

Phylum Arthropoda

‘Jointed Feet’

Examples: Lobsters, Crayfish, Crabs,
Shrimp, Barnacles, Spiders, Insects,
Millipedes, Centipedes, Scorpions

Phylum Arthropoda

Learning Outcomes

- Students should be able to:
- Describe the unifying characteristics of members of phylum arthropoda
- Describe how arthropods carry out their life functions
- Describe the ecological roles of arthropods

General Characteristics

- Bilateral symmetry
- True coelom
- Ventral nerve cord
- Exoskeleton composed of chitin and protein
- Have the ability to molt (shed exoskeleton)
- Have jointed appendages

Class Arachnida

- Examples: spiders, scorpions, ticks
- Have 2 body parts: cephalothorax (fused head and thorax) and abdomen
- Have 4 pairs of legs
- Have book lungs for respiration



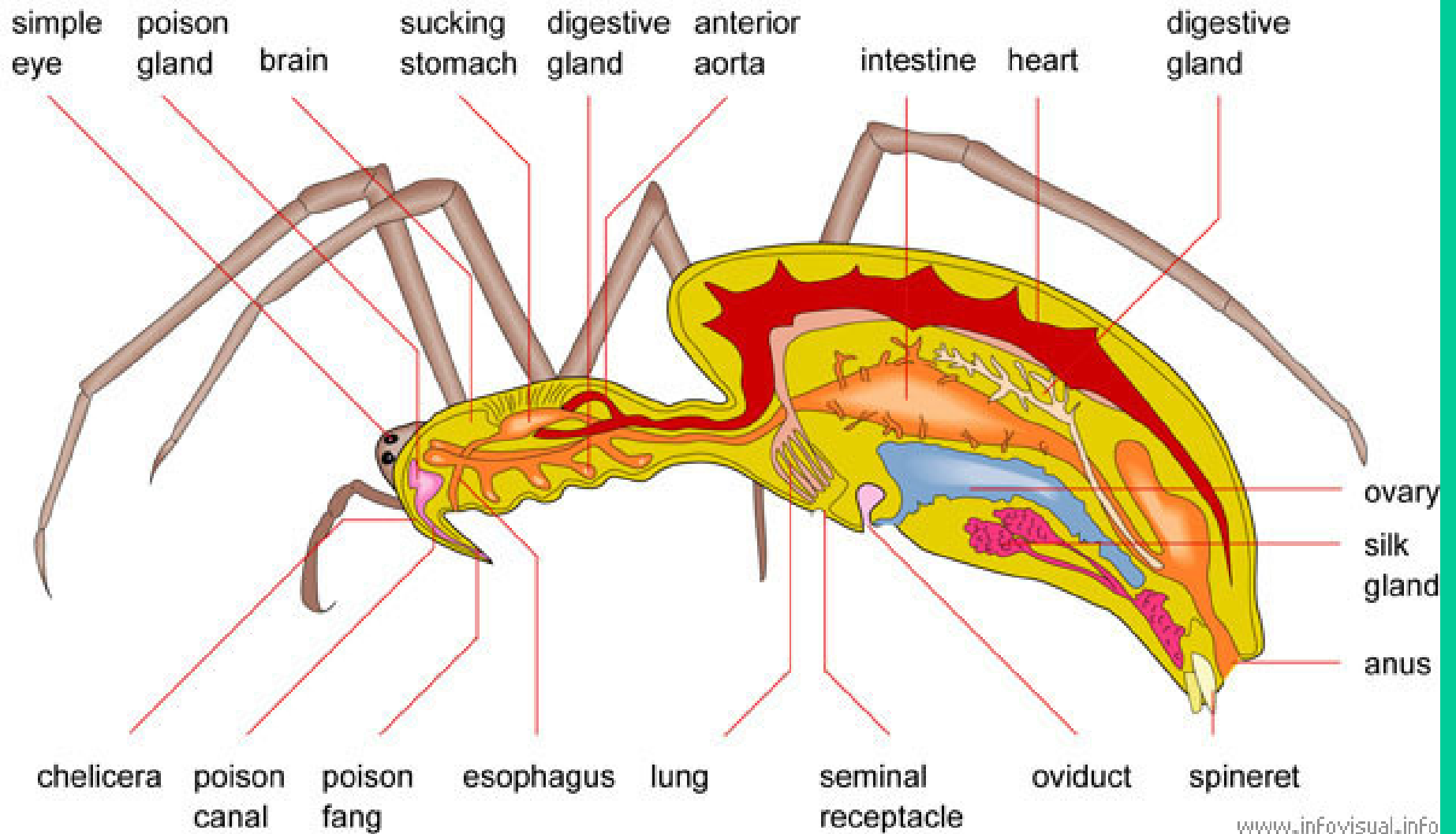


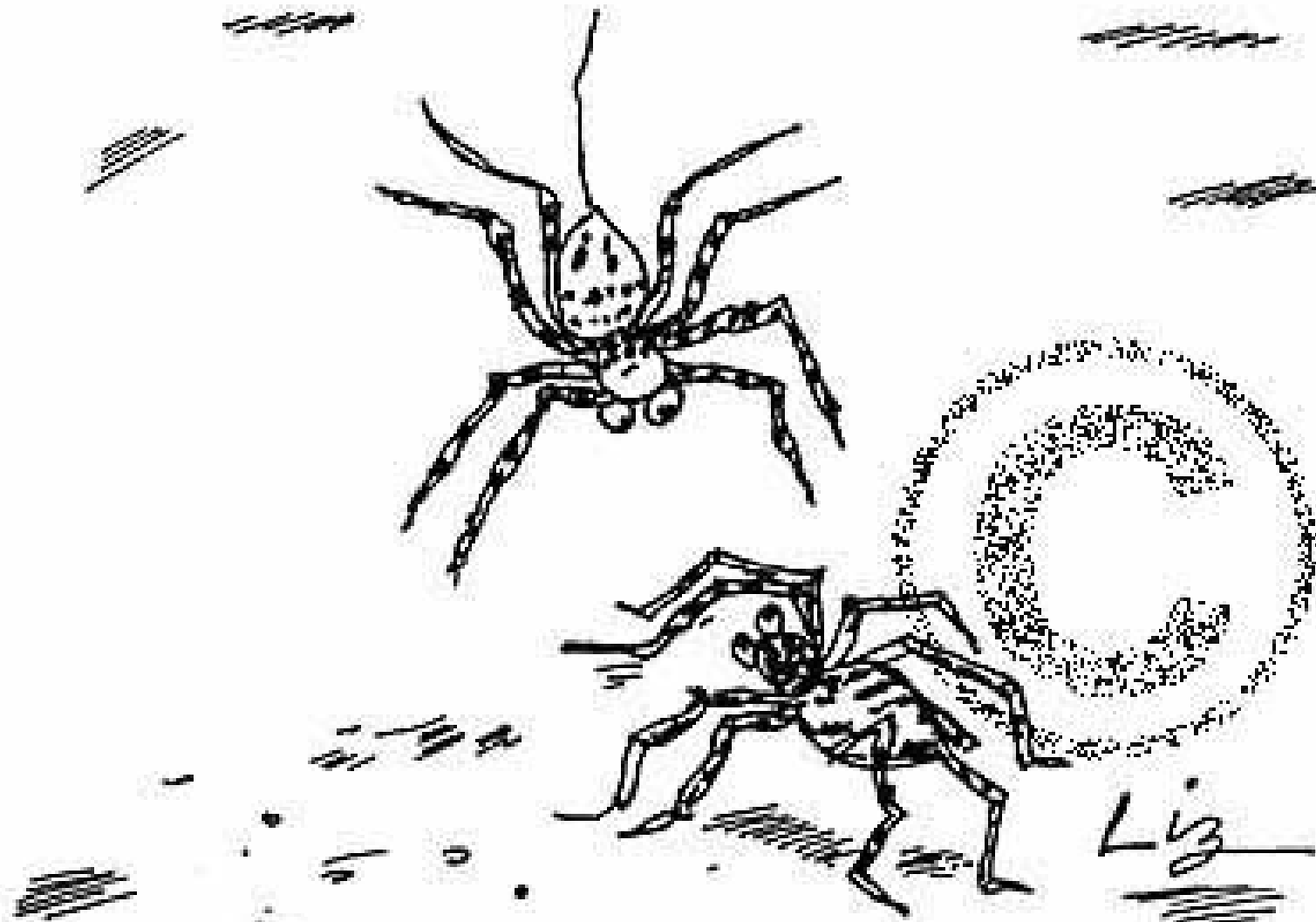






INTERNAL ANATOMY OF A SPIDER





"Are you seriously saying you don't have your own web site?"









Class Chilopoda Centipedes





Class Diplopoda Millipedes





Class Crustacea

Crustaceans

Examples: Crayfish, Crab, Lobster,
Shrimp, Barnacle, Wood Bug,
Daphnia







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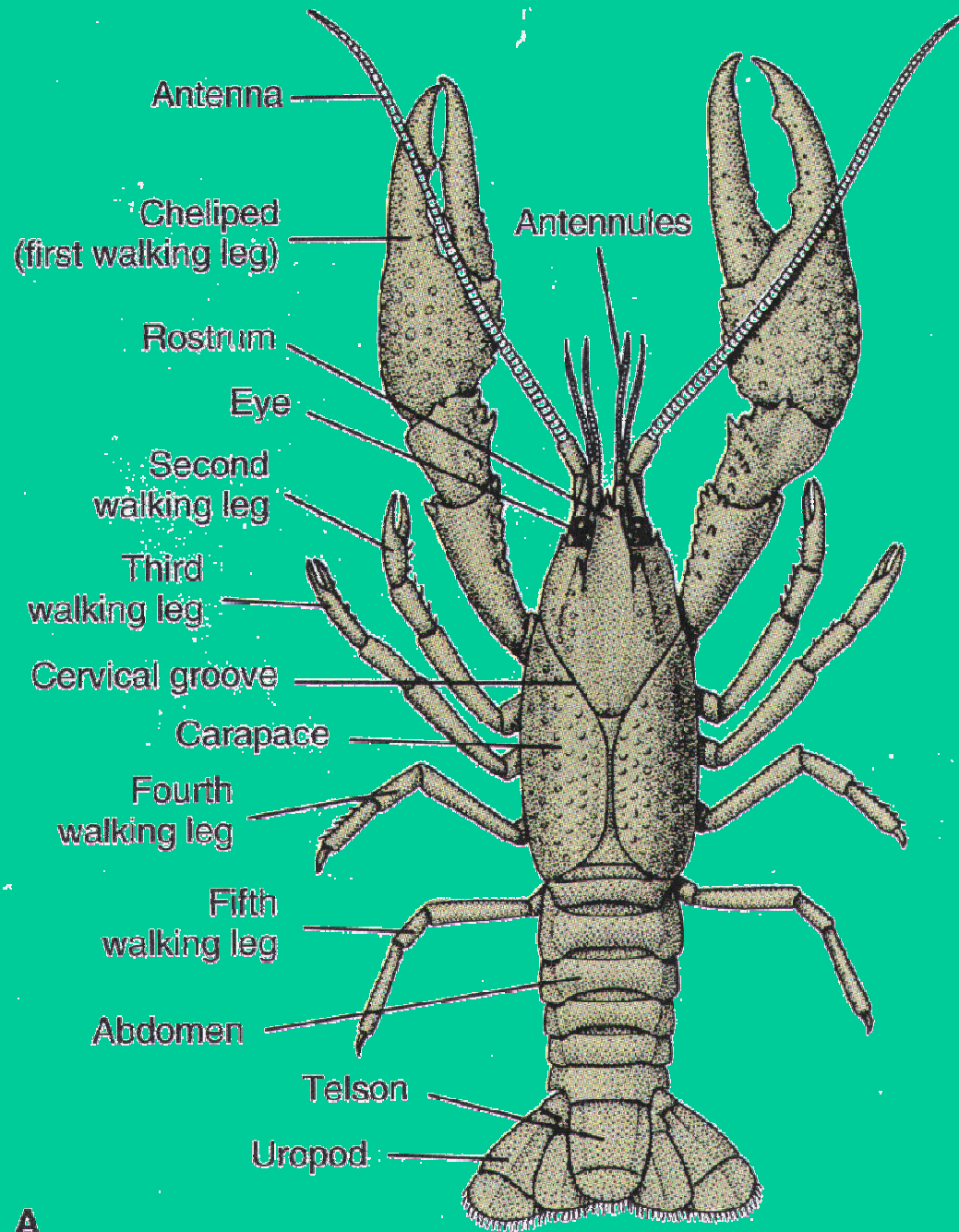
Class Crustacea

General Characteristics

- Body is divided into 2 parts: an abdomen and a cephalothorax (fused head and thorax)
- Have gills for respiration
- 2 pairs of antennae and many specialized appendages
- Have an exoskeleton that contains calcium carbonate
- Body is segmented

Crayfish Structure

- Crayfish have paired appendages that are specialized for different functions



A

Crayfish Ingestion

- Chelipeds (claws) are used to capture food
- Food is held and torn by maxillae and maxillipeds
- Food is chewed by mandibles
- Food passes into the mouth and enters the esophagus

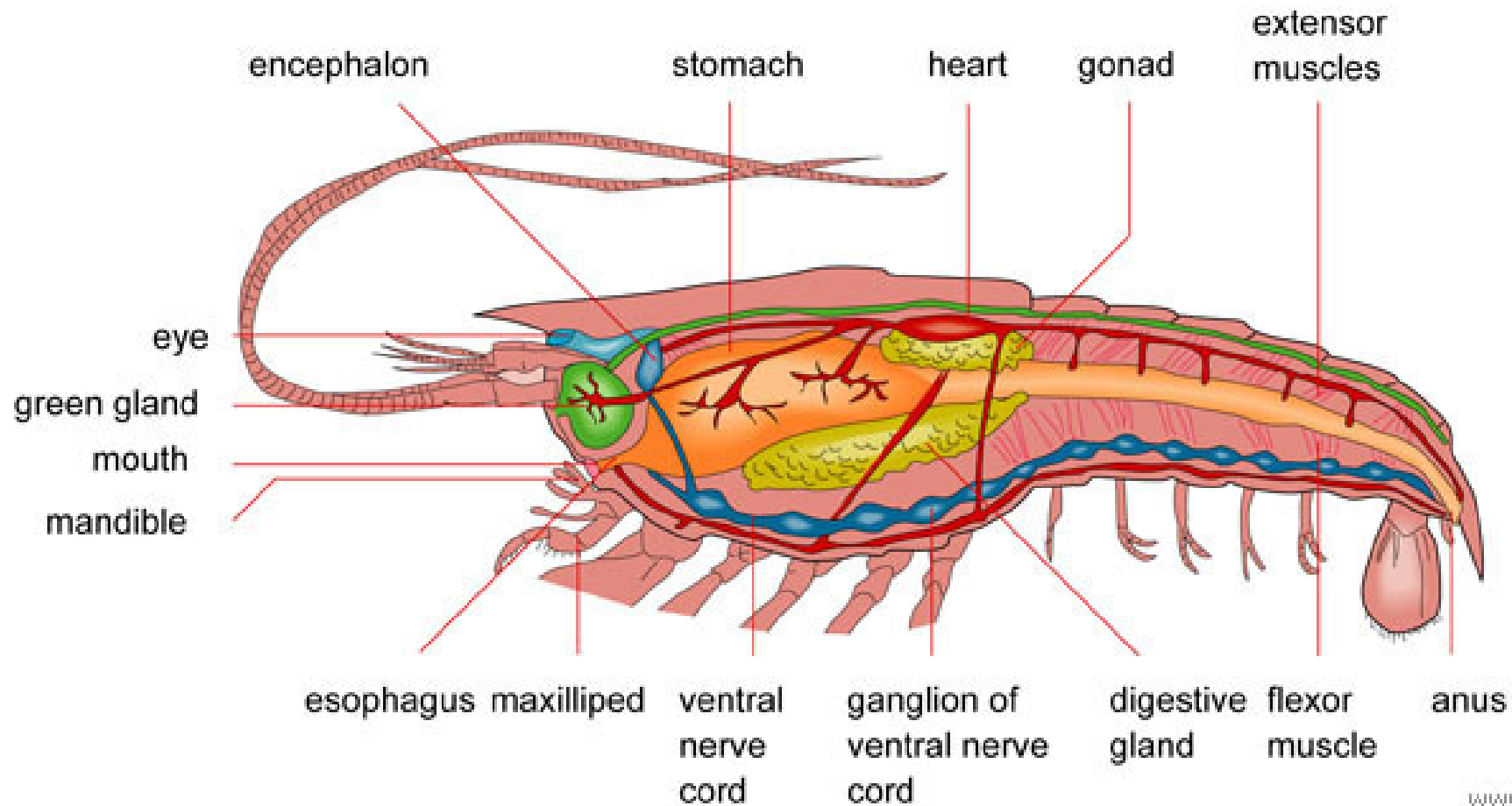
Crayfish Digestion

- Food enters the stomach and is ground up by teeth
- Digestive glands secrete enzymes that digest food
- Nutrients are absorbed through the wall of the intestine and into the blood

Crayfish Elimination

- Undigested food waste exits through the anus

INTERNAL ANATOMY OF A CRAYFISH



Crayfish Respiration & Circulation

- Gas exchange occurs at the gills
- Maxillae move to increase the amount of water that passes over the gills
- Crayfish have an open circulatory system

Crayfish Excretion

- Crayfish have green glands in the head region that remove nitrogenous wastes from the blood
- Nitrogenous wastes exit through an opening at the base of the antennae

Crayfish Reproduction

- Male crayfish have copulatory swimmeretes that are used to deposit sperm in the female
- Female crayfish use their swimmeretes to move water over their attached fertilized eggs to ensure they get enough oxygen

Crayfish Nervous System

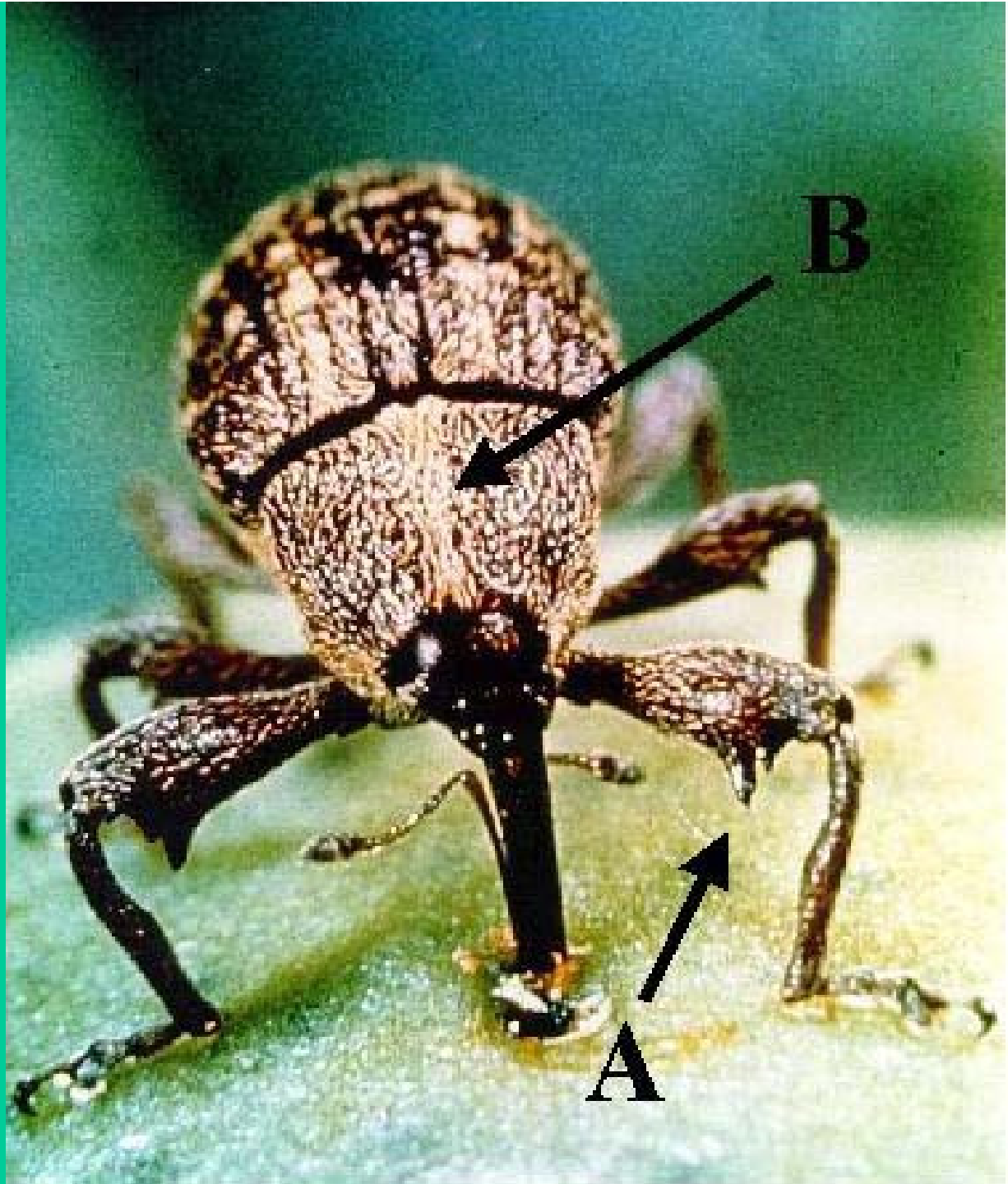
- Antennules act as sensory appendages for taste, touch, and equilibrium
- Antennae act as sensory appendages for taste and touch
- Have a primitive brain and a ventral nerve cord

Crayfish Movement

- Walking legs allow for slow movement
- Uropods and Telson (tail) propel the crayfish through the water with the help of abdominal muscles – this allows the crayfish to move backwards quickly

Class Insecta

Examples: Bees, ants, mantids, lady bugs, flies, beetles, grasshopper...







African Flower Mantis

Photograph © Bob Jensen









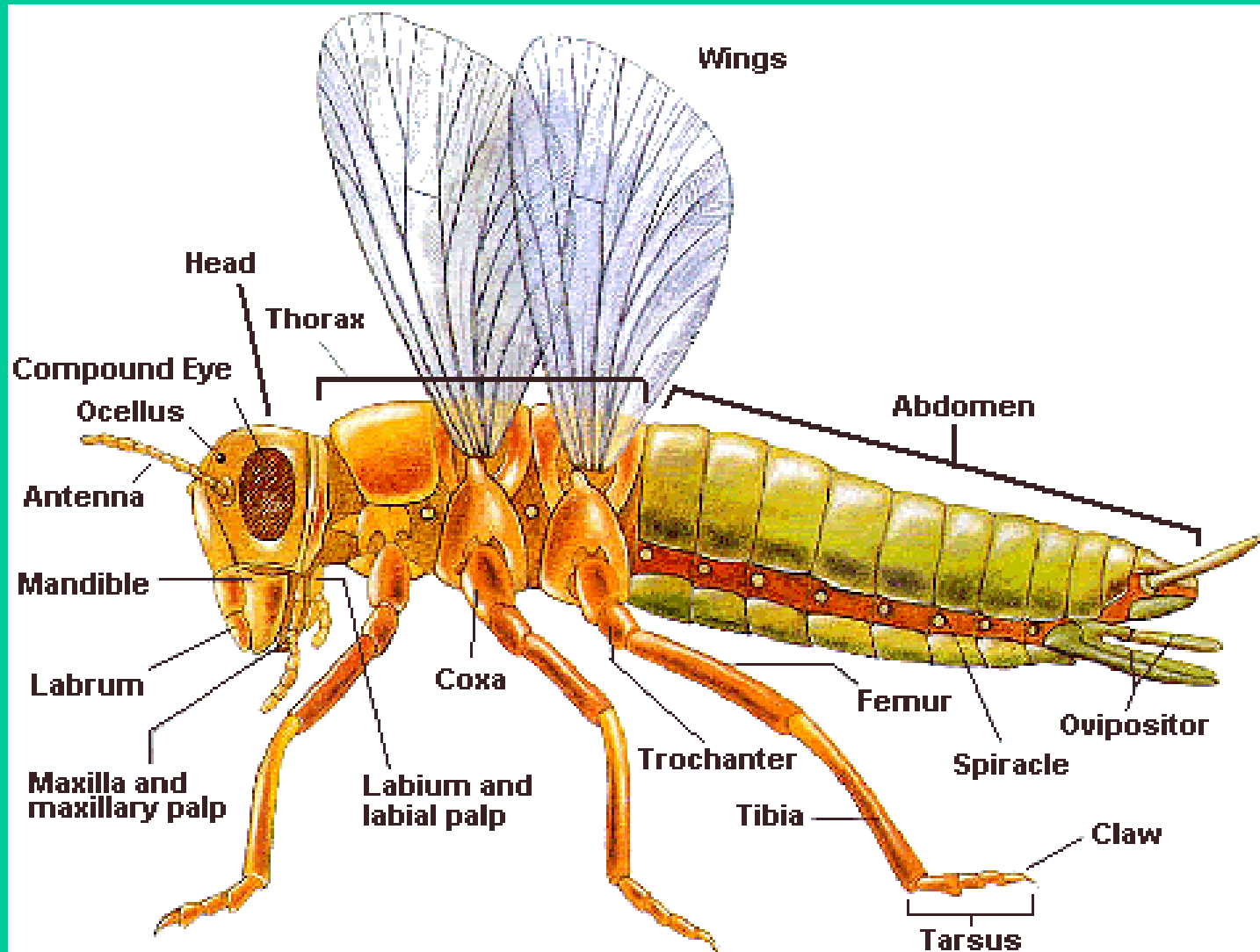




Class Insecta General Features

- 3 body parts: head, thorax, abdomen
- 3 pairs of legs on the thorax
- 2 pairs of wings on the thorax
- 1 pair of antennae
- Life cycle has either incomplete or complete metamorphosis

Grasshopper Structure



Grasshopper Ingestion

- Labrum and Labium hold grass
- Mandible and maxilla cut grass and transfer it to the mouth
- Food enters the mouth where it is moistened by saliva (saliva is produced in salivary glands)
- Food passes into the esophagus
- Food enters the crop for storage

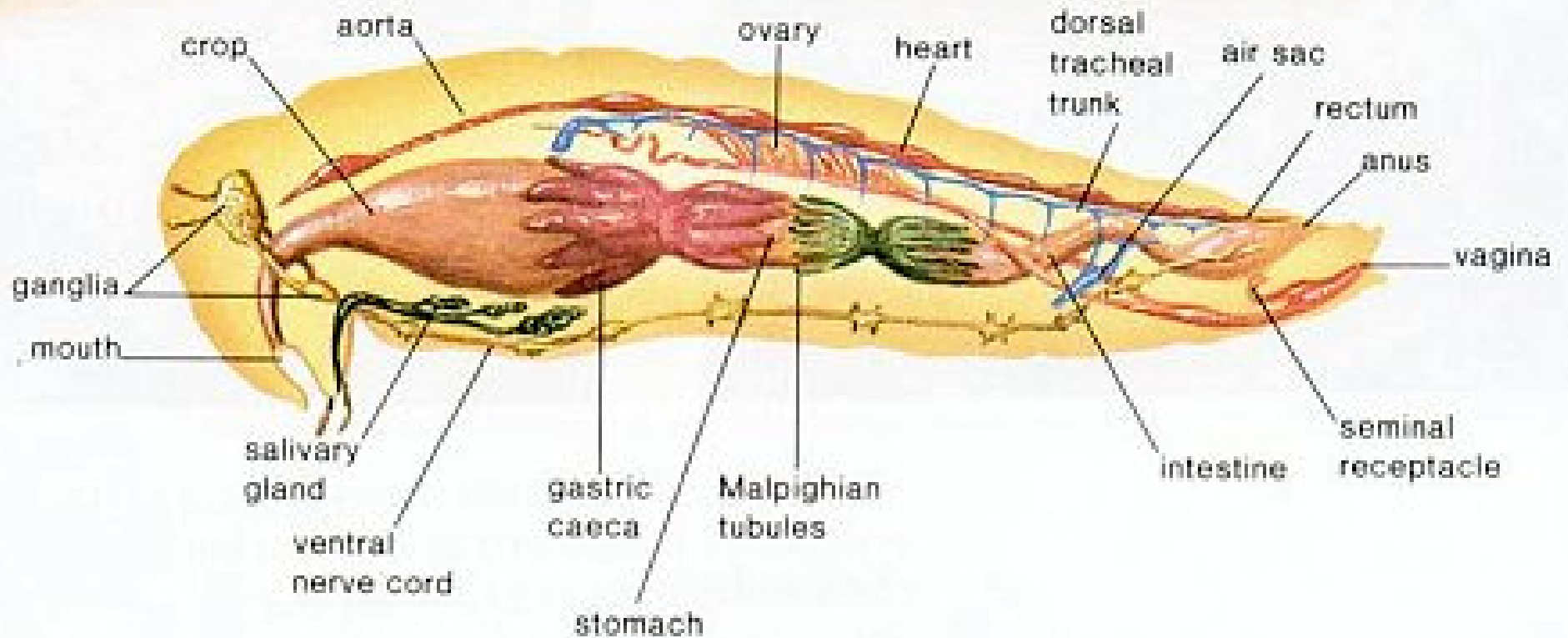
Grasshopper Digestion

- Food enters the gizzard where sharp teeth shred to food
- Food enters the stomach where the gastric ceca secrete enzymes to break down the food
- Nutrients pass into the coelom

Grasshopper Elimination

- Undigested food wastes pass through the intestine and into the rectum
- Solid wastes exit through the anus

Grasshopper Internal Structure



Grasshopper Respiration

- Body muscles expand and oxygen flows through the spiracles and into the trachea
- Oxygen diffuses into the tissues
- Carbon dioxide exits through the spiracles
- Valves control the opening of the spiracles

Grasshopper Circulation

- Open circulatory system
- Blood contains nutrients and nitrogenous wastes
- Heart pumps blood forward through the aorta into the coelom carrying nutrients to the organs
- Blood from the coelom enters the aorta and returns to the heart

Grasshopper Excretion

- Nitrogenous wastes enter the coelom and are picked up by the blood
- Malpighian tubules remove, concentrate and deposit nitrogenous wastes into the rectum
- Nitrogenous wastes exit through the anus

Grasshopper Nervous System

- Consists of a simple brain connected to a ventral nerve cord
- 3 simple eyes that detect light
- 2 compound eyes to detect images and movement
- 2 tympanum (membranes) located on the first abdominal segment that detect sound
- Antennae detect touch and taste

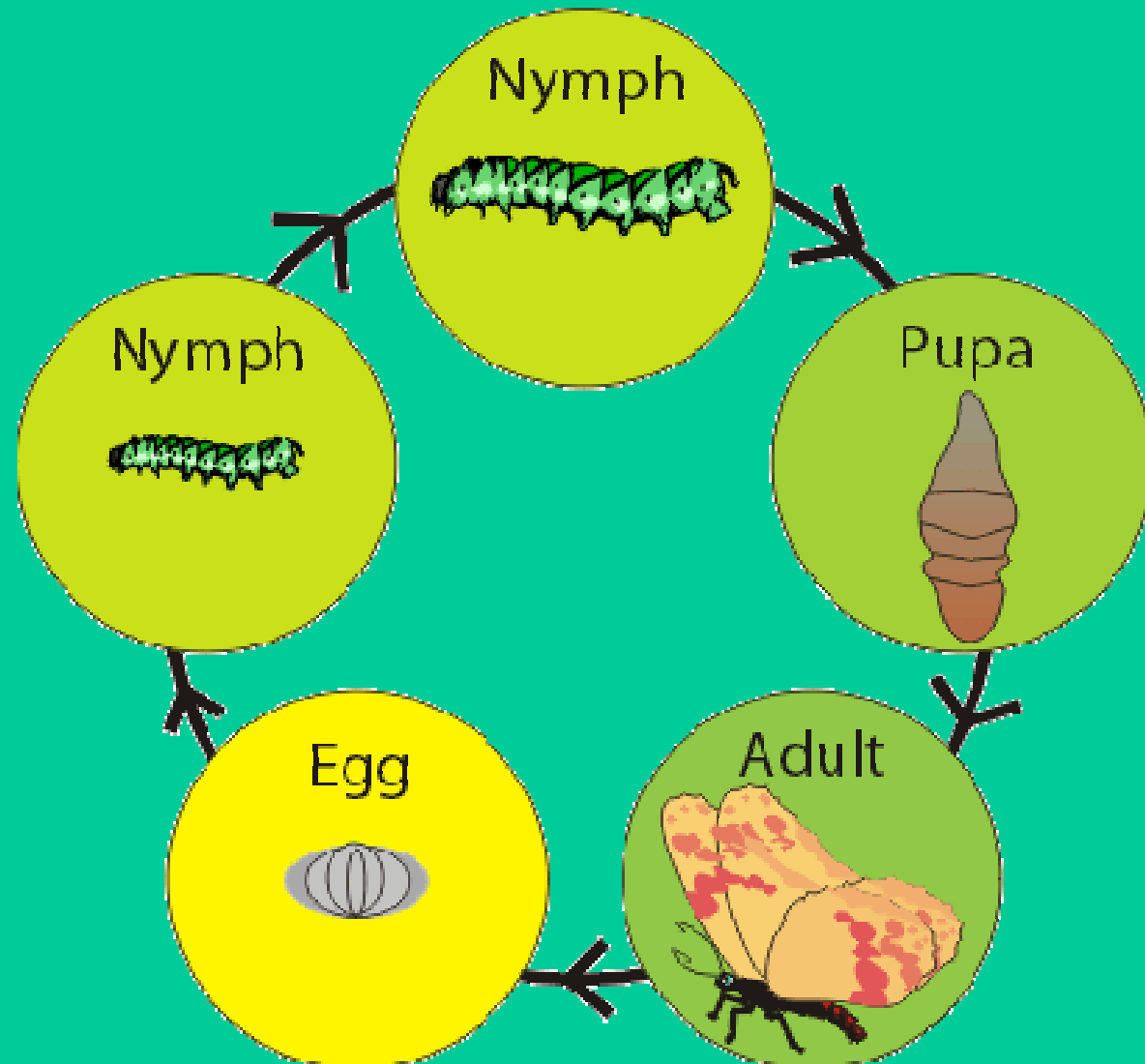
Grasshopper Movement

- 2 pairs of walking legs, 1 pair of jumping legs
- Legs have hooks for grip & protection
- 2 pairs of wings
- Forewings protect the hindwings
- Hindwings are used for flight
- Muscles attach to the exoskeleton and allow for movement

Insect Life-Cycles

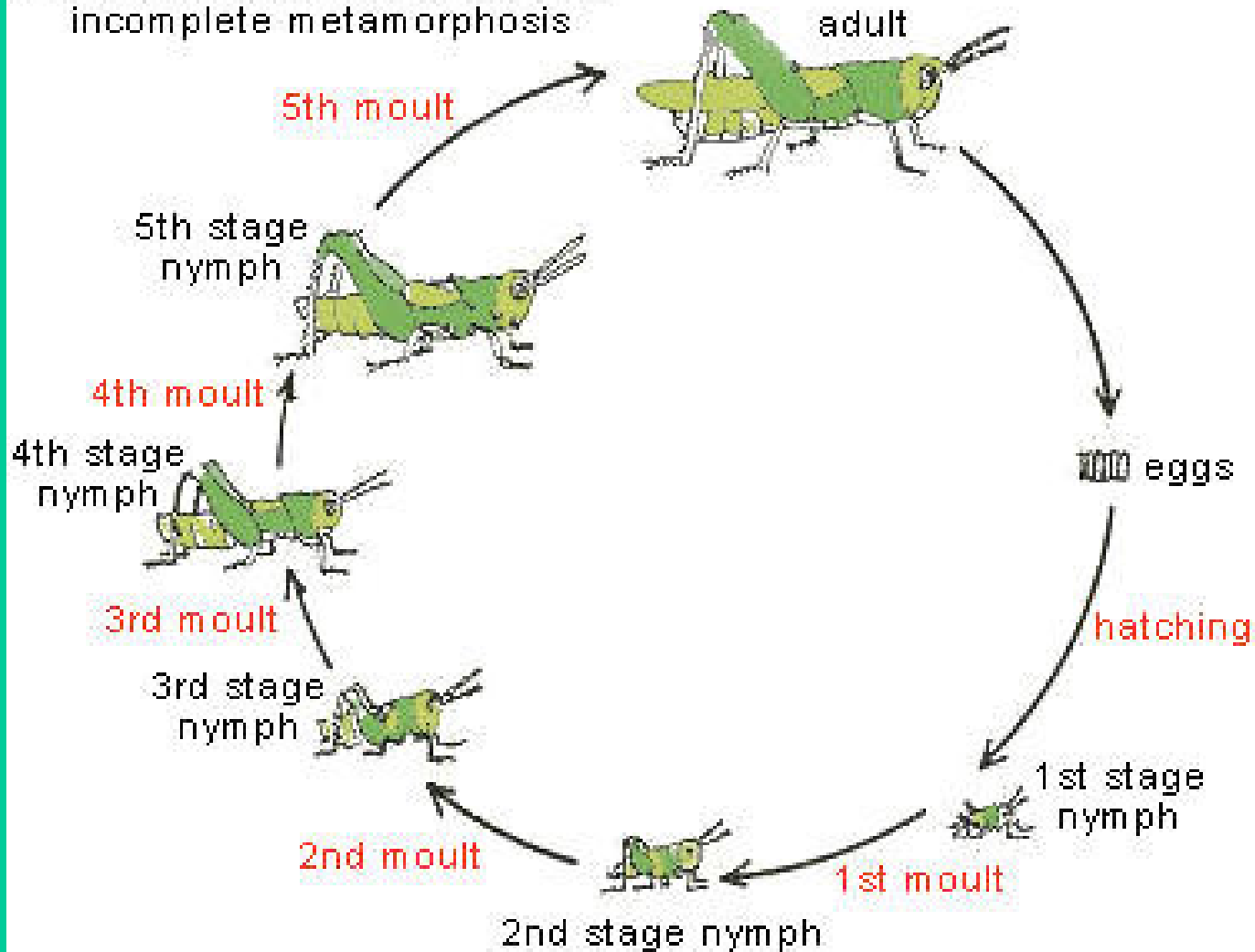
- Insects go through a complex life-cycle called metamorphosis (meaning many stages/shapes of development)
- 2 types – complete and incomplete
- Most insects go through complete metamorphosis (88%) ie butterflies, moths
- 12% of insects go through incomplete metamorphosis ie grasshoppers, mantids

Complete Metamorphosis



Incomplete Metamorphosis

The life cycle of a grasshopper :
incomplete metamorphosis



Advantages of Exoskeleton in Arthropods

- Provide protection and support
- Muscles can be attached to the inside of the exoskeleton for movement

Disadvantages of Exoskeleton in Arthropods

- Limits flexibility
- They must molt in order to grow
- Weight problem (limits size)

Ecological Importance

- Pollinators of 66% of the world's flowering plants
- Direct source of food for carnivores
- Insects and spiders are predators or parasites on other organisms