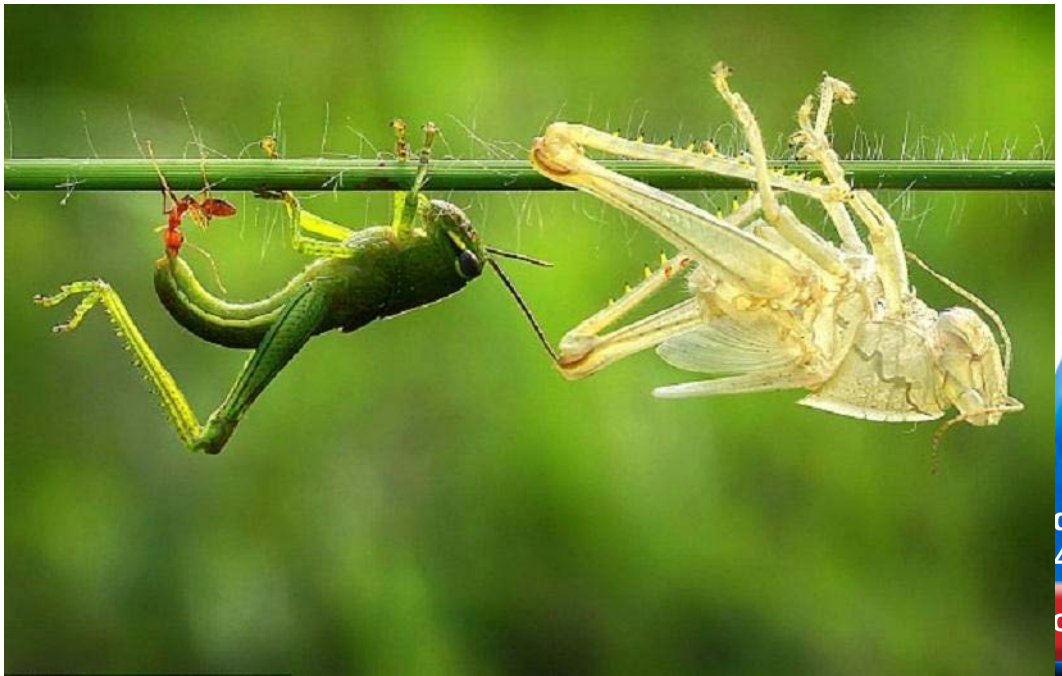
- Internal fertilization

Aquatic arthropods

- Internal or external fertilization

Growth and Development in Arthropods

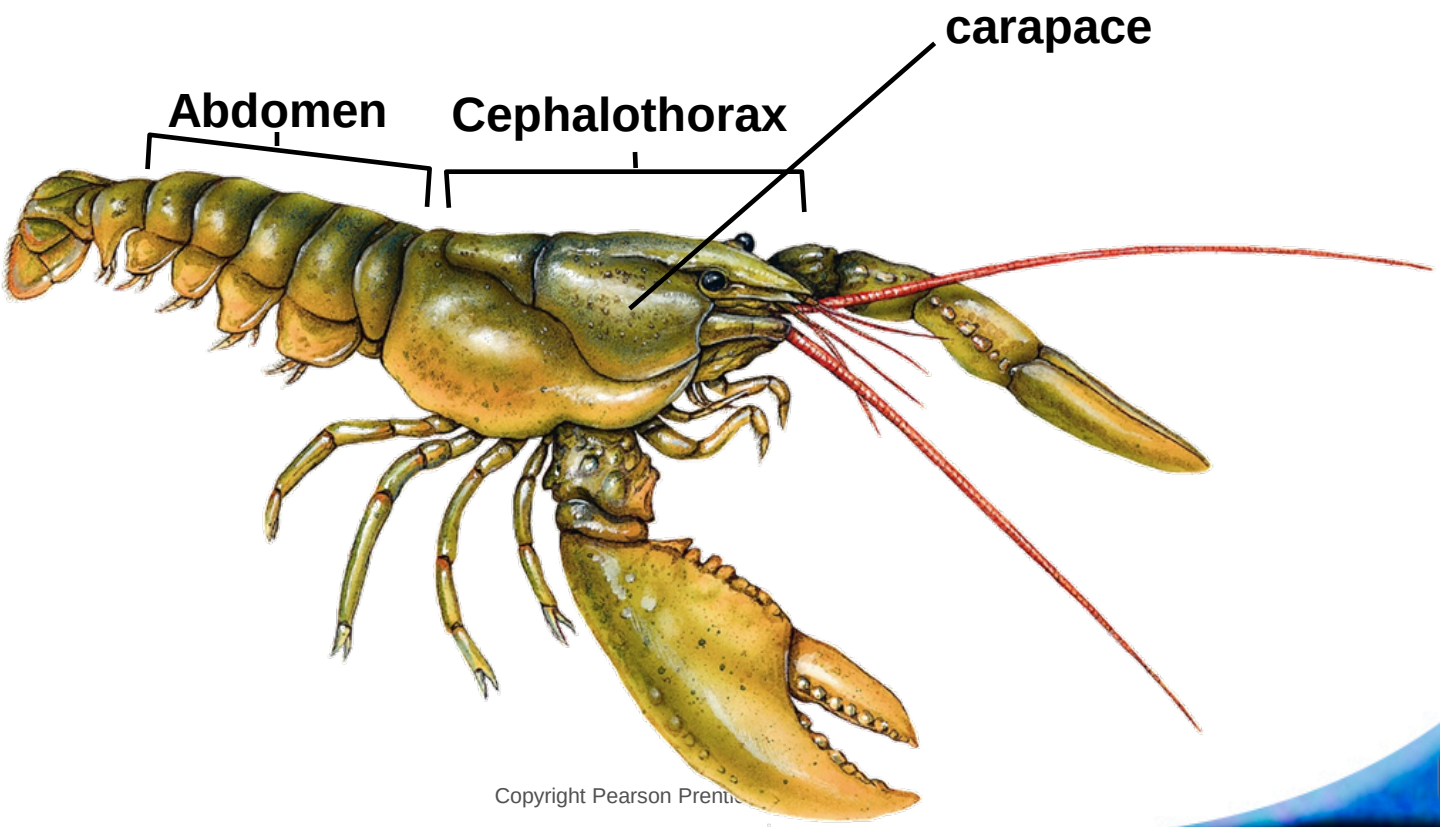
An exoskeleton does not grow as the animal grows, therefore, when the animal outgrows its exoskeleton it undergoes a period of molting. During molting the entire exoskeleton is shed and a new larger skeleton is formed.



The Crayfish Anatomy

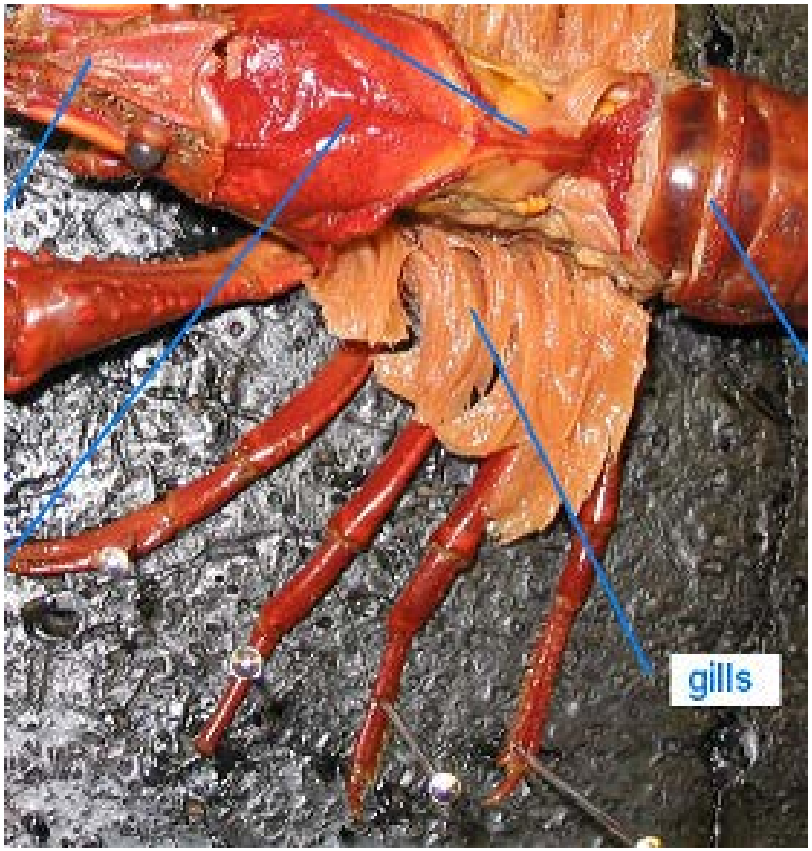
Two body sections:

- **Cephalothorax** - head and thorax – houses most of the internal organs. The cephalothorax is covered by an exoskeleton called the **carapace**.
- **Abdomen** – is the posterior part of the body.



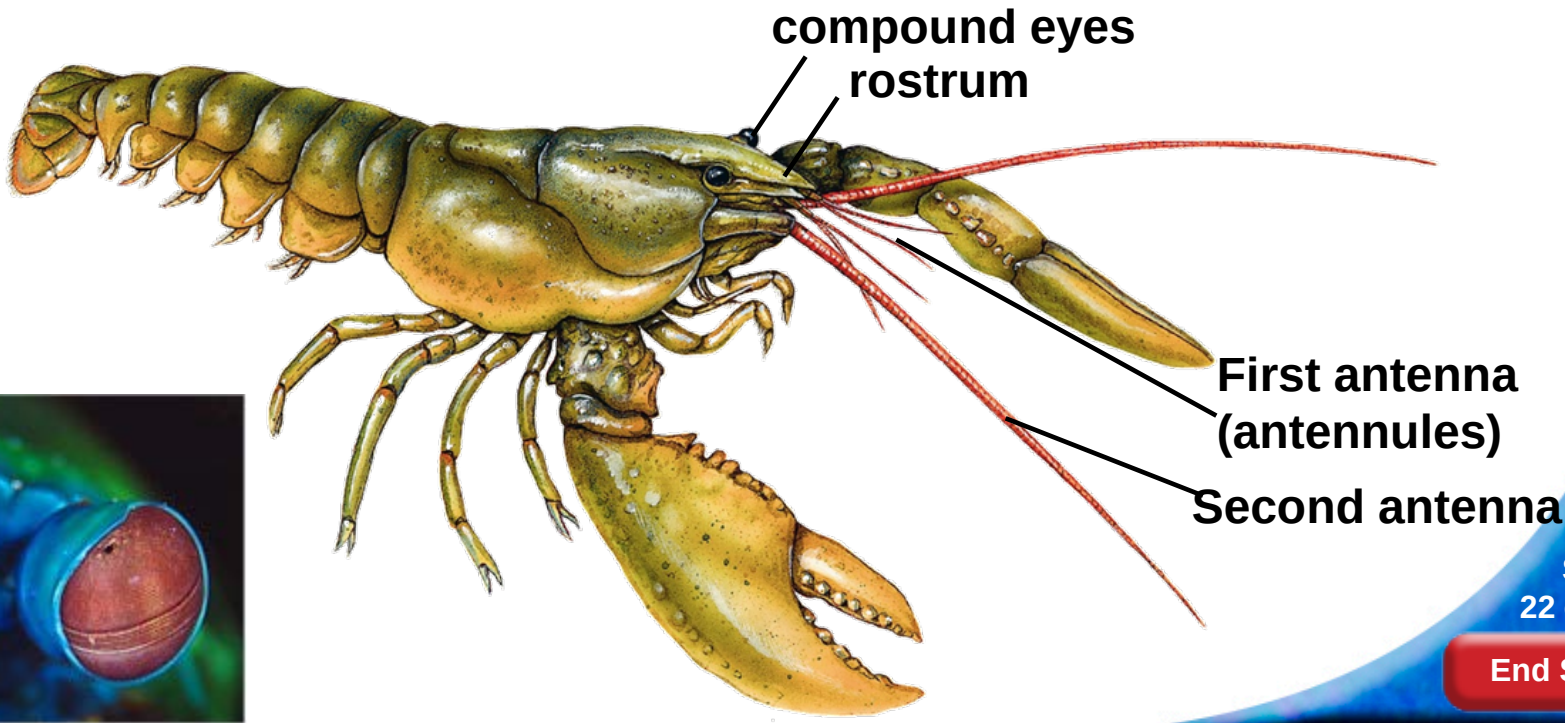
Appendages - Gills

- **Gills** are attached to the appendages associated with the cephalothorax.



Appendages - Antennae

- The **first two pairs** of appendages are **antennae** which bear many sensory hairs. In crayfish, antennae are primarily sense organs. In other crustaceans they are used for feeding or swimming.
- The crayfish have two **compound eyes**. The “nose” is called rostrum.

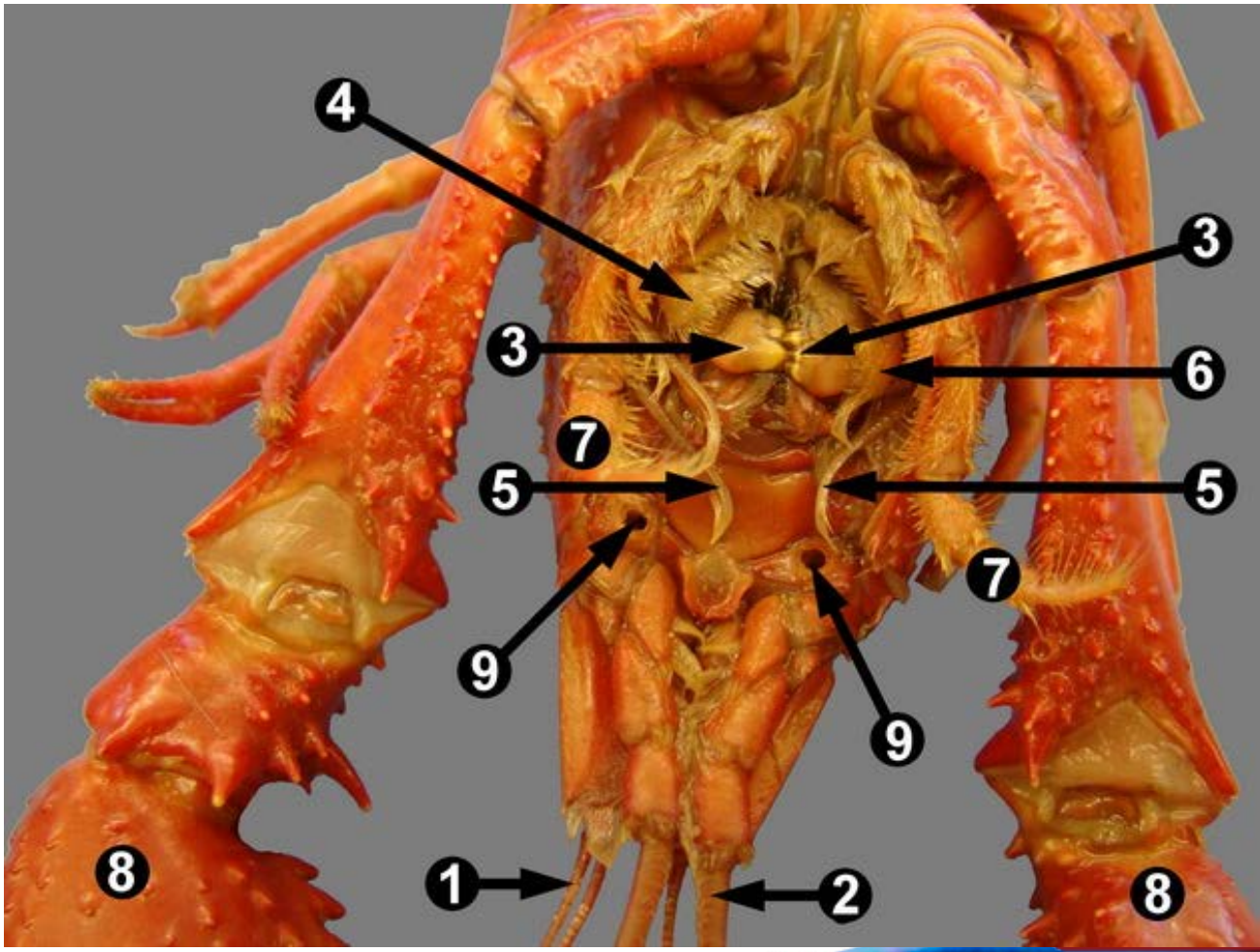


Appendages – Mouth parts

- The third pair of appendages are the **mandibles** (jaws).

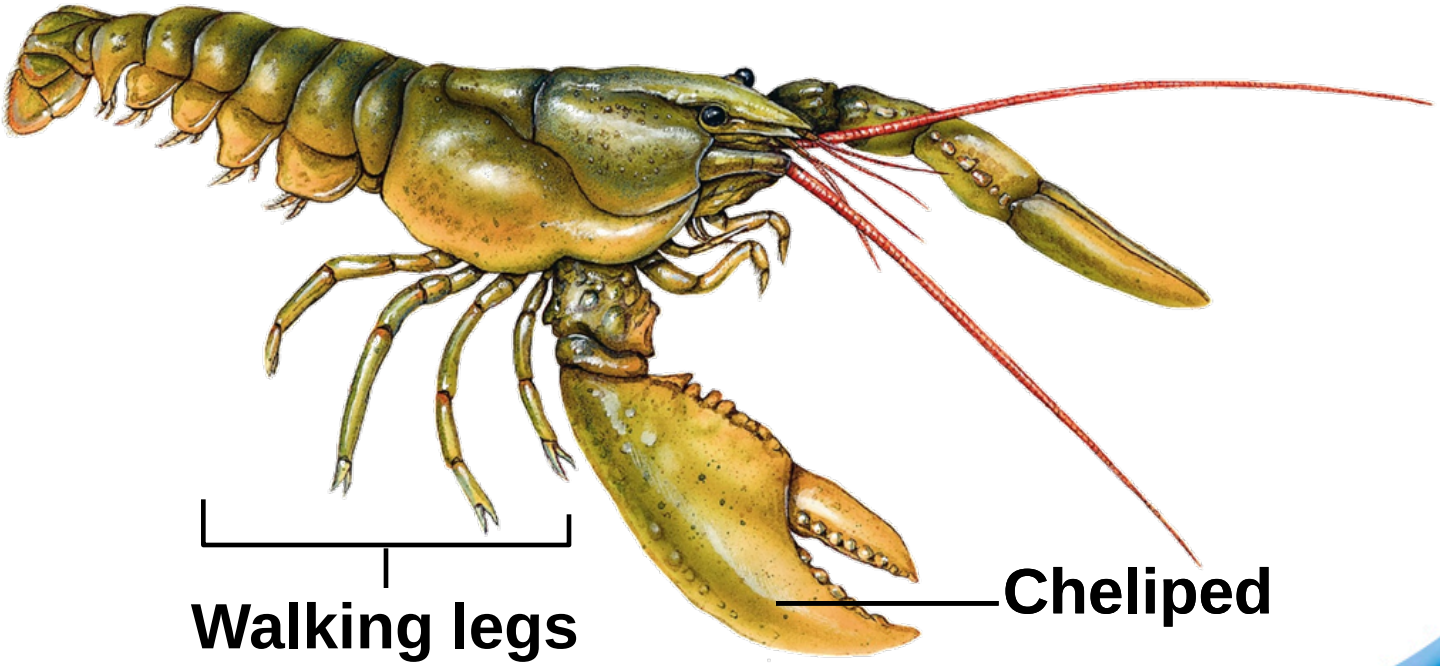
A mandible (no.3 on the picture) is a mouthpart adapted for biting and grinding food.

- 2 pairs of **maxillae** (no.4)
- 3 pairs of **maxillipeds** (no.5,6,7)

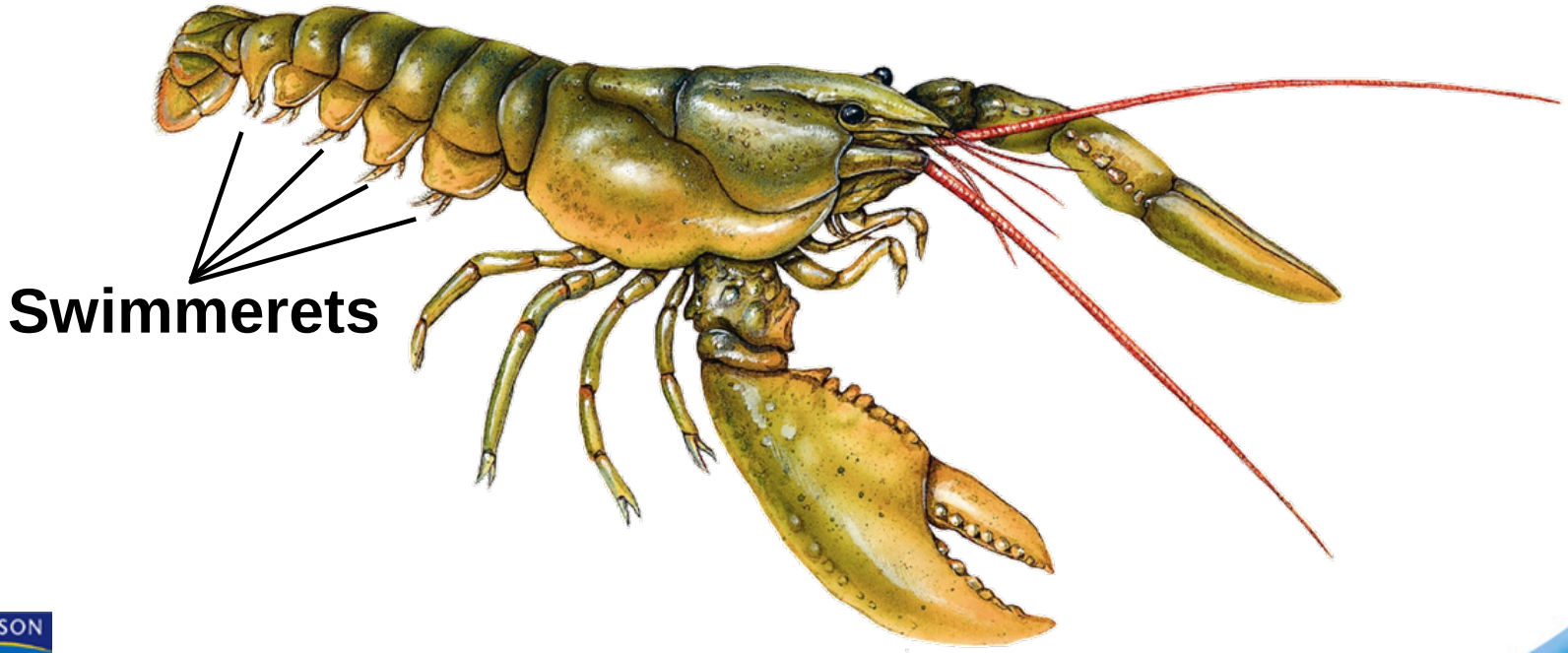


Decapods have **five pairs of legs (**deca =10 pod = foot). They include crayfishes, crabs, shrimps, lobsters.

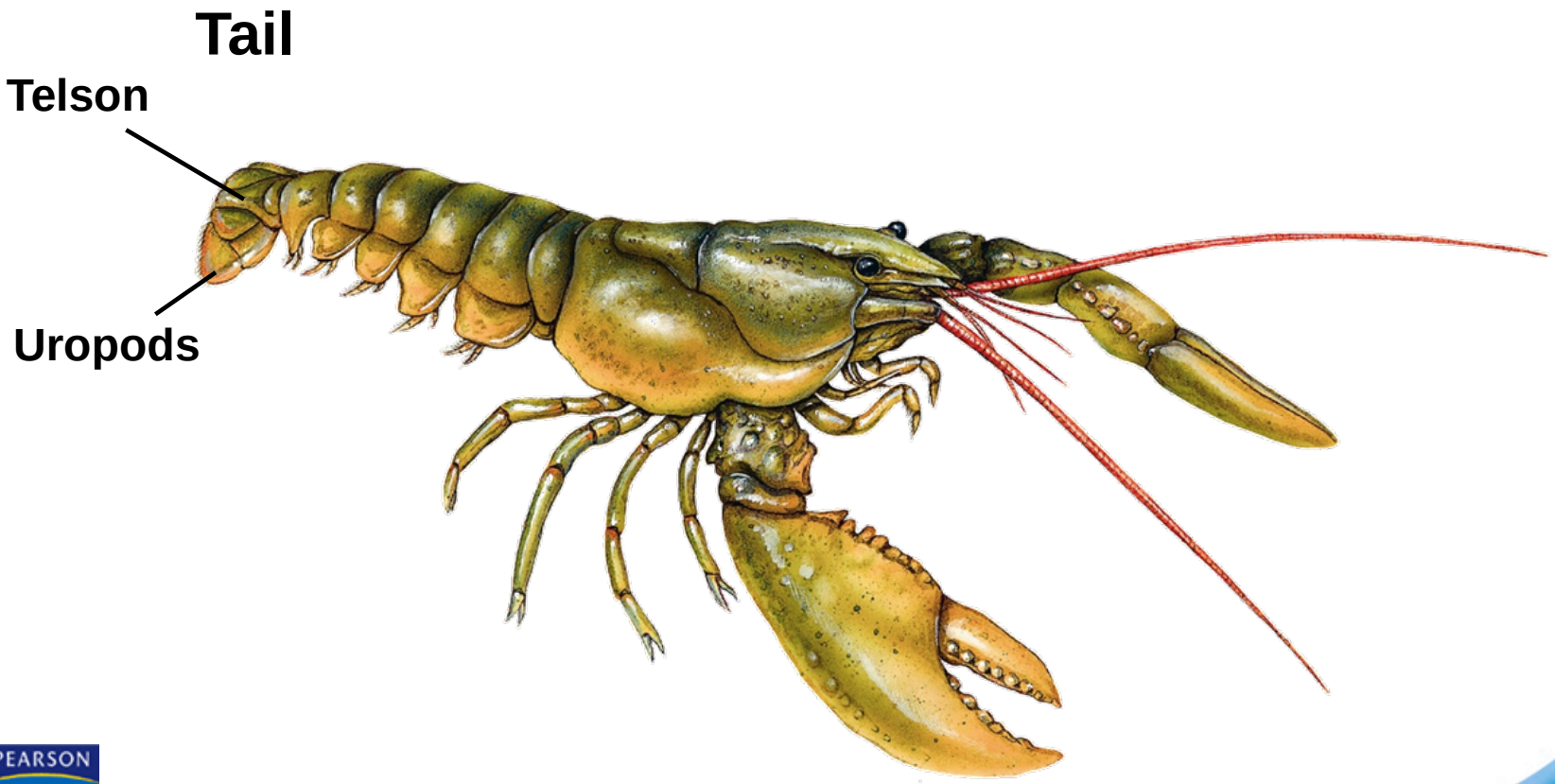
In crayfishes, the first pair of legs, called **chelipeds,** have large claws that catch, pick up, crush, and cut food.



Along the abdomen are several pairs of **swimmerets**, which are flipperlike appendages used for swimming.



The final abdominal segment is fused with a pair of paddlelike appendages, the **uropods**, to form a large, flat tail with the triangle structure between the uropods, called the **telson**.



Internal anatomy

- First image (This image shows a dorsal view of the anterior half of the crayfish with the carapace removed)

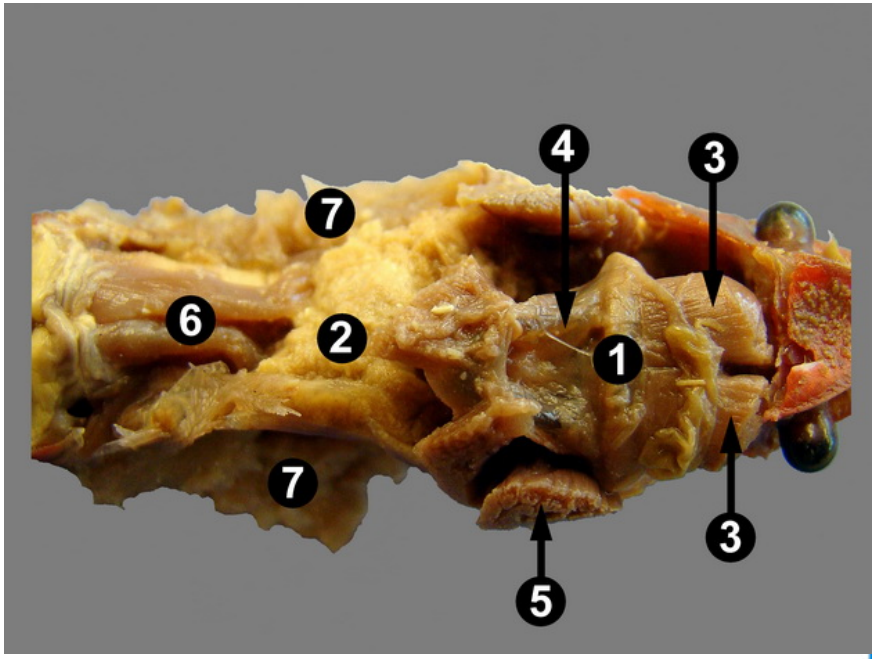
  1: Stomach

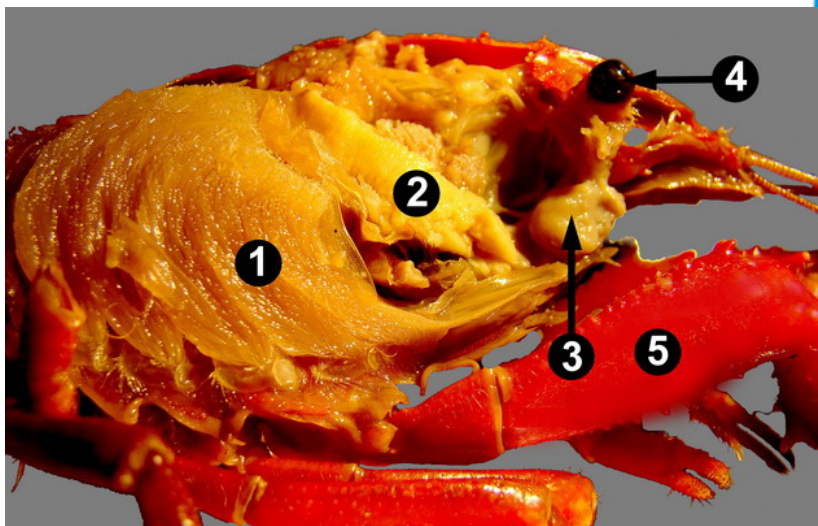
  2: Digestive glands

  6: heart

- second image

  3: green gland





http://www.uwlax.edu/

Sea sapphire, an invisible crustacean (1min38):

https://www.youtube.com/watch?v=Ex39GYeLQFk

28–2 Section QUIZ

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28–2 Section QUIZ

1 The two main groups of chelicerates are

a. spiders and scorpions.

b. horseshoe crabs and spiders.

c. horseshoe crabs and arachnids.

d. arachnids and insects.

2 Insects are part of the group

a. crustaceans.

b. uniramians.

c. chelicerates.

d. diplopods.

3 Most mites and ticks are

a. parasites.

b. predators.

c. herbivores.

d. detritovores.

4 Which of the following is NOT a typical crustacean characteristic?

a. either two or three body segments

b. chewing mouthparts called mandibles

c. chelicerae that paralyze prey

d. two pairs of antennae