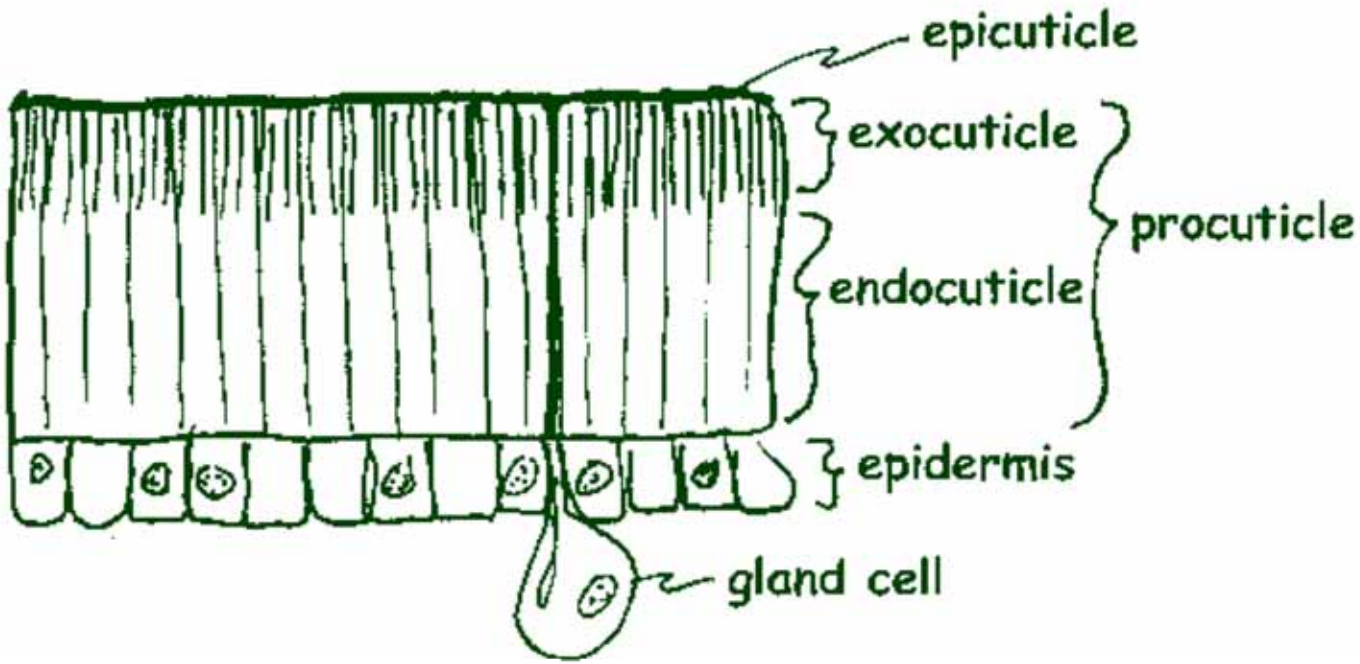
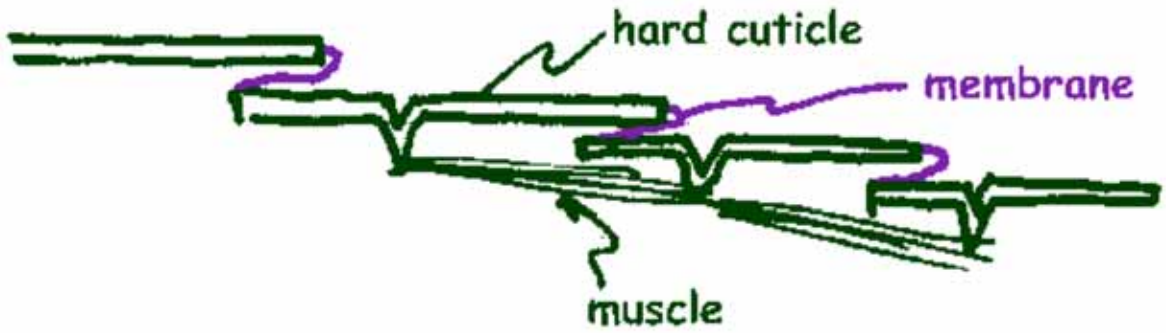
Insect Exoskeleton

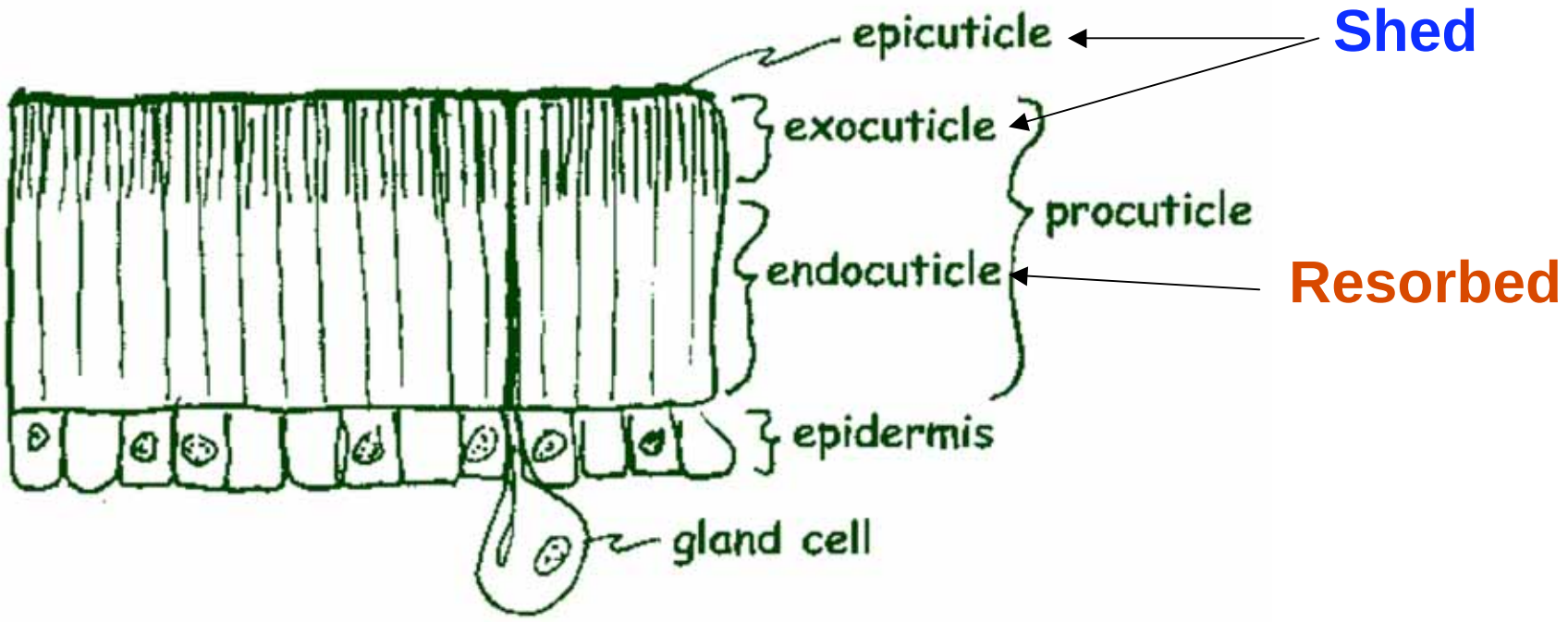




View this link for a tutorial
Review both pages

http://www.cals.ncsu.edu/course/ent425/tutorial/integ.html

Molting (Ecdysis)



•Under control of growth hormones AKA insect growth regulators juvenile hormone and ecdysone).

• Ratio of juvenile type to ecdysone type hormones moderates maturation process

How Insects Jump Out of Their Skins

- Apolysis – Air is blown to separate cuticle from epidermis
- Chitinases and proteases secreted from endodermal glands dissolve endocuticle
- Epidermal cells multiply and secrete new cuticle
- Waxy layer secreted
- Old insects cuticle splits along specialized wrinkles (ecdysial lines) and insect crawls out

Cicada Ecdysis

Adult breaks through ecdysial suture in the insect exoskeleton

Cuticle Hardening

- Newly molted exoskeletons are soft and light colored.
- Exposure to air and other chemicals (tyrosine) produced by insect causes sclerotization (hardening) and later melanization (browning)
- This can take several days

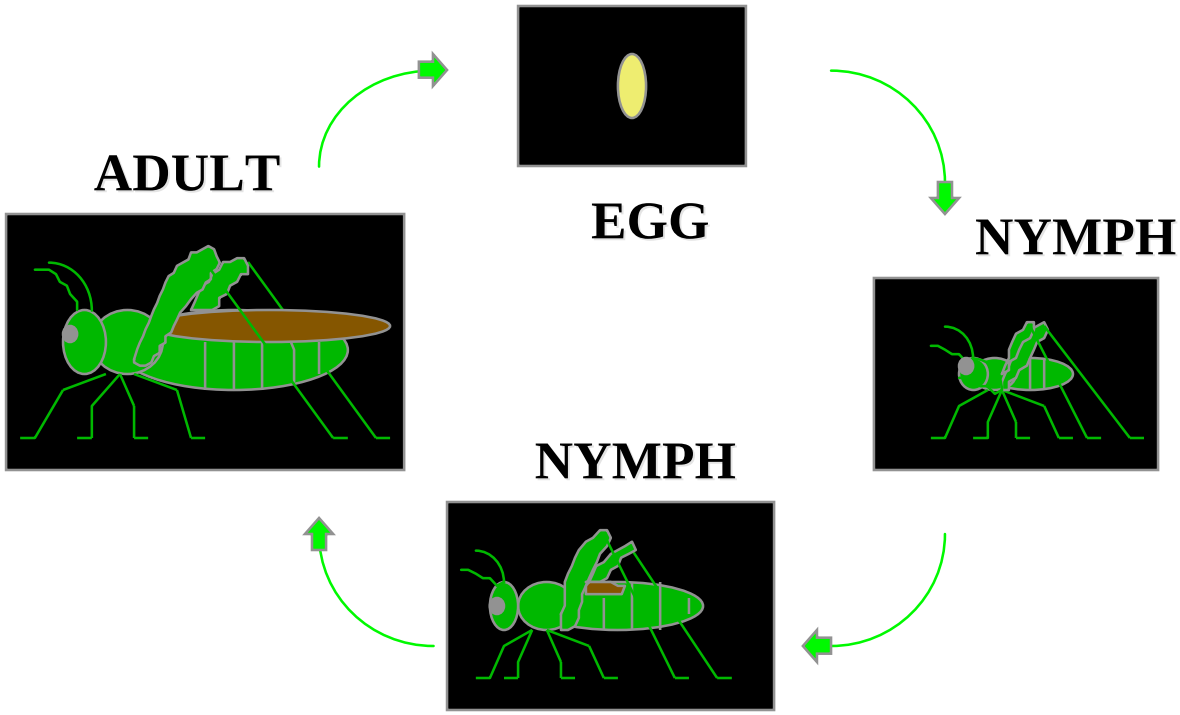
The Cicada Life Cycle

http://www.bio.indiana.edu/~hangarterlab/broodx/broodxmovies/NSFmovie.htm

Kinds of Metamorphosis

- Ametabolous
  - no metamarphosis
- Hemimetabolous
  - Incomplete metamorphosis
- Holometabolous
  - Complete metamorphos

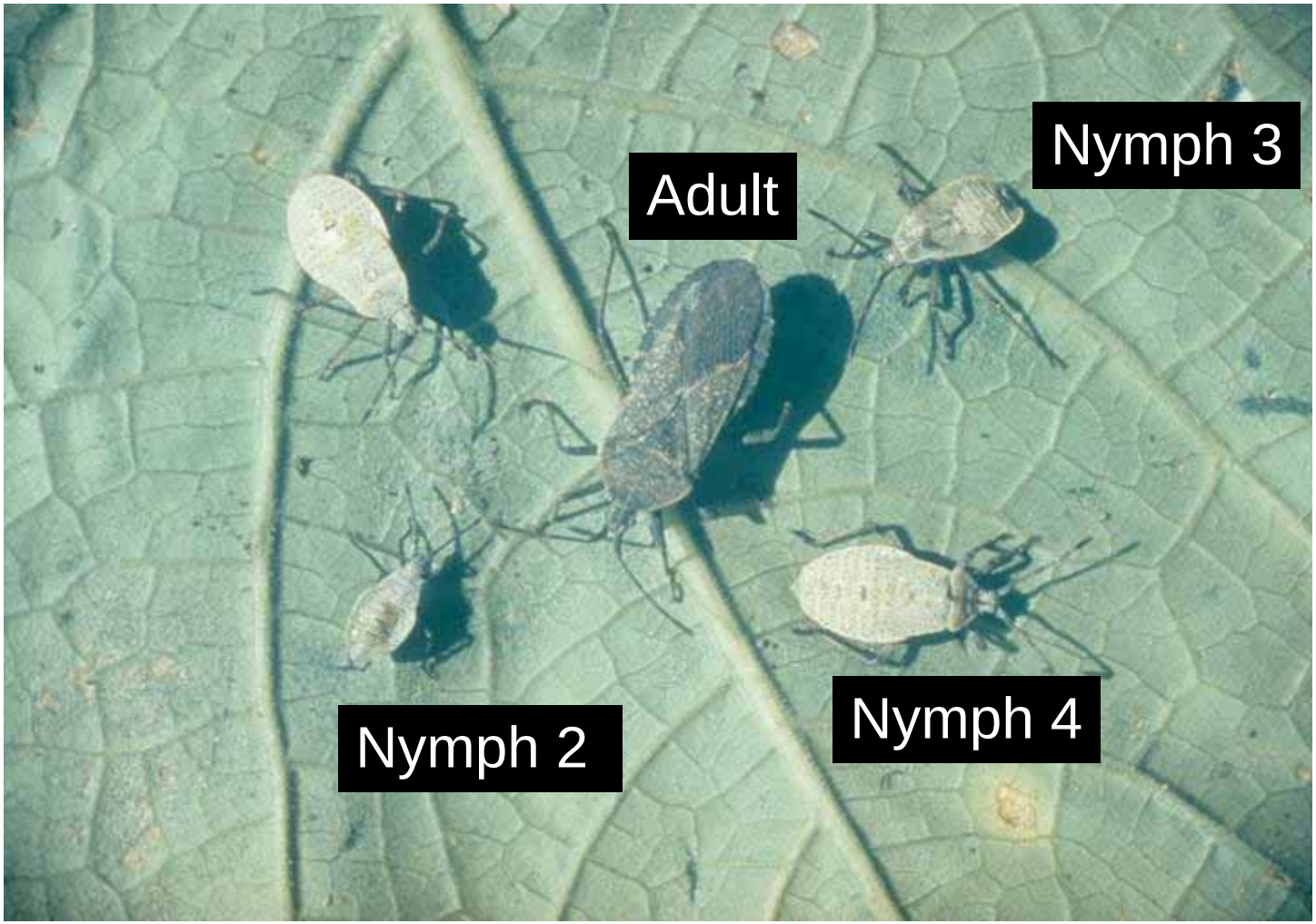
Incomplete Metamorphosis



Incomplete Metamorphosis

- 3 Insect Stages
  - Eggs
  - Larvae
    - Body form resembles adult
    - No wings
  - Adults
    - No increase in size
    - Reproduction
    - Wings fully grown if present

Example: Squash Bug



Do small butterflies grow up to be big butterflies?

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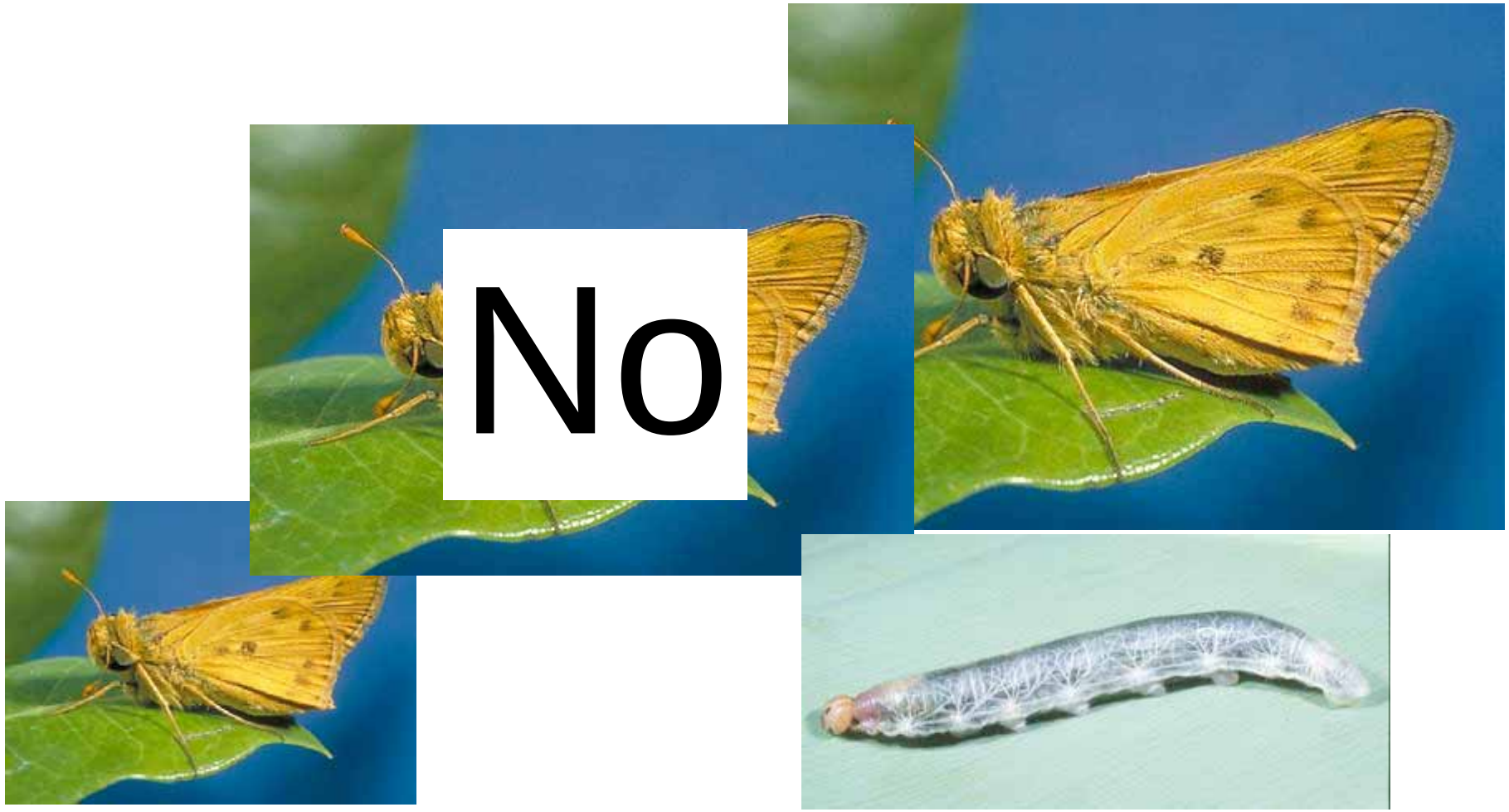
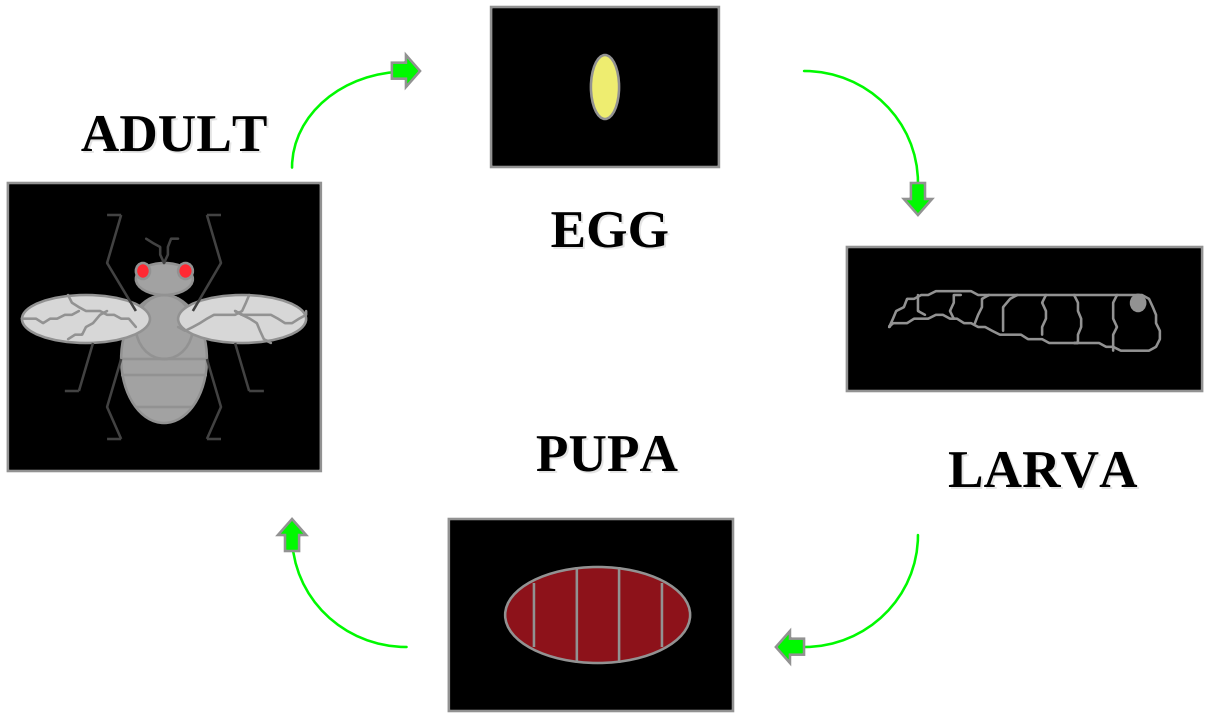


Complete Metamorphosis

- 4 Insect Stages
  - Eggs
  - Larvae
  - Pupae
    - Transformation from larva to adult
    - True legs, wings, antennae are formed
  - Adults
    - No increase in size
    - Reproduction
    - Short Life span

Complete Metamorphosis (fly)



Adult and immature insects with complete metamorphosis feed on the different food

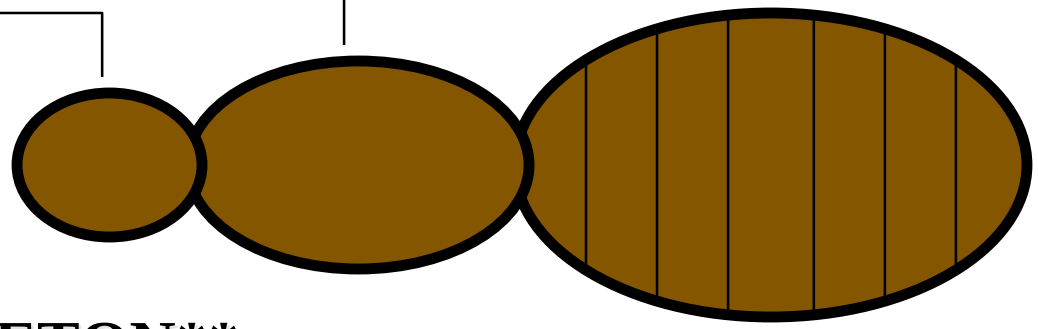
egg 1st 2nd instar larva 3rd pupa adult

Insect Characteristics

- Three body regions
- 3 pairs of legs
- Adults usually have 2 pairs of wings

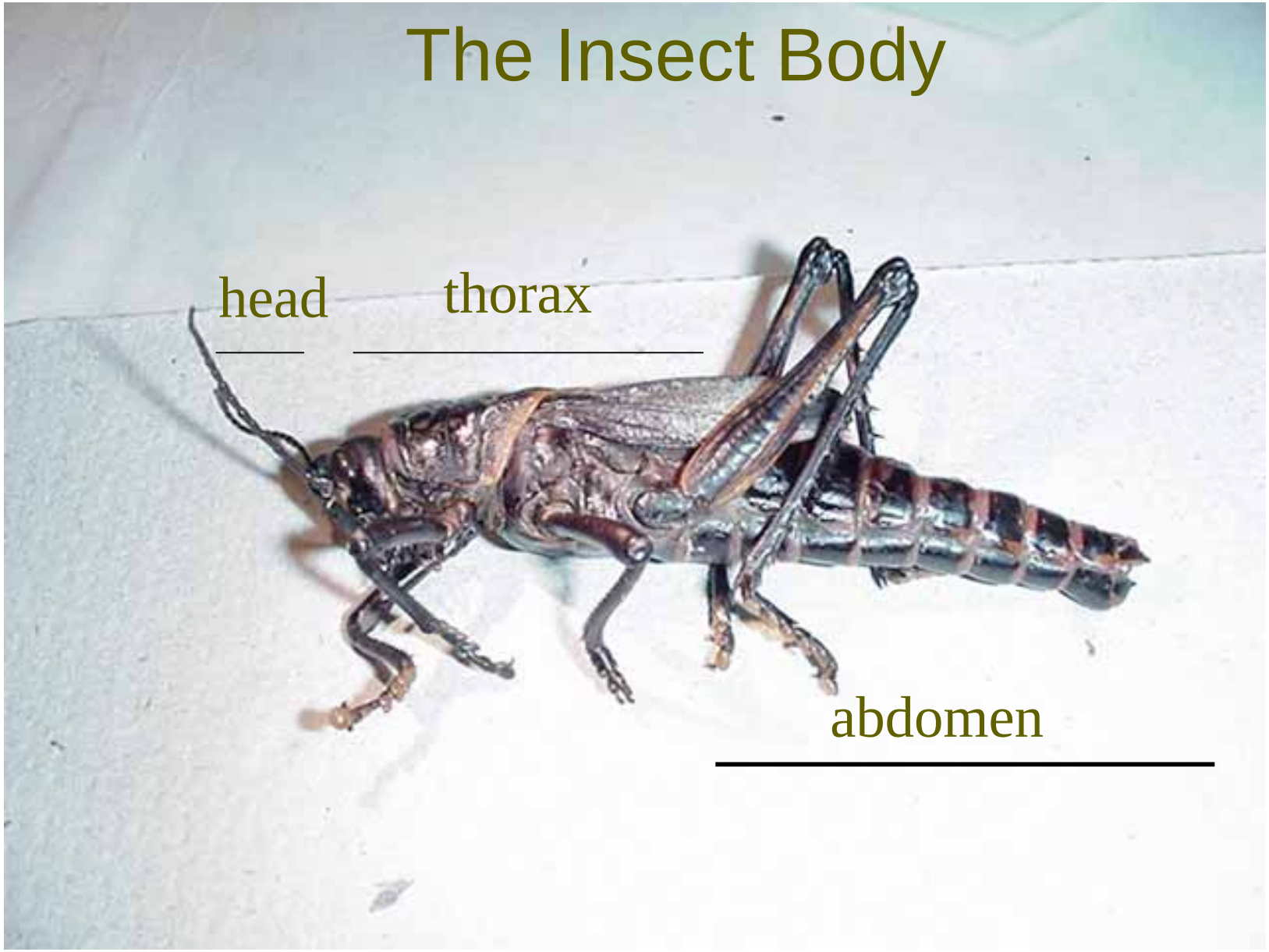
Insects

- 3 Distinct body regions
  - Abdomen
  - Thorax
  - Head



****EXOSKELETON****

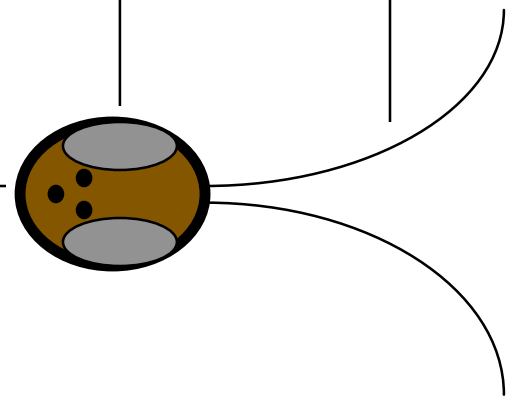
The Insect Body



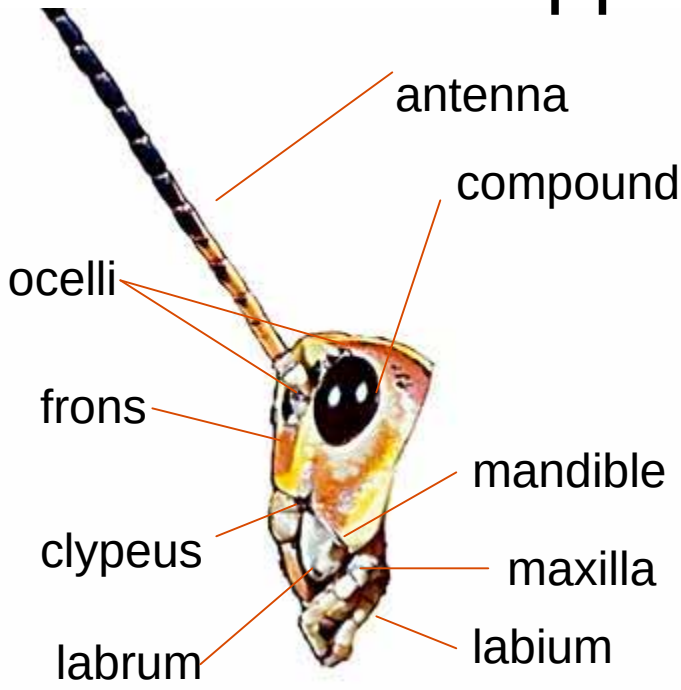
Head

(Perception and Ingestion)

- 1 Pair of antennae
- 1 Pair of compound eyes
- Ocelli
- **Mouthparts

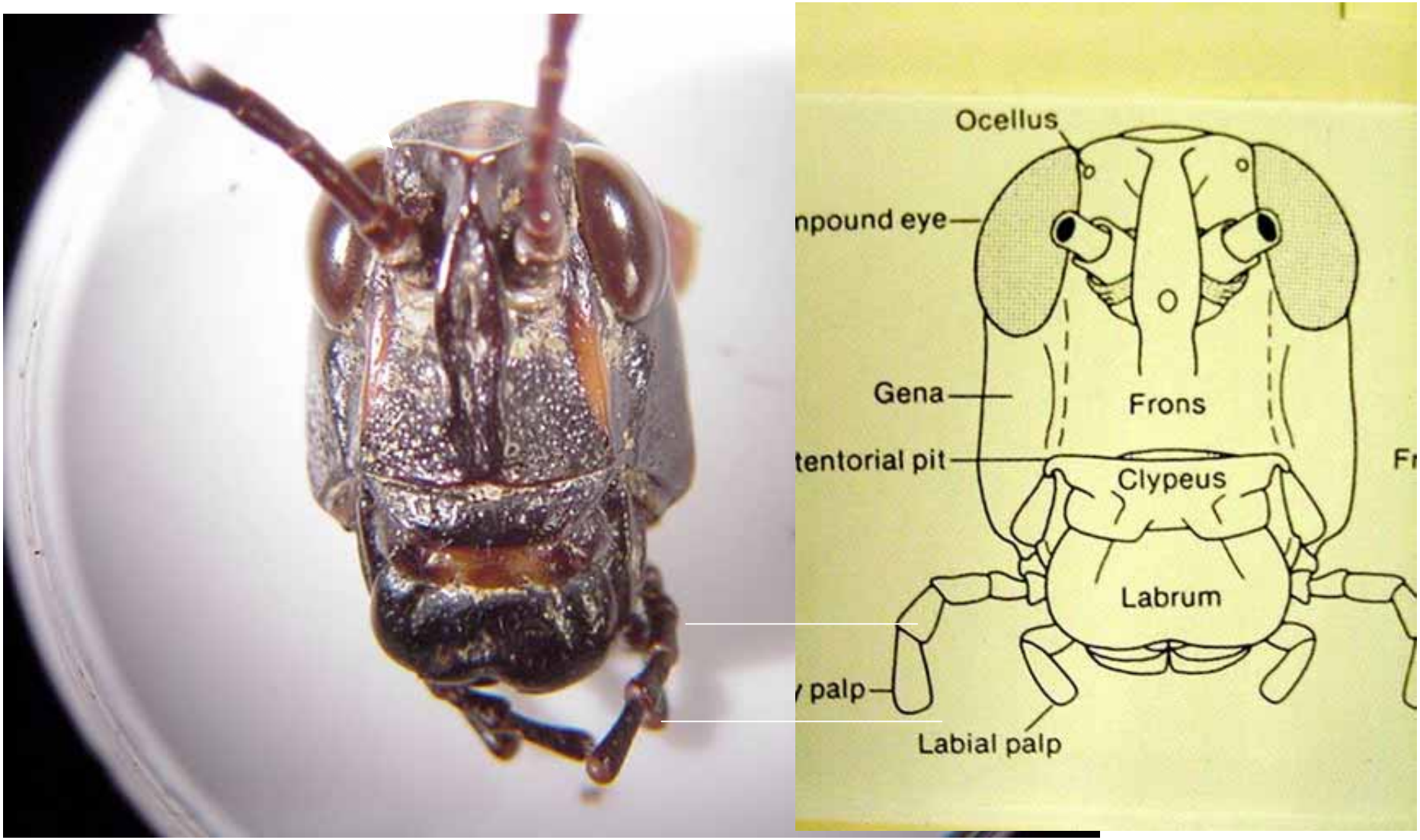


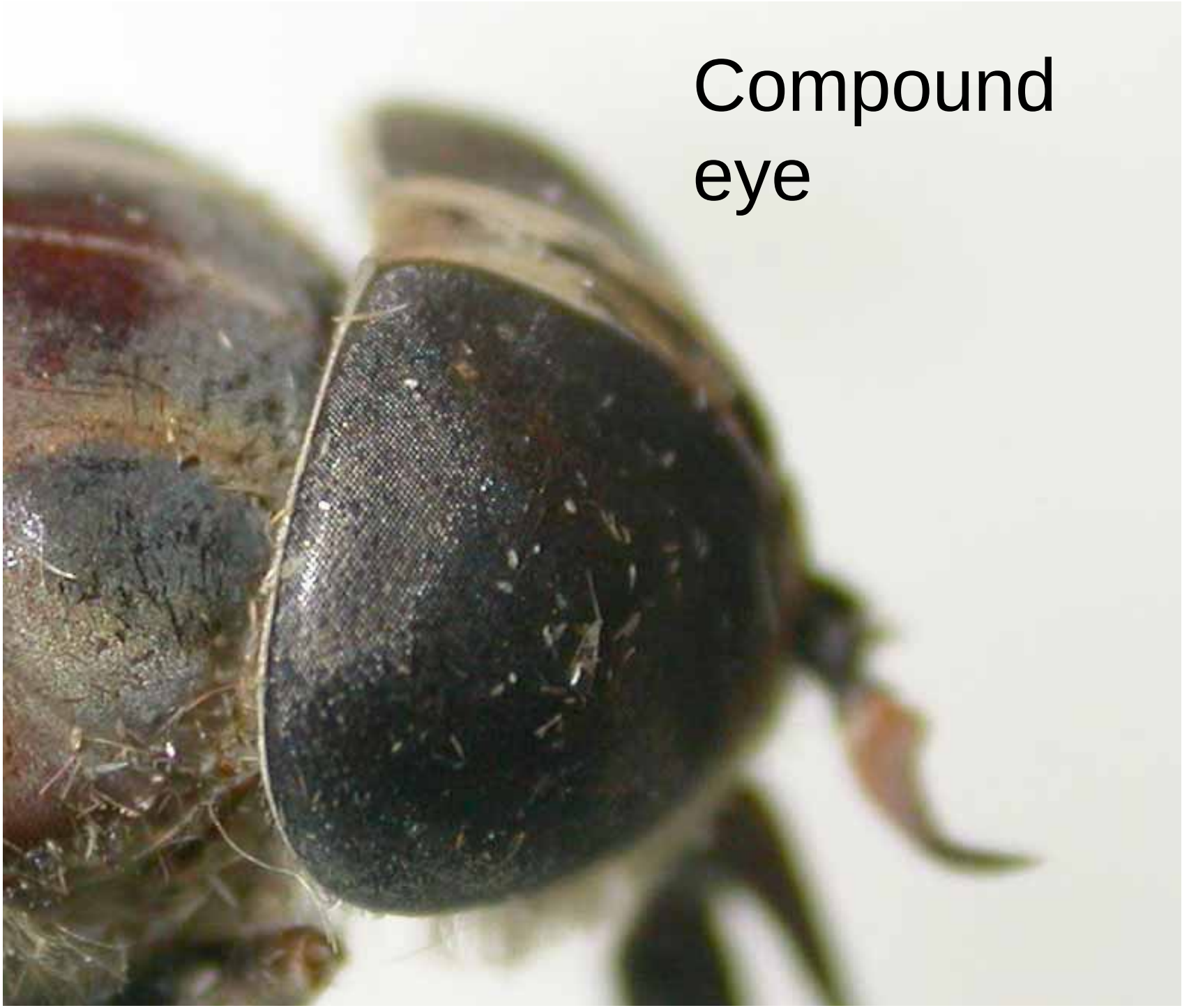
Lubber Grasshopper Head with Dissected Mouth



Function of Head?

The Insect Head - Frontal




Compound
eye

Mouthpart Orientation
Hypognathous

Hypognathous (Ventral) – Many herbivores

Modifications of Chewing Mouthparts

Elongate rostrum of chewing insect
Hollyhock weevil

Chewing mouthparts of yellow jacket
Wasp

Mouthpart Orientation

Prognathous (Anterior) – Many Predators

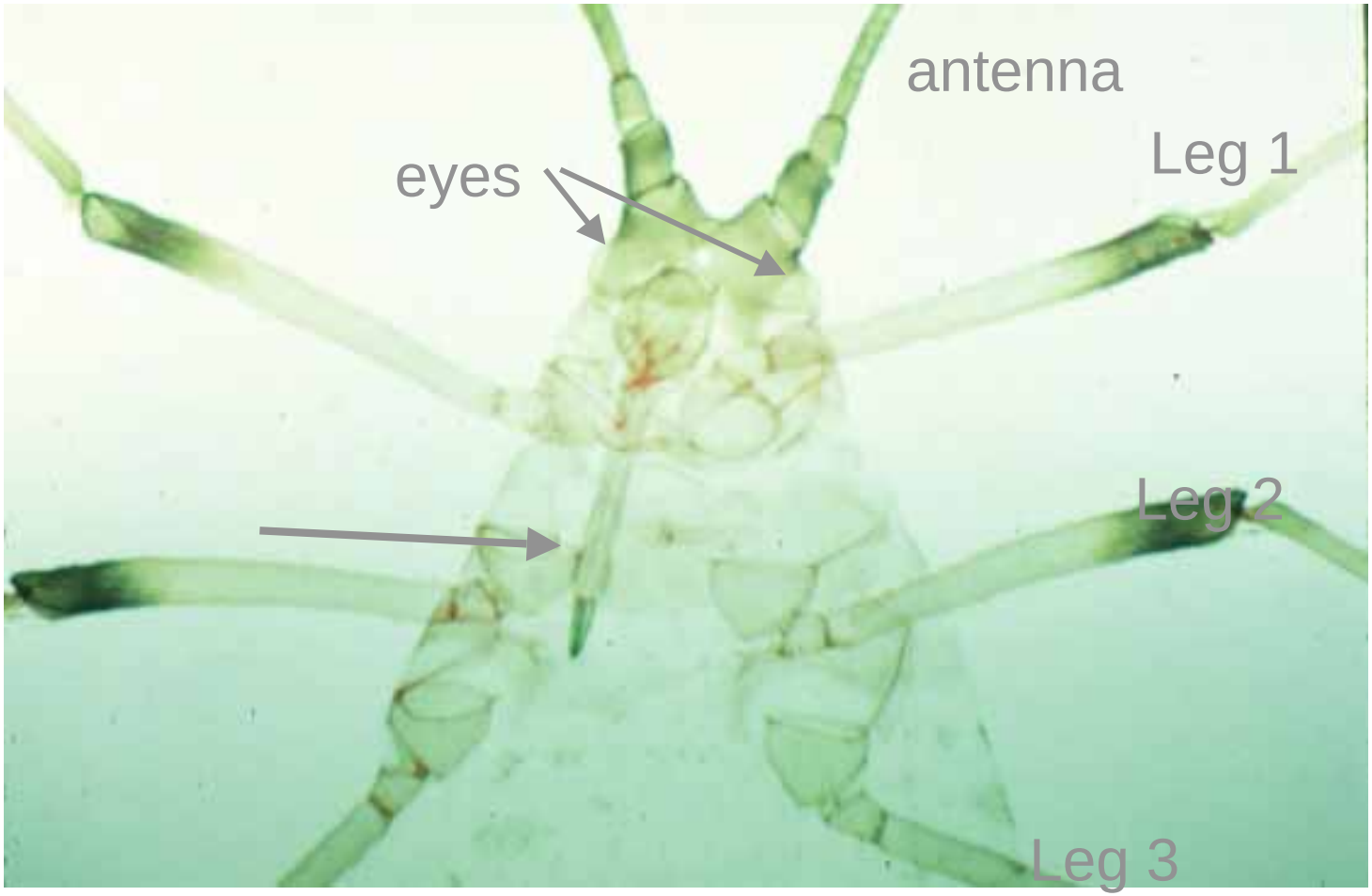
Mouthpart Orientation
Opistognathous

Hinged toward posterior (predator)

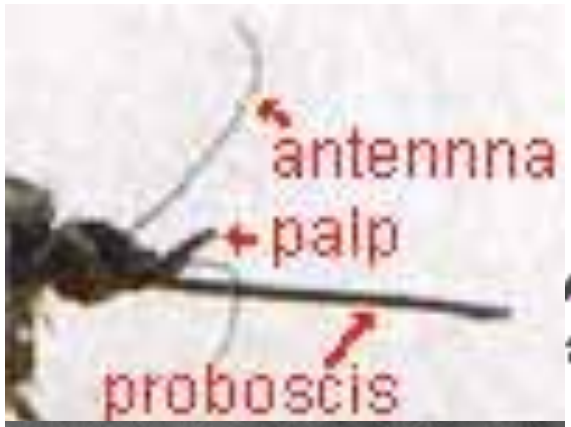
Fixed toward posterior (herbivore)

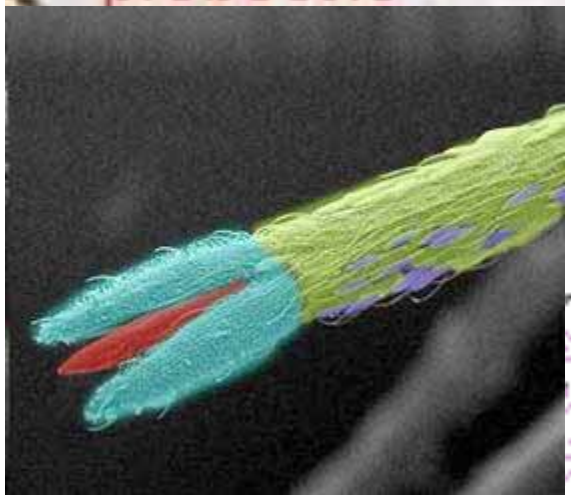
Piercing Sucking

Piercing-Sucking Mouthparts



Diptera – Fly Mouth



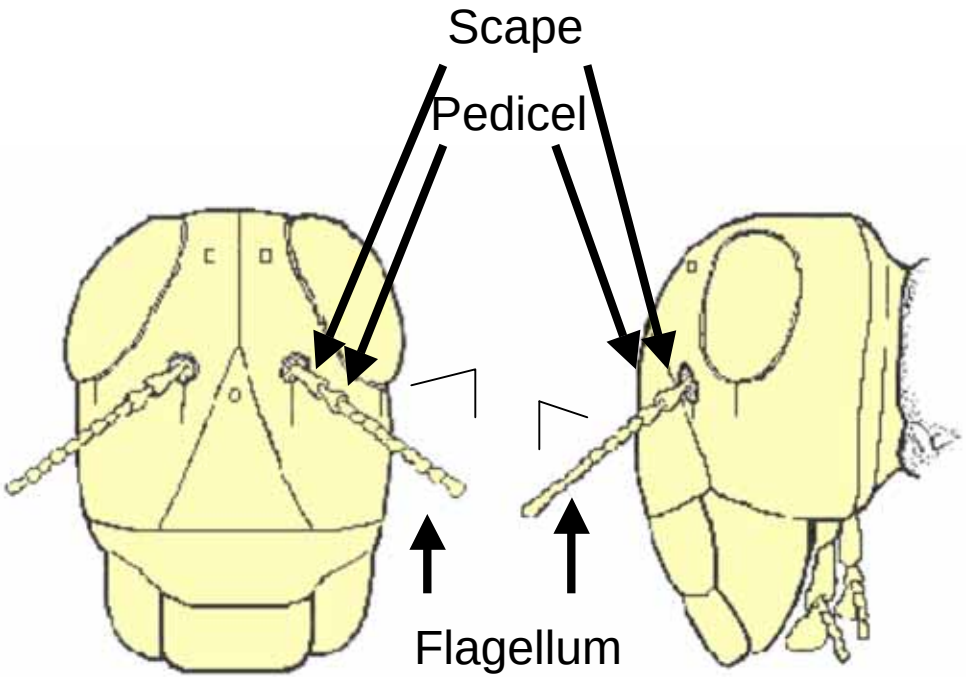


Mosquitoes

Horsefly

Lepidoptera - Butterflies and Moths

Modifications of the Antenna



http://www.cals.ncsu.edu/course/ent425/tutorial/antenna.html

Filiform Antennae

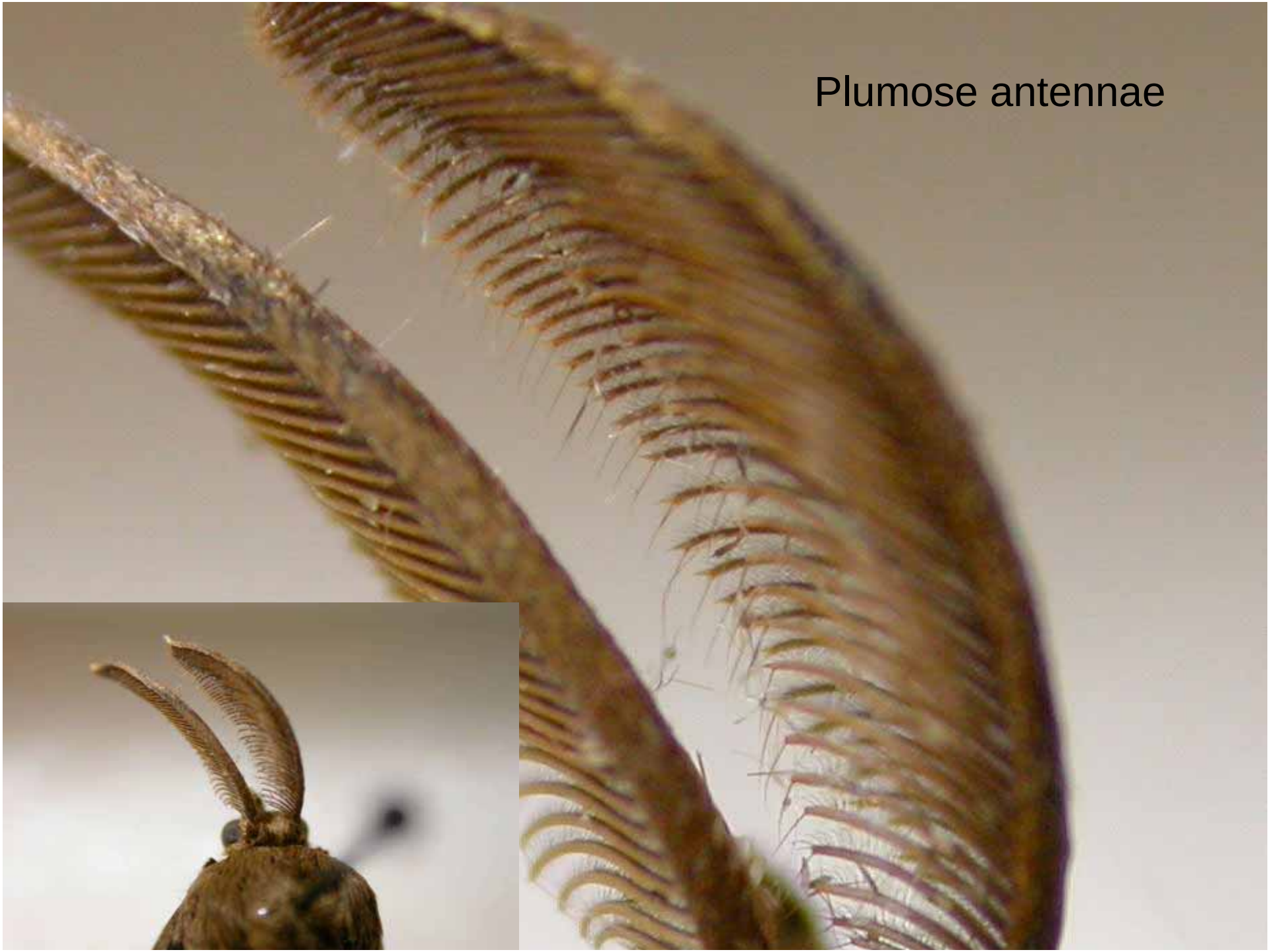
Capitate antennae

Geninculate (bent) antennae

Weevil

Wasp

Lamellate Antenna of Scarab Beetle


Plumose antennae