# PHYLUM ARTHROPODS

"JOINTED LEGS"

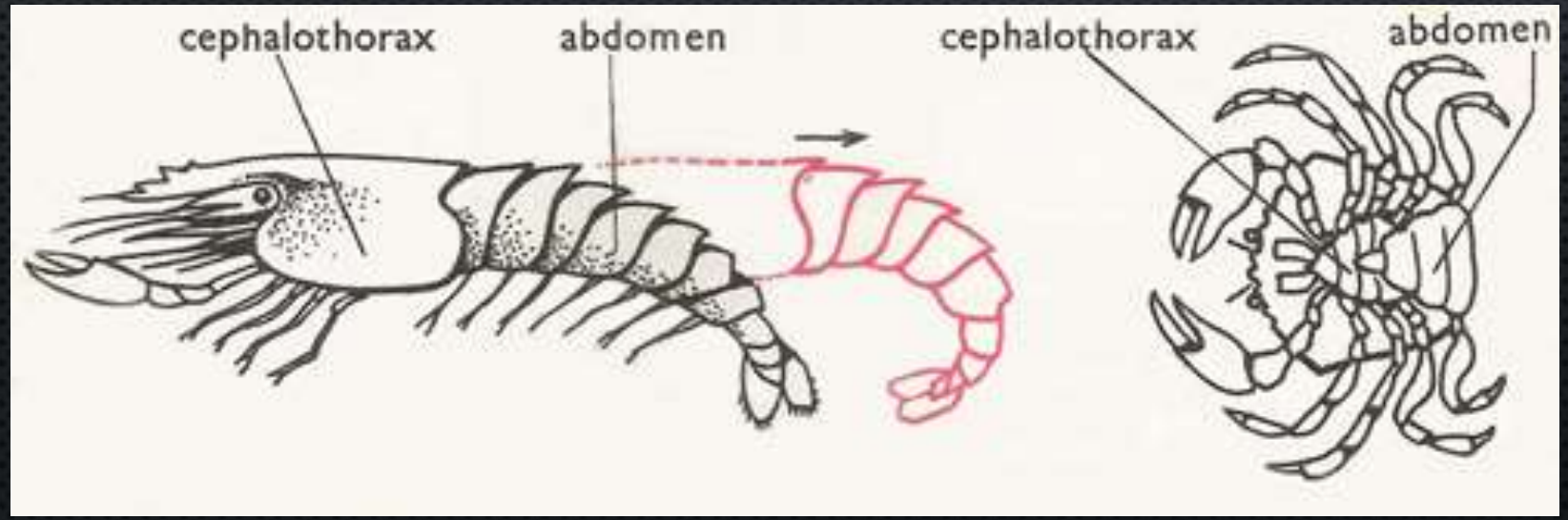
# PHYLUM ARTHROPODA

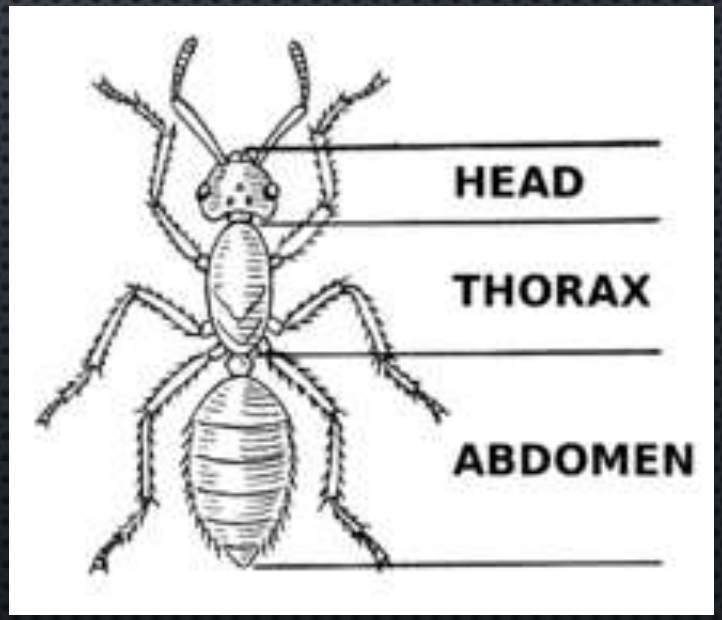
- Ex. Insects, crustaceans (crabs), arachnids (spiders), etc
- Over 900 000 species
- Found in every habitat on earth
- Arthropods make up over 82% of all living things
- $10^{18}$ arthropods living right now!




# ARTHROPOD CHARACTERISTICS

- **Segmented body** = Specialization
  - Head – Contains mouth parts, sense organs, antenna
  - Thorax – Attachment of appendages
    - Cephalothorax = head & thorax fused
  - Abdomen – Organs, few appendages



# ARTHROPOD CHARACTERISTICS

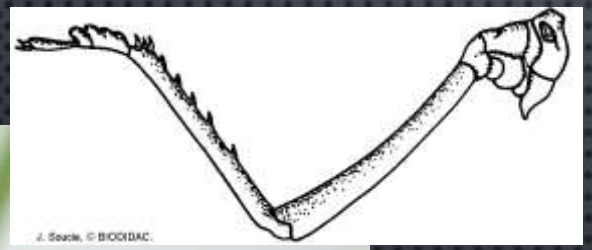
- **Exoskeleton** = Protection
  - Hard covering outside of ectoderm
  - Made from chitin (protein)
  - Protects organs
  - Prevents water loss (waxy cuticle)
  - Site of muscle attachment
  - Limits the size an arthropod can grow (heavy!)
    - Exoskeleton does not grow once it has formed – organism must molt and regrow skeleton to increase size

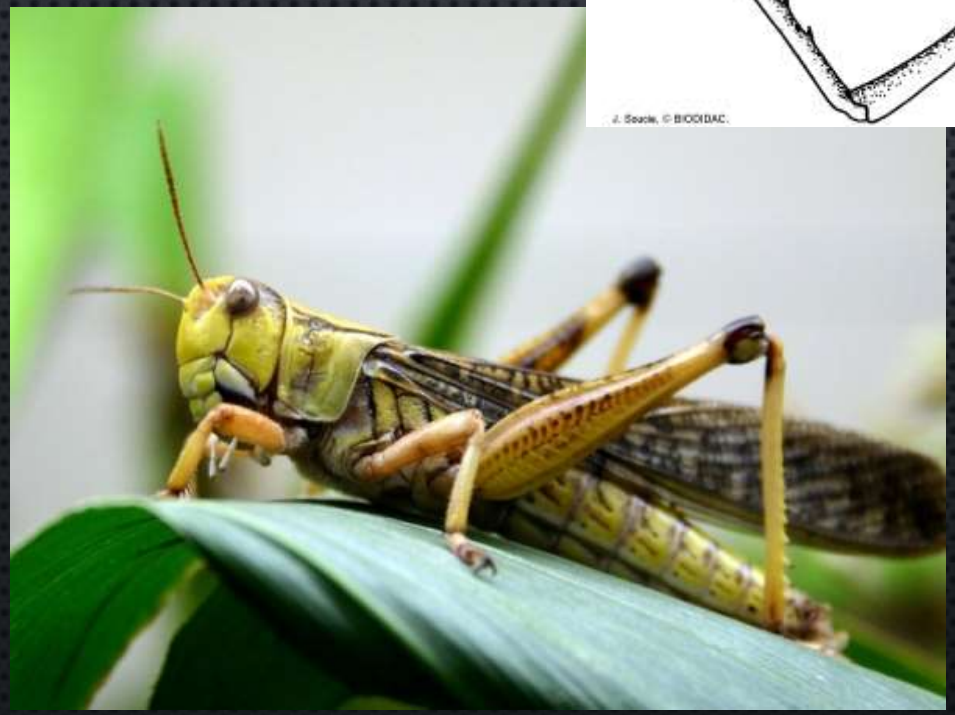
# ARTHROPOD CHARACTERISTICS

**Jointed Appendages** = Locomotion, feeding, reproduction

- Uniramous (single branch)

  eg. Insects





- Biramous (two branches)

  eg. Crustaceans

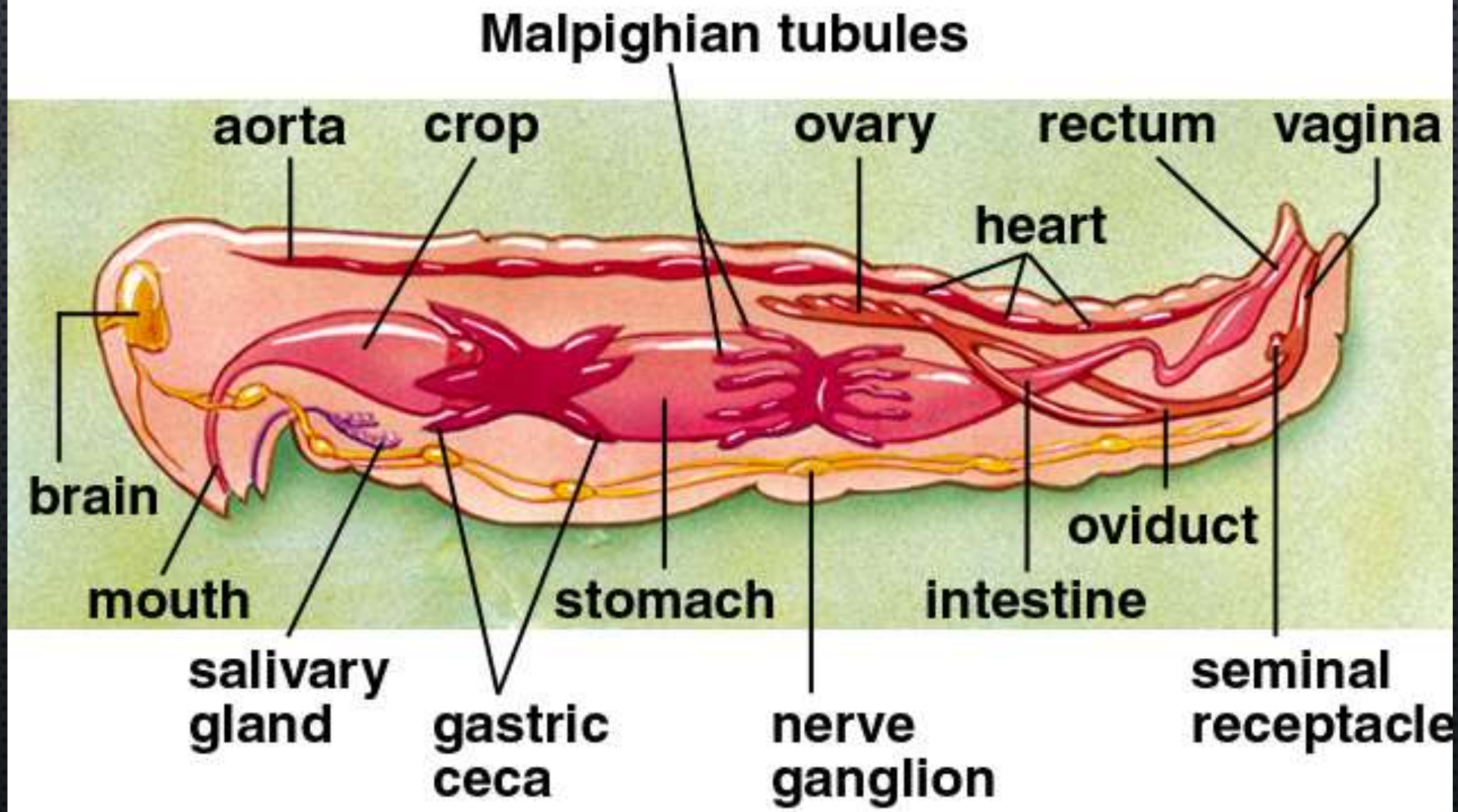
# ARTHROPOD CHARACTERISTICS

- Body Type: Bilateral Symmetry
- Body Organization: Triploblastic (3 layers)
- Body Cavity: Coelom (fluid filled cavity fully lined by mesoderm)

# ARTHROPOD CHARACTERISTICS

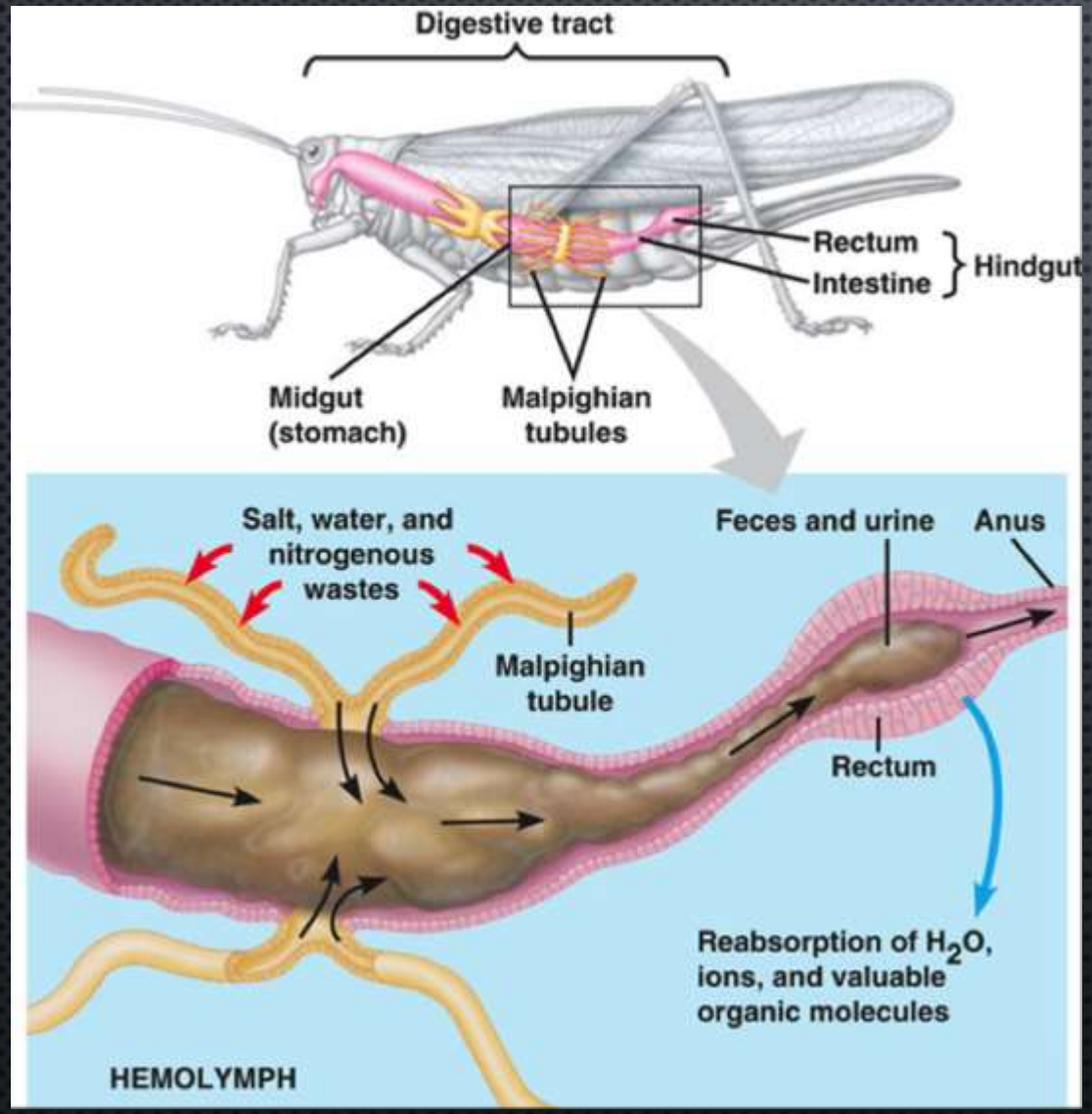
- Digestive System
  - Complete – Mouth and anus separate
  - Specialized by segmentation
  - Specialized mouthparts
    - Chelicera – Piercing, sucking or Mandible – Biting, chewing

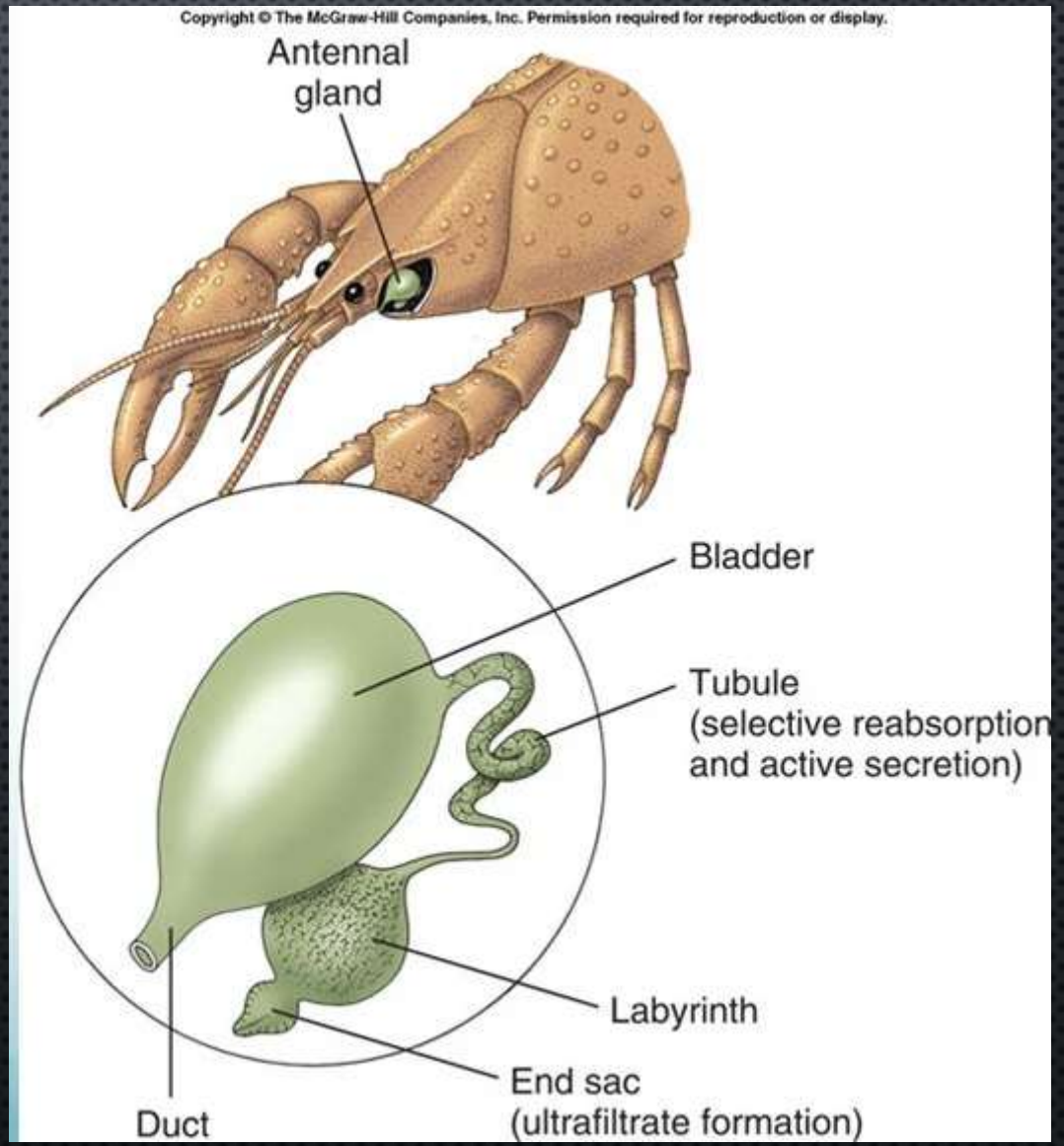
# Female grasshopper



# ARTHROPOD CHARACTERISTICS

- **Excretory System**
  - Anus
  - Malpighian Tubules (terrestrial)
    - Nitrogenous wastes crystalized and combined with feces
    - Conserve water
  - Green Gland (aquatic)
    - Concentrates nitrogenous wastes
    - Excreted nead base of antennae


Digestive tract
Rectum
Intestine
Hindgut
Midgut
(stomach)
Malpighian
tubules
Salt, water, and
nitrogenous
wastes
Malpighian
tubule
Feces and urine
Anus
Rectum
Reabsorption of $H_2O$,
ions, and valuable
organic molecules
HEMOLYMPH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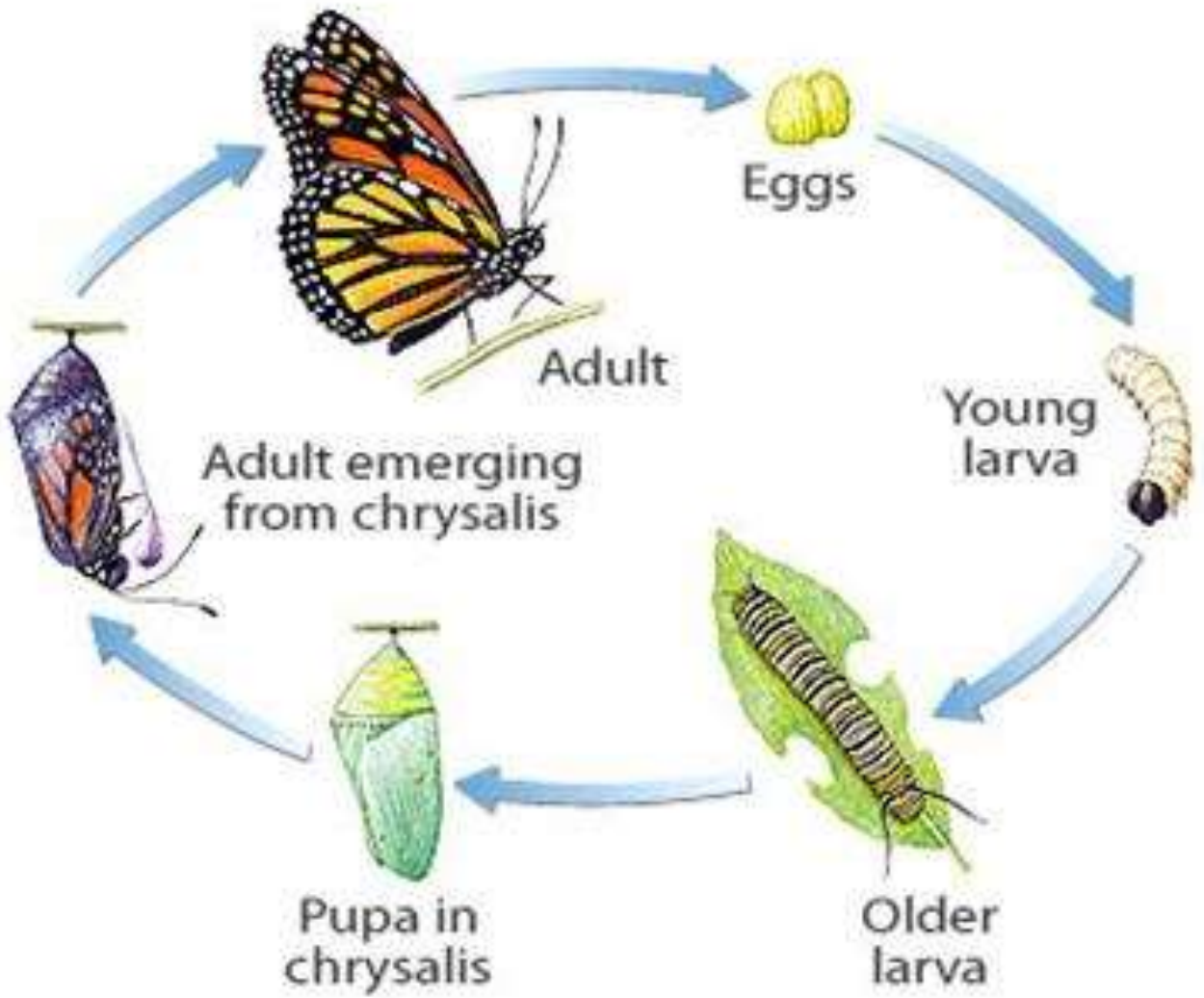
Antennal
gland
Bladder
Tubule
(selective reabsorption
and active secretion)
Labyrinth
End sac
(ultrafiltrate formation)
Duct

# ARTHROPOD CHARACTERISTICS

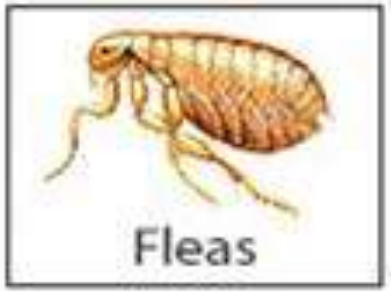
Reproduction

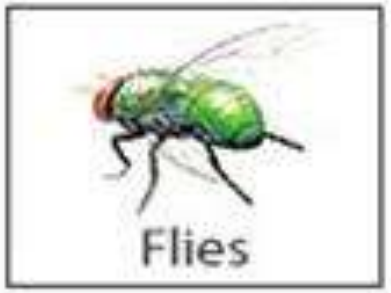
- Sexual – Dioecious
  - Internal fertilization (terrestrial, some aquatic) or external fertilization (some aquatic)
- Asexual – Some species are able to regenerate lost limbs

- Undergo metamorphosis
  - Complete: egg – larva – pupa – adult
  - Incomplete: egg – juvenile - adult

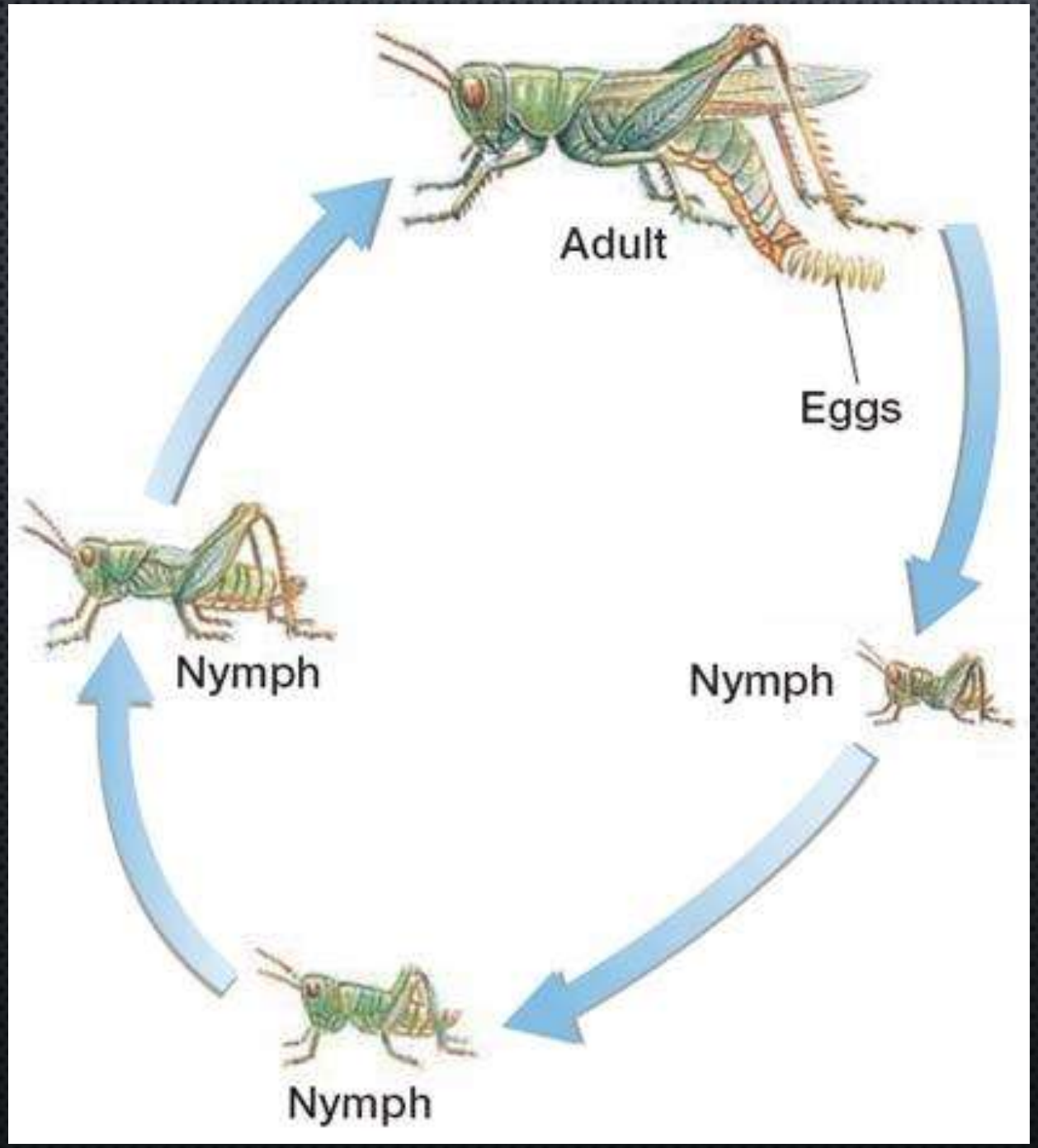

Adult
Eggs
Young larva
Older larva
Pupa in chrysalis
Adult emerging from chrysalis


Butterflies


Fleas

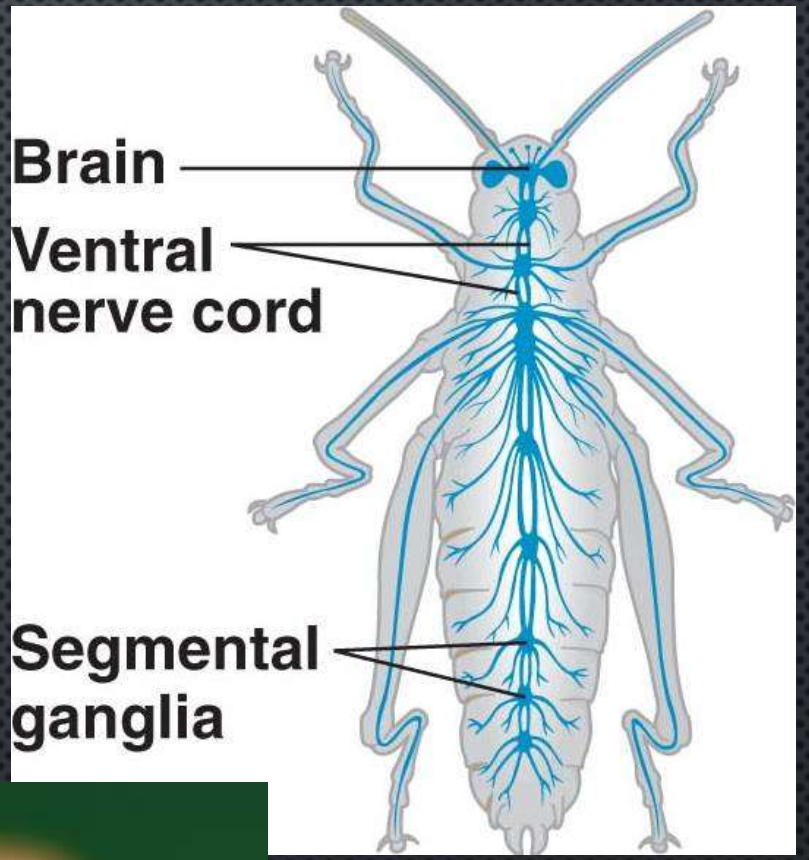

Flies


Wasps


Adult
Eggs
Nymph
Nymph
Nymph

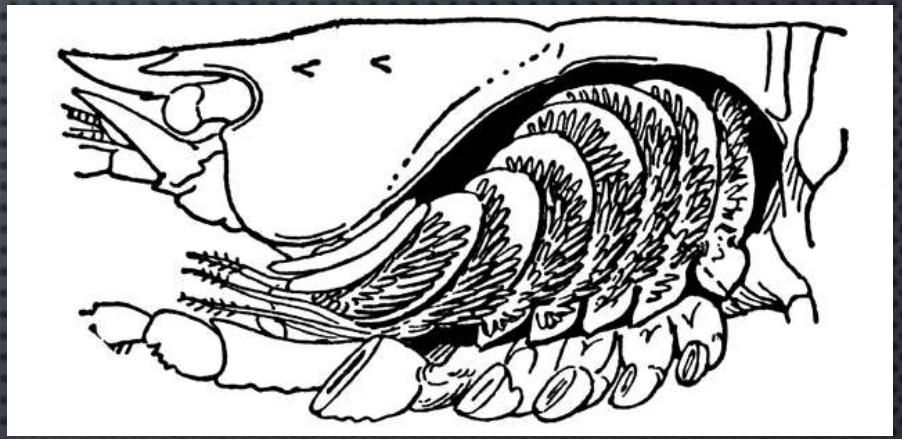
# ARTHROPOD CHARACTERISTICS

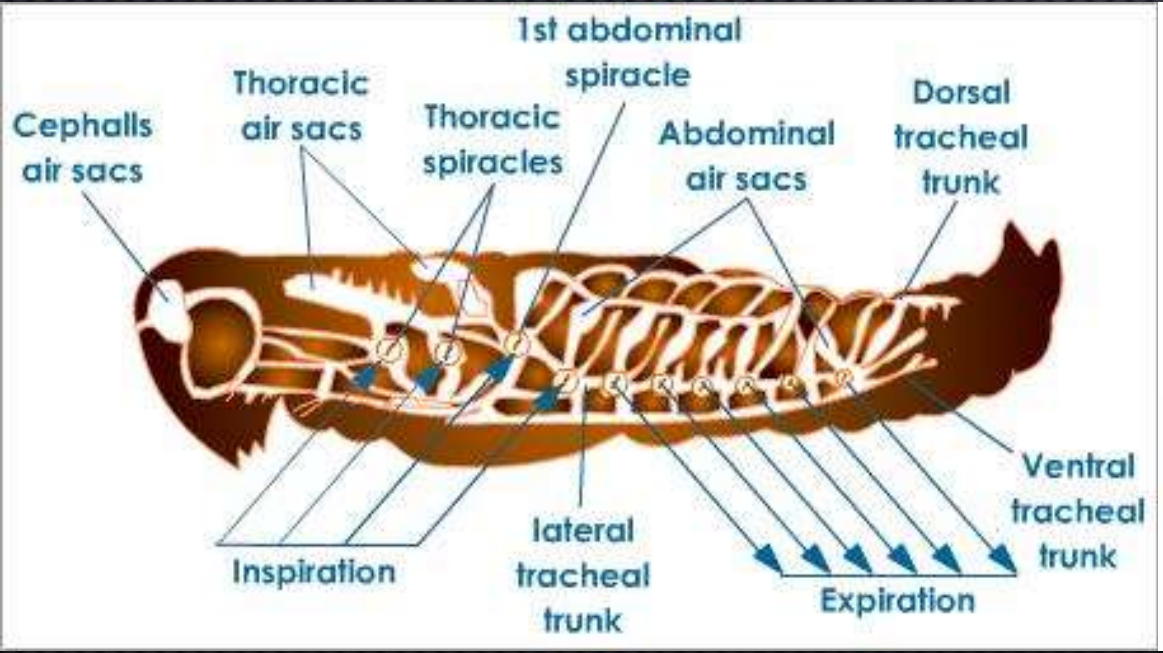
- Nervous System
  - Brain
  - Ventral nerve cord
  - Specialized sensory organs
    - Antenna
    - Compound eyes & ocelli
    - Olfactory organs

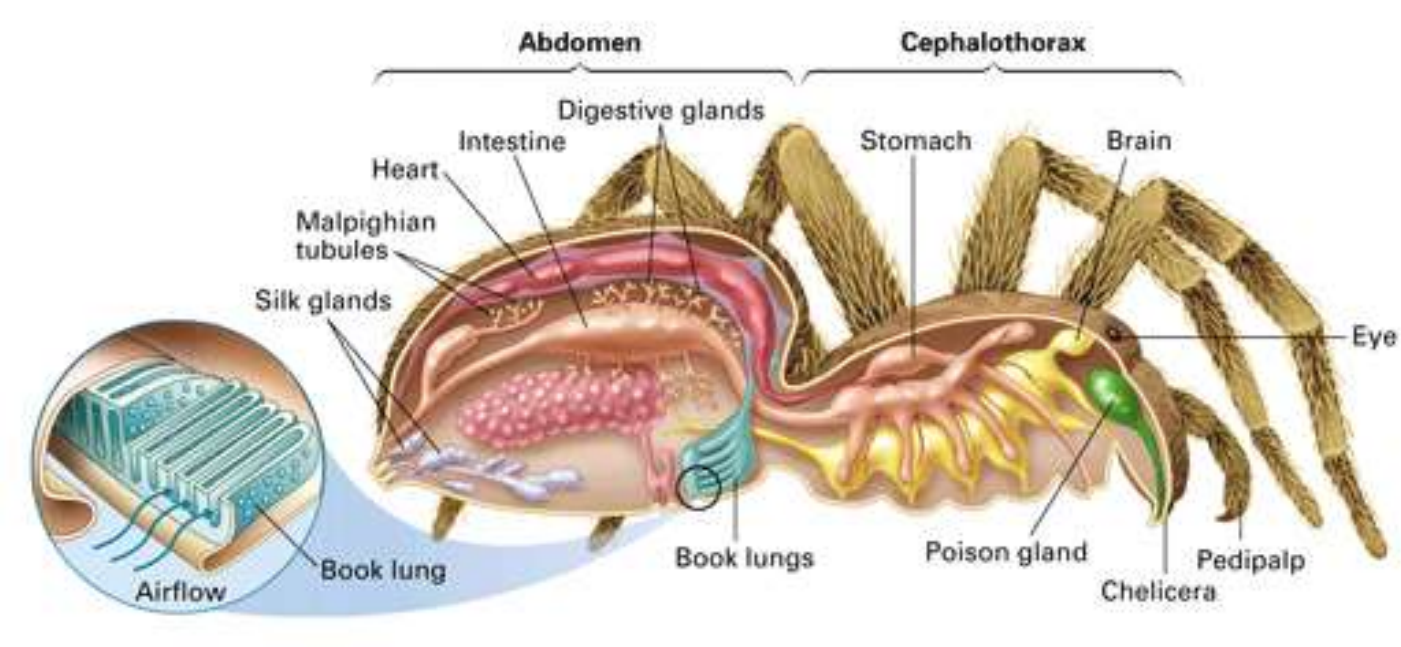



# ARTHROPOD CHARACTERISTICS

- Respiration
  - Aquatic - Gills
  - Terrestrial – Book lungs (arachnids)
    - Trachea/Spiracles (insects)

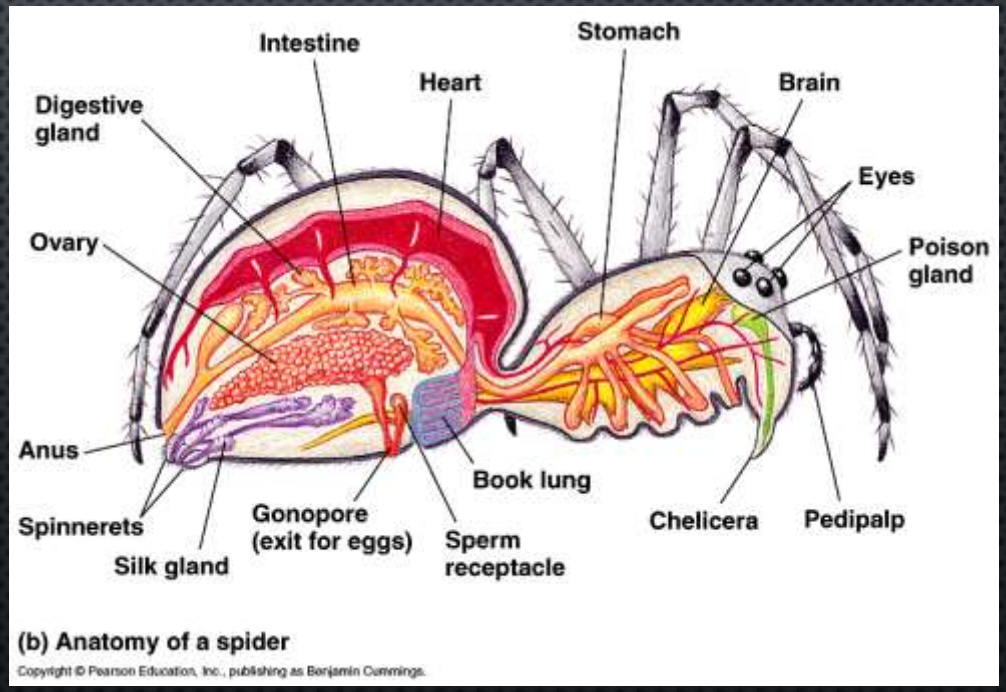




# ARTHROPOD CHARACTERISTICS

- Circulatory System
  - Open circulation – Blood pumped by heart to sinuses around tissues
  - Blue colour due to copper



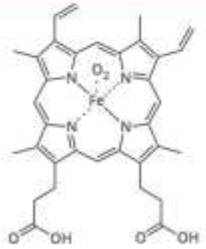

http://www.iflscience.com/plants-and-animals/how-horseshoe-crab-blood-saves-millions-lives

# THE CHEMISTRY OF THE DIFFERENT COLOURS OF BLOOD

## Red

**HUMANS AND THE MAJORITY OF OTHER VERTEBRATES**

### HAEMOGLOBIN



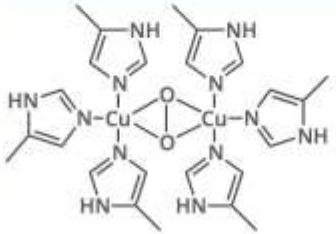
HAEMOGLOBIN
*(oxygenated form)*

Haemoglobin is a protein found in blood, built up from subunits containing 'haems'. These haems contain iron, and their structure gives blood its red colour when oxygenated. Deoxygenated blood is a deep red colour - not blue!

## Blue

**SPIDERS, CRUSTACEANS, SOME MOLLUSCS, OCTOPUSES & SQUID**

### HAEMOCYANIN



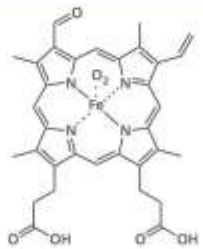
HAEMOCYANIN
*(oxygenated form)*

Unlike haemoglobin, which is bound to red blood cells, haemocyanin floats free in the blood. Haemocyanin contains copper instead of iron. When deoxygenated, the blood is colourless, but when oxygenated, it gives a blue colouration.

## Green

**SOME SEGMENTED WORMS, SOME LEECHES, & SOME MARINE WORMS**

### CHLOROCRUORIN



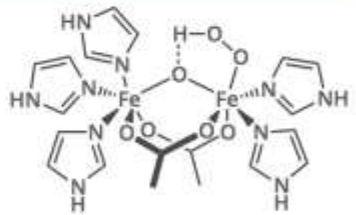
CHLOROCRUORIN
*(oxygenated form)*

Chemically similar to haemoglobin; the blood of some species contains both haemoglobin & chlorocruorin. Light green when deoxygenated, it is green when oxygenated, although when more concentrated it appears light red.

## Violet

**MARINE WORMS INCLUDING PEANUT WORMS, PENIS WORMS & BRACHIOPODS**

### HAEMERYTHRIN



HAEMERYTHRIN
*(oxygenated form)*

Haemerythrin is only 1/4 as efficient at oxygen transport when compared to haemoglobin. In the deoxygenated state, haemerythtin is colourless, but it imparts a violet-pink colour when oxygenated.

# ARTHROPOD CHARACTERISTICS

- **Ecological Roles**
  - Predators/Prey
  - Parasites/Vectors (lice, ticks, mosquitos)
  - Food source
  - Agricultural pests (locusts, catepillars, beetles, )
  - Pollinators (bees, butterflies)
  - Produce honey, silk
  - Medical uses (bee pollen, crab blood)