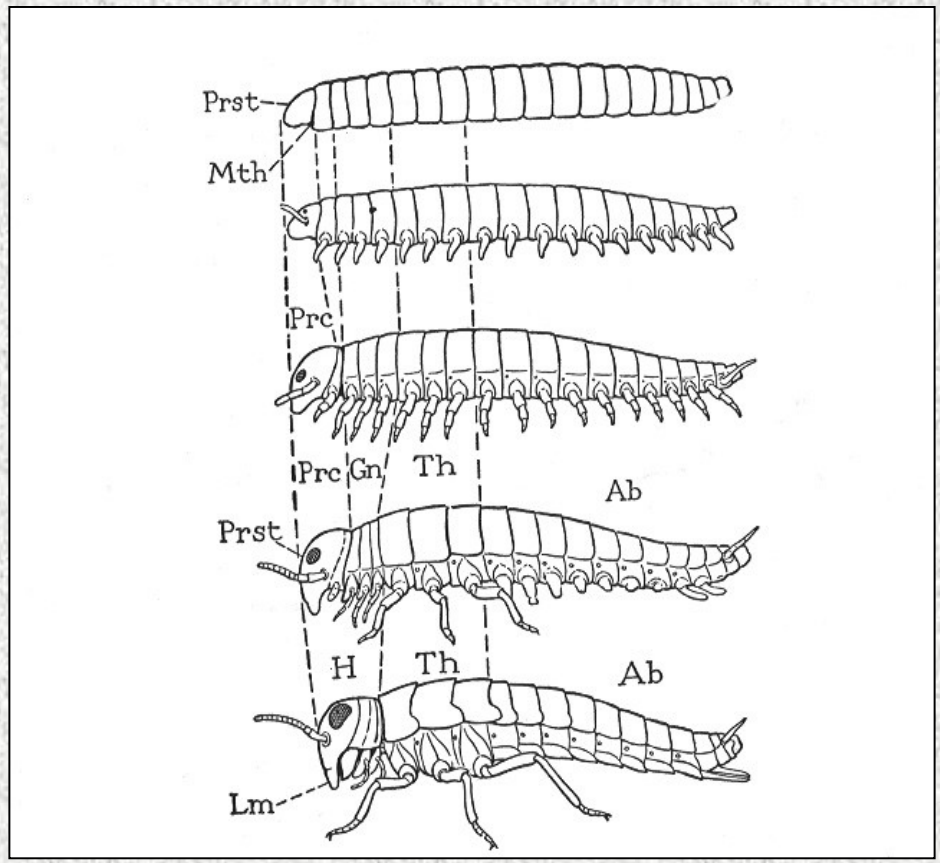
External Morphology

(after R. Zack, Washington State University)

The body of an arthropod is composed of repeating segments



Tagmosis = the grouping of body segments into functional units

Tagma(ta) = the grouped segments of a functional unit
e.g., head, thorax, abdomen

The insect body is composed of three distinct tagmata

- Head
- Thorax
- Abdomen

The insect body covering is referred to as an Exoskeleton in both adults and immatures

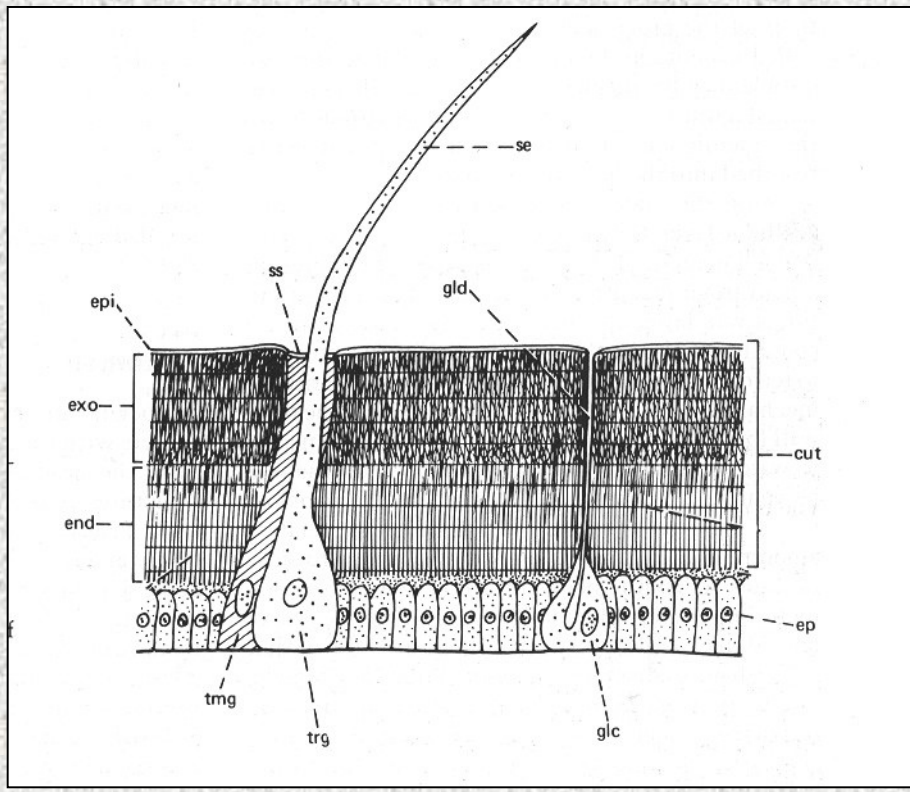
Advantages and disadvantages of an exoskeleton

- Protective armor - prevents wear and tear
- Protection from invasion by pathogens and harmful agents
- Impermeable to water
- Base for muscle attachment

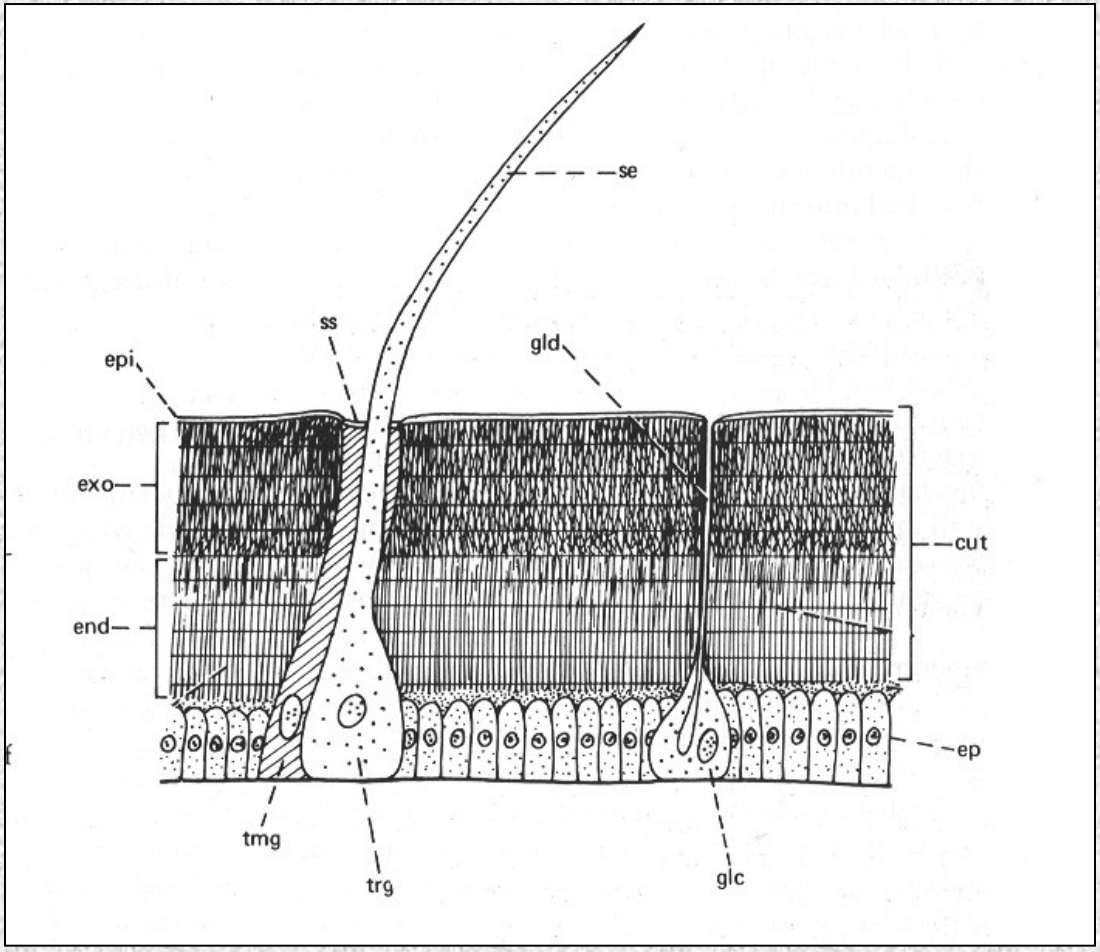
- Does not expand - must be shed in order to grow - molting

The exoskeleton (cuticle) of an insect consists of a number of layers

- Epicuticle - non-living
- Exocuticle - non-living
- Endocuticle - non-living
- Epidermis - living



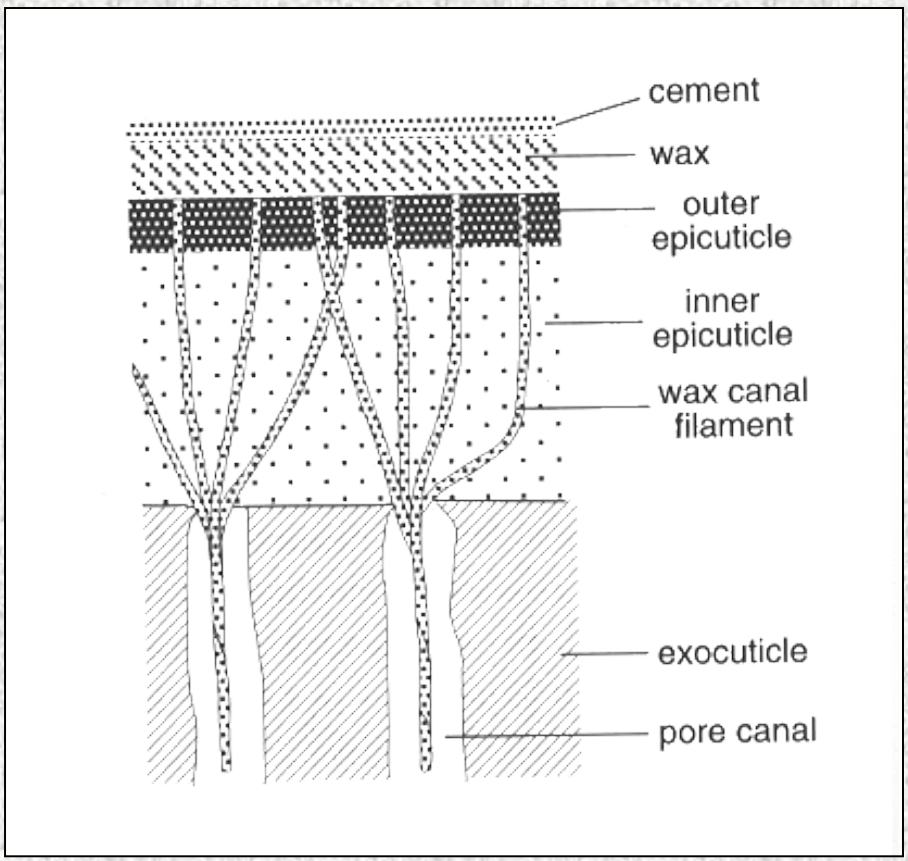
Exoskeleton (cuticle) of an arthropod



Insects and People
External Morphology

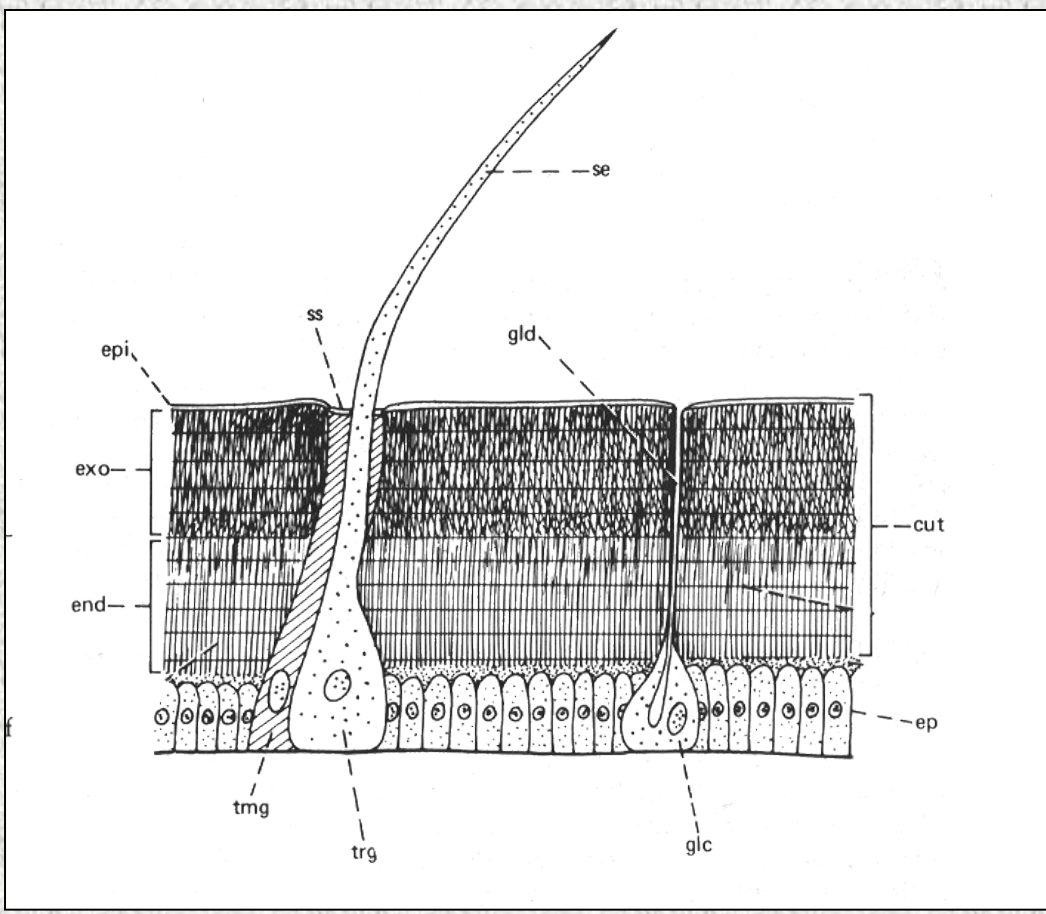
Epicuticle - outer-most layer is itself multilayered

- Cement
- Wax
- Outer epicuticle
- Inner epicuticle



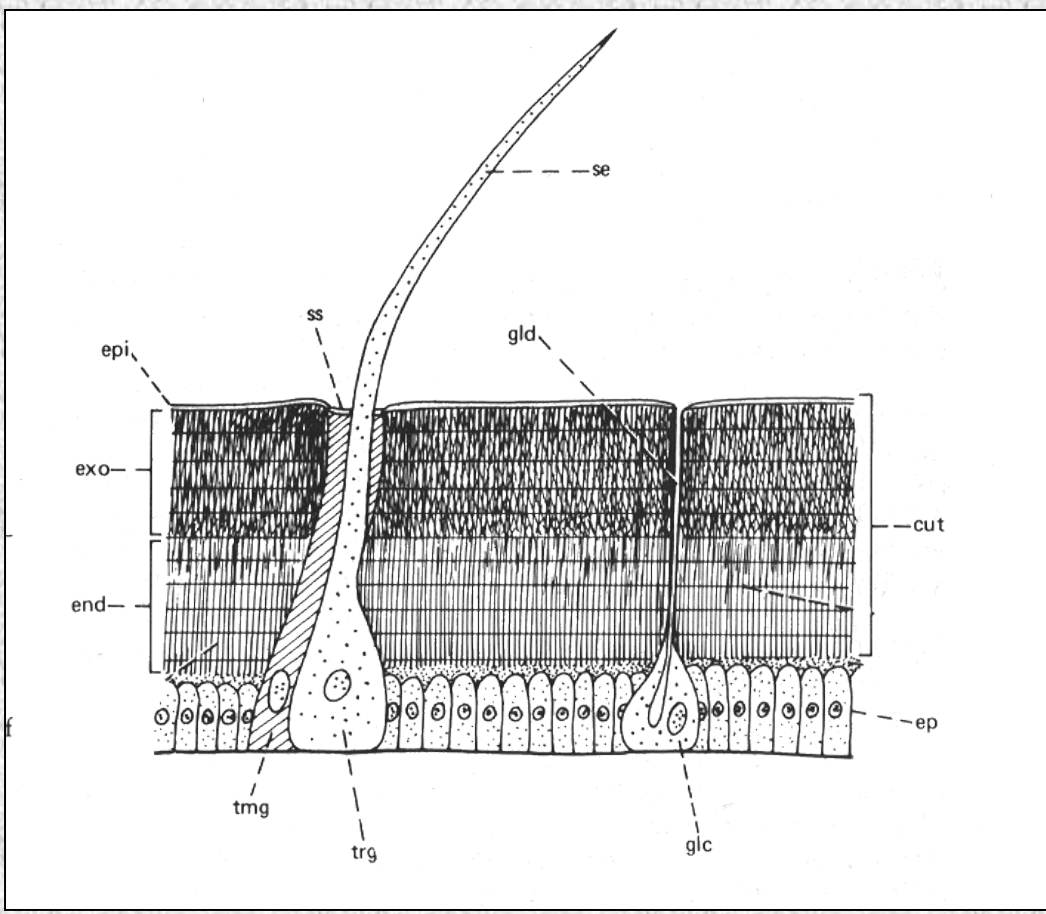
Exocuticle and Endocuticle

- Non-living
- Non-cellular
- Provide strength and rigidity (chitin)
- Provide flexibility (resilin)



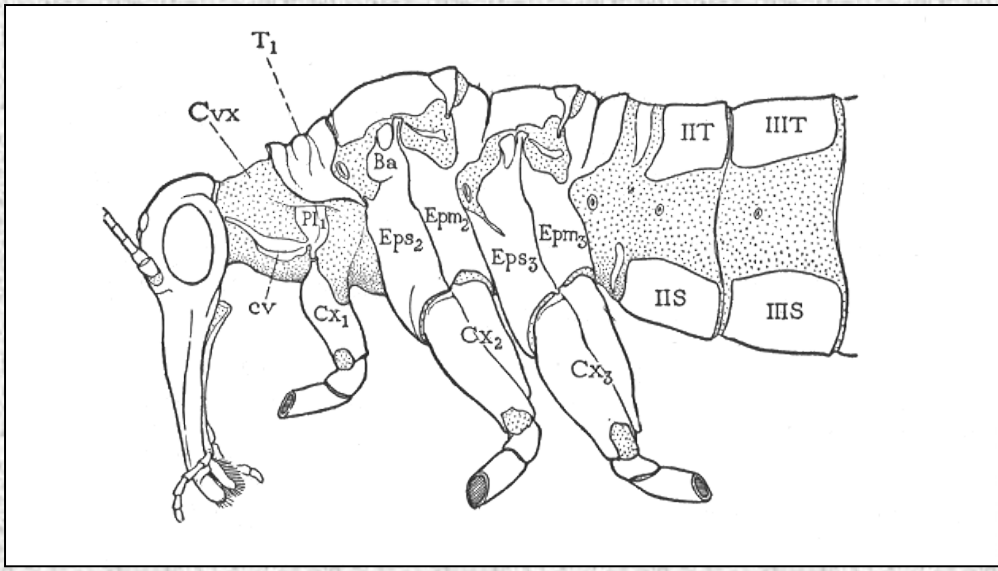
Epidermis

- Living layer
- At maximum depth during molting - secretes substances involved in molting



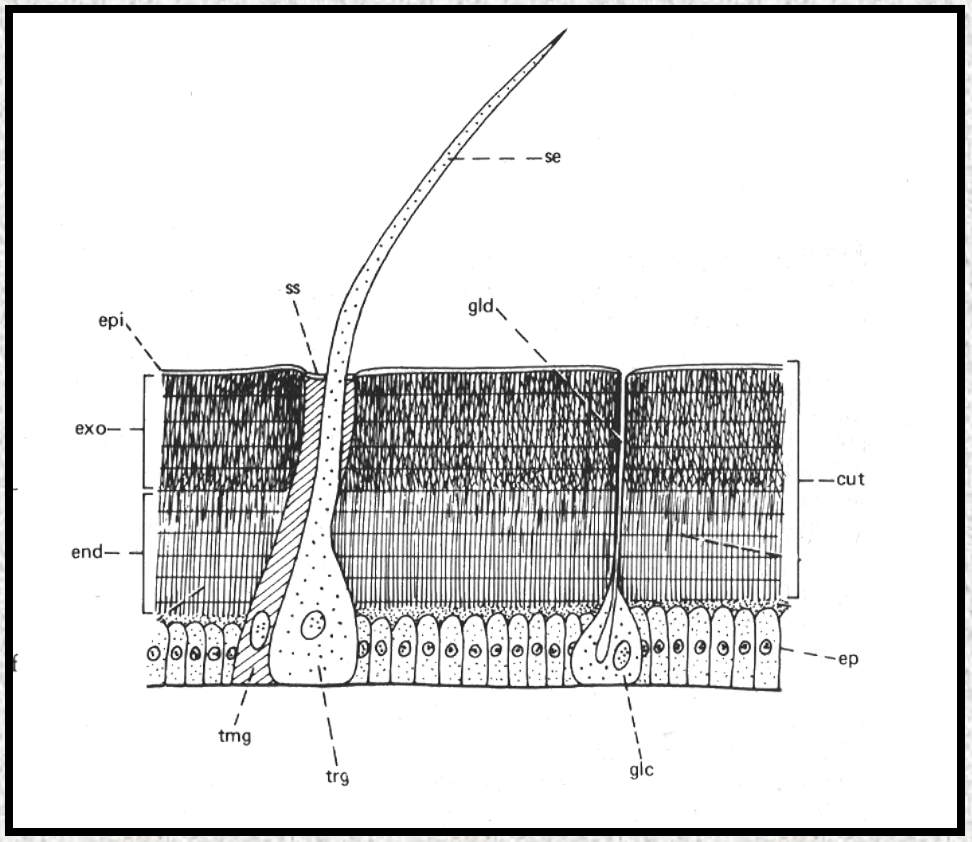
Rigidity and Flexibility in the Exoskeleton

- Sclerite - a plate of the body wall surrounded by sutures or membrane.
- Suture - the line of fusion of two plates
- Membrane - thin and pliable cuticle



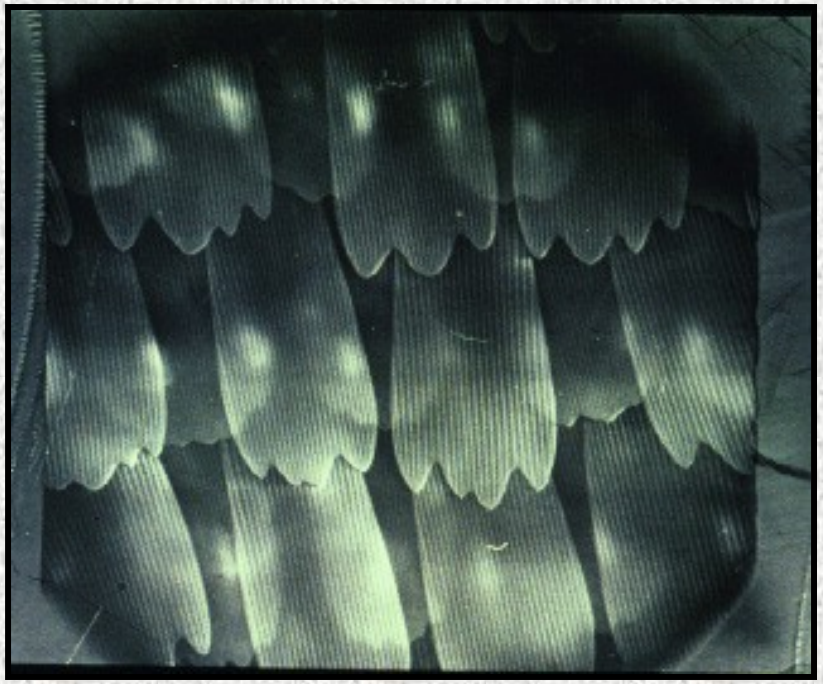
Cuticular Appendages - Seta(e)

- Setae are hair-like projections of the cuticle which arise from a trichogen cell.



Cuticular Appendages - Scales

- Scales are flattened setae that serve a “covering” purpose”
- Wings of butterflies and moths
- The bodies of silverfish and some beetles are covered with scales

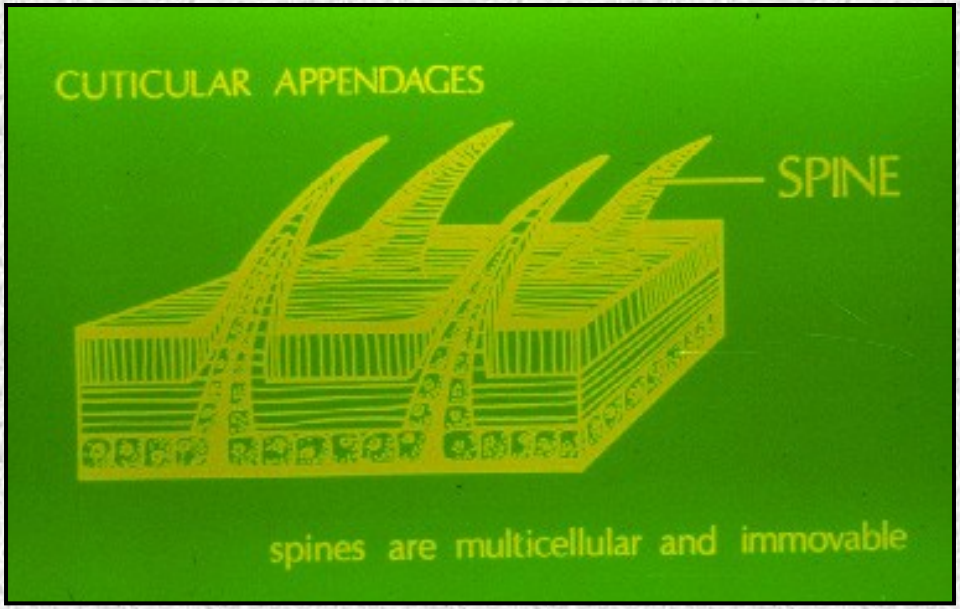


Cuticular Appendages - Glandular Setae

- Glandular setae produce secretions involved in protection or communication

Cuticular Appendages - Spines

- Spines are simply outgrowths of the cuticle, not produced by a cell.
- Spines may help in grasping, clinging to objects, or in protection

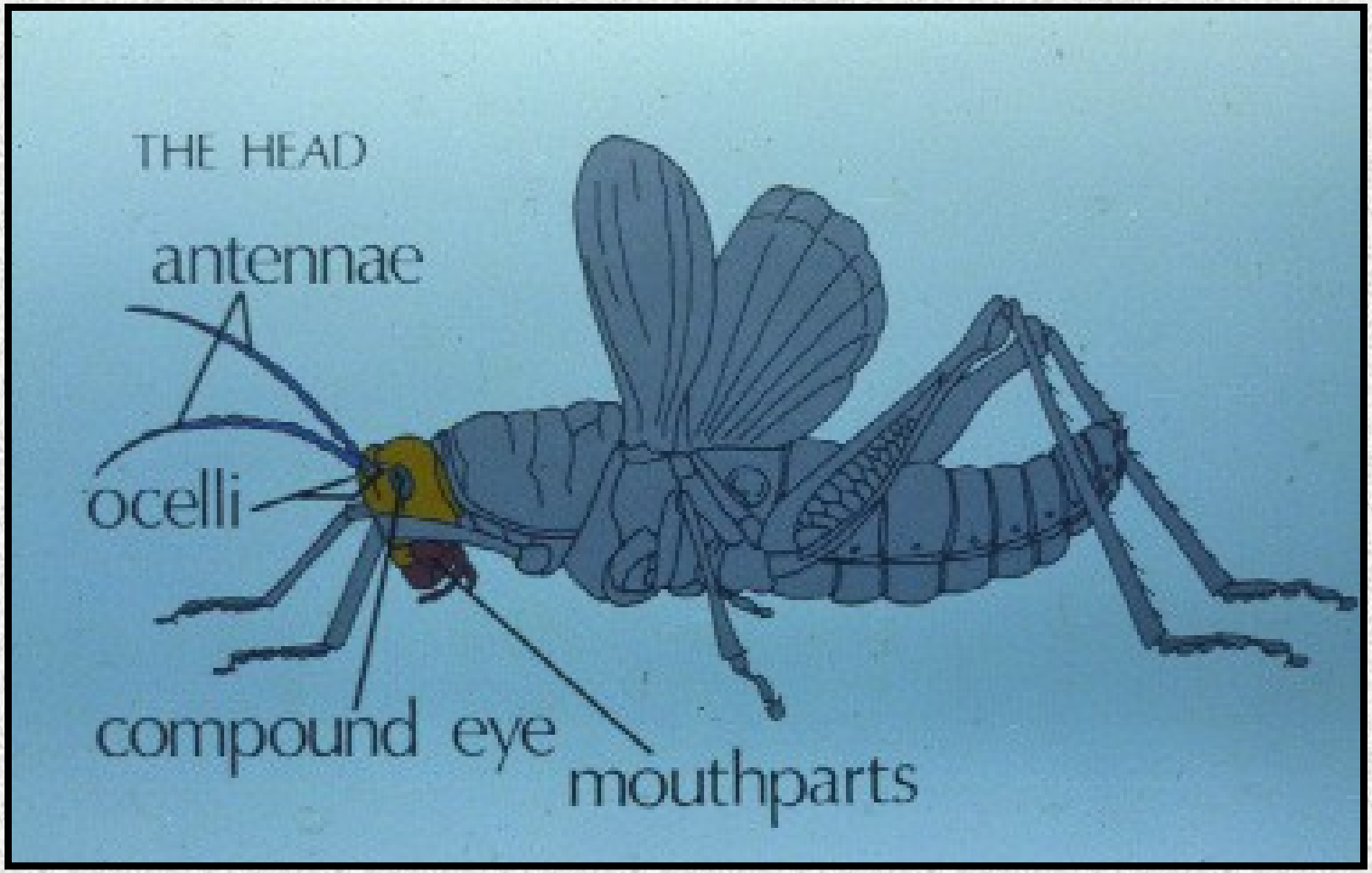


Examples of Spines

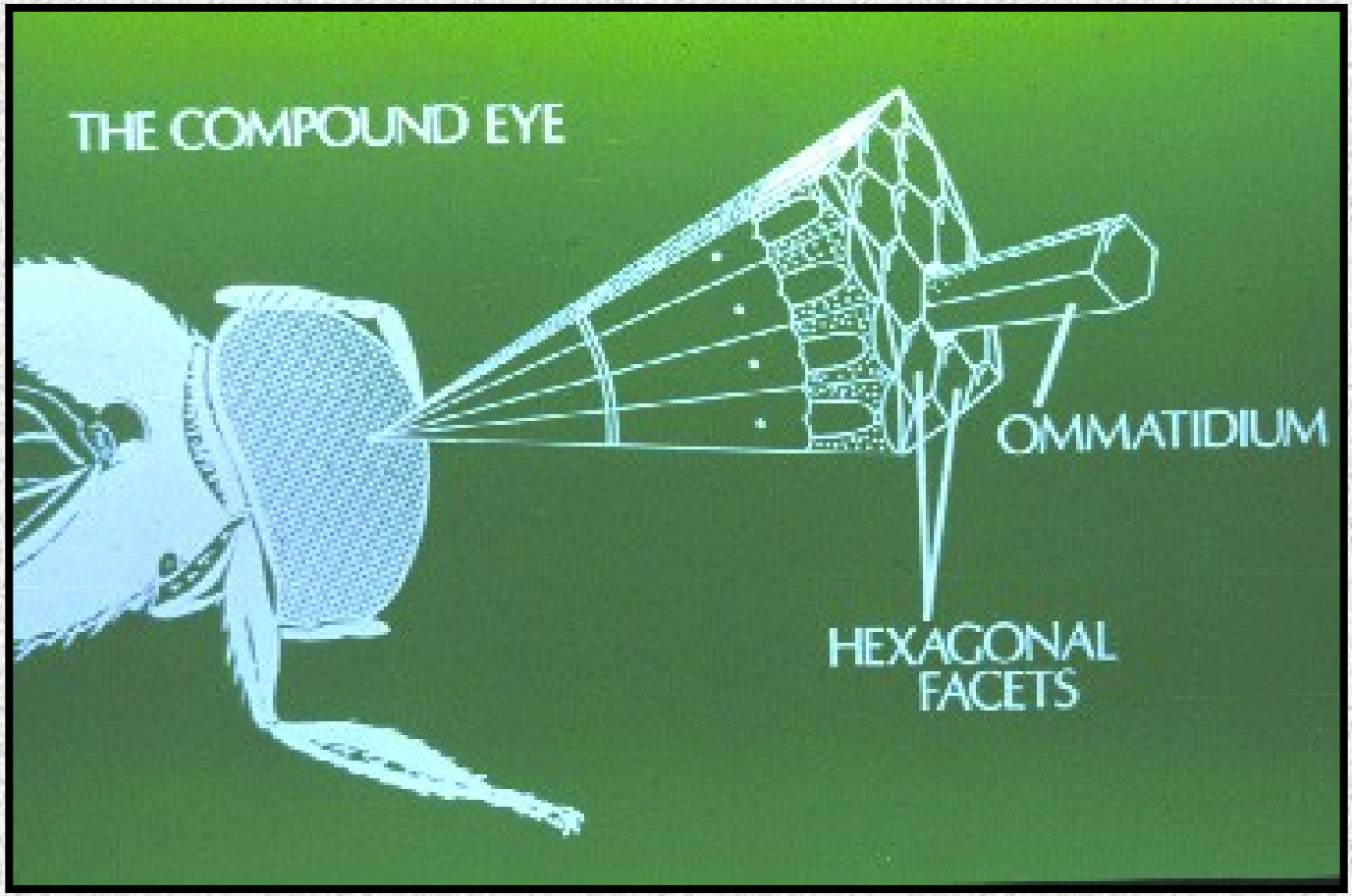
The Insect Head

- Sensory
  - Eyes
  - Ocelli
  - Antennae
- Feeding
  - Paired mouthparts

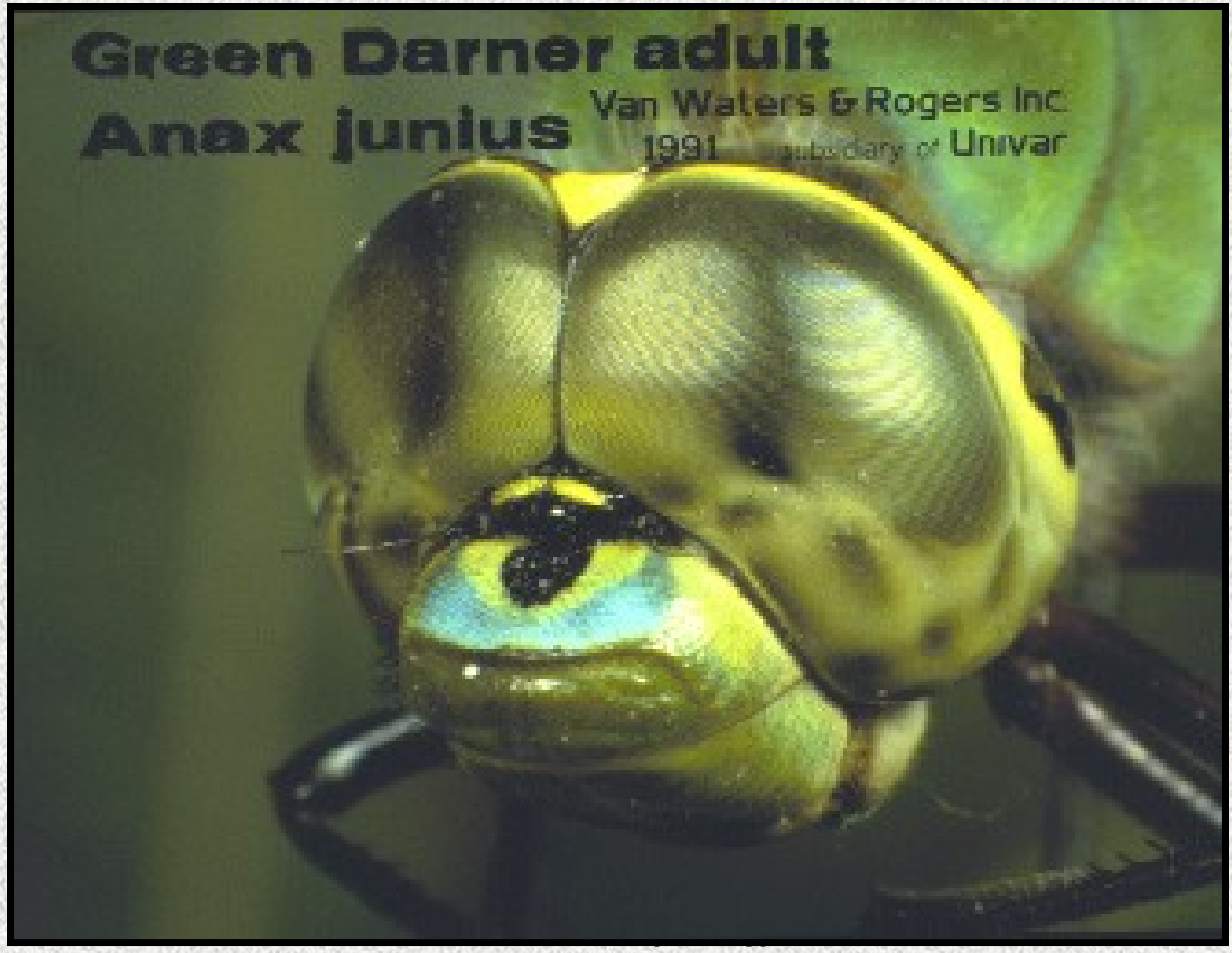
The Insect Head



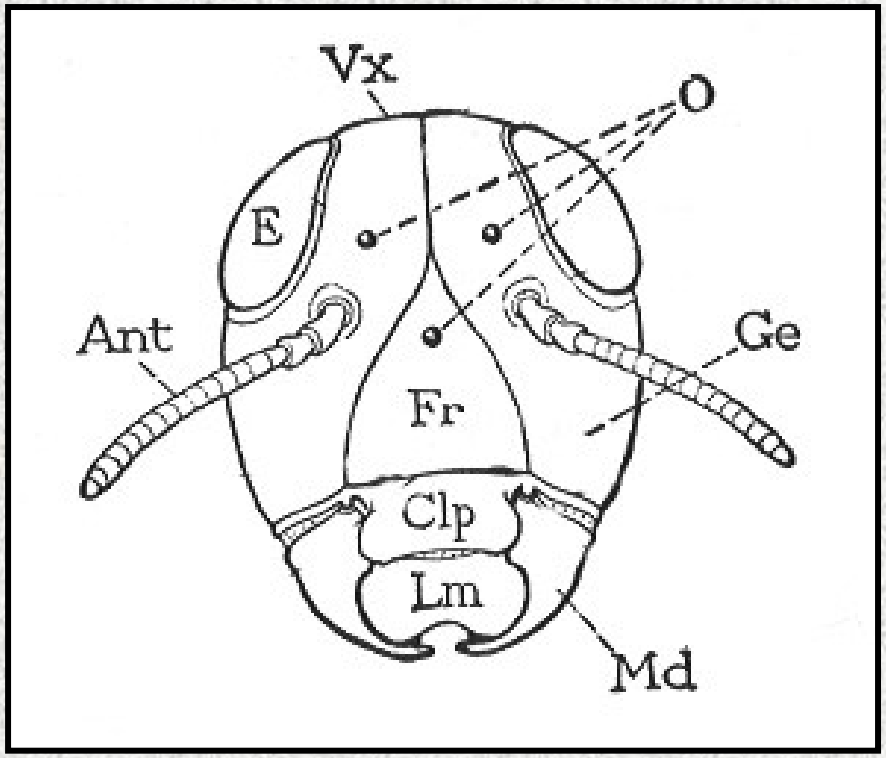
Insect Compound Eyes

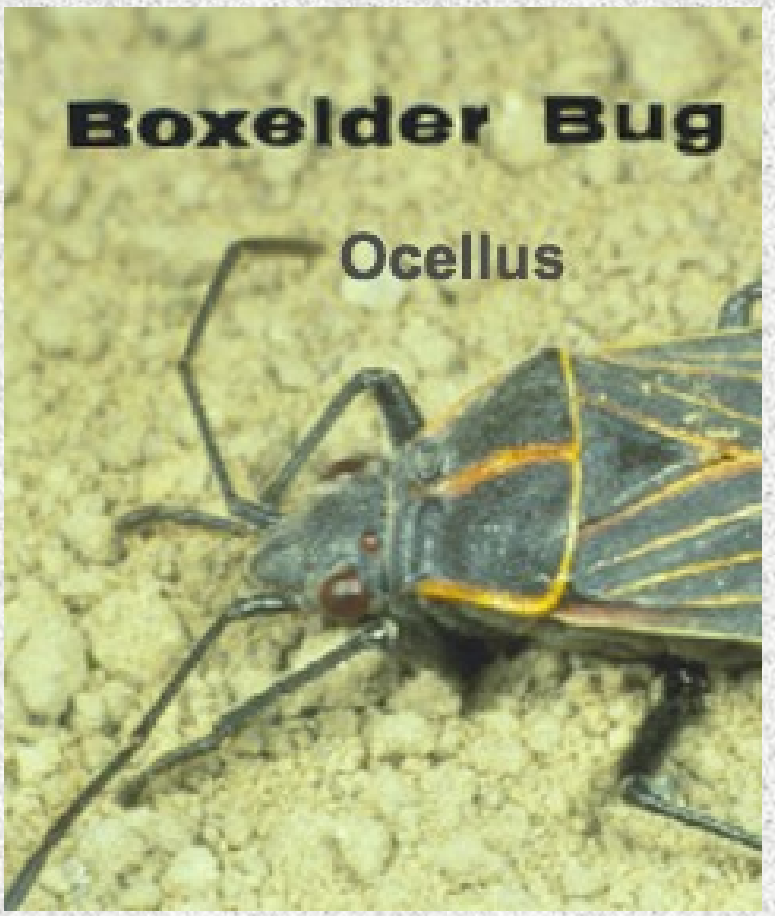


More Ommatidia - Better Vision



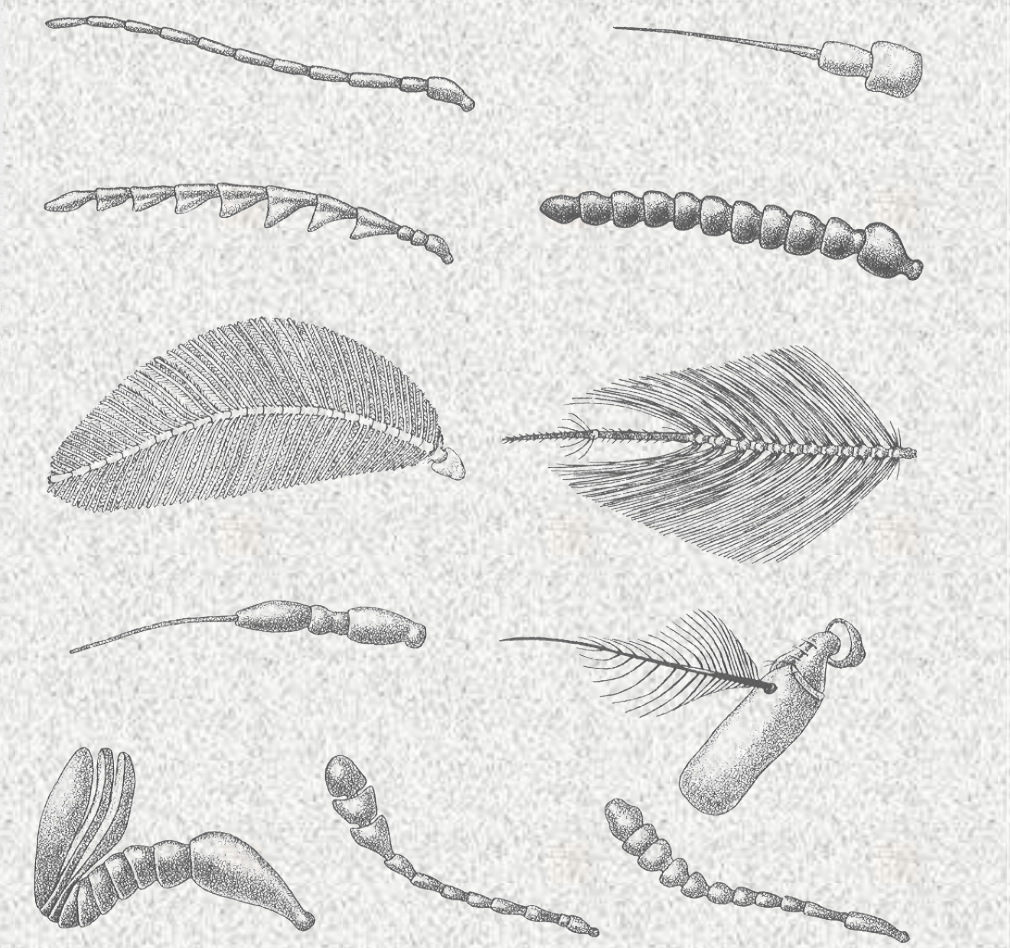
Insect Ocelli





Insect Antenna(e)

Antennae come in many shapes and sizes

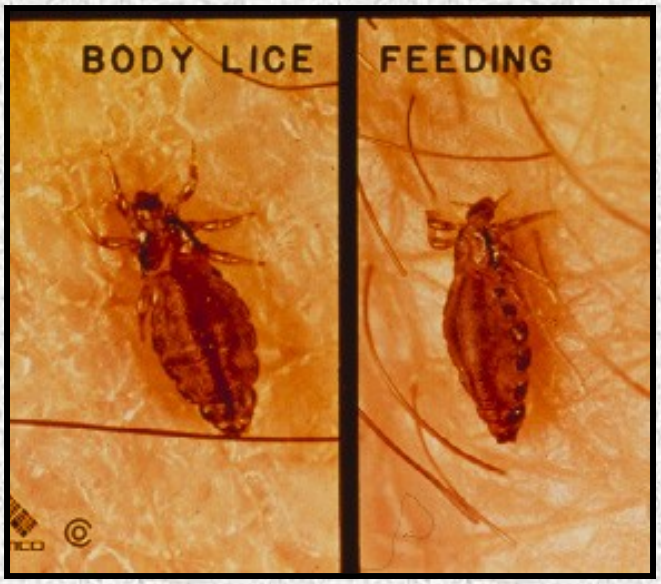


Insect Mouthparts

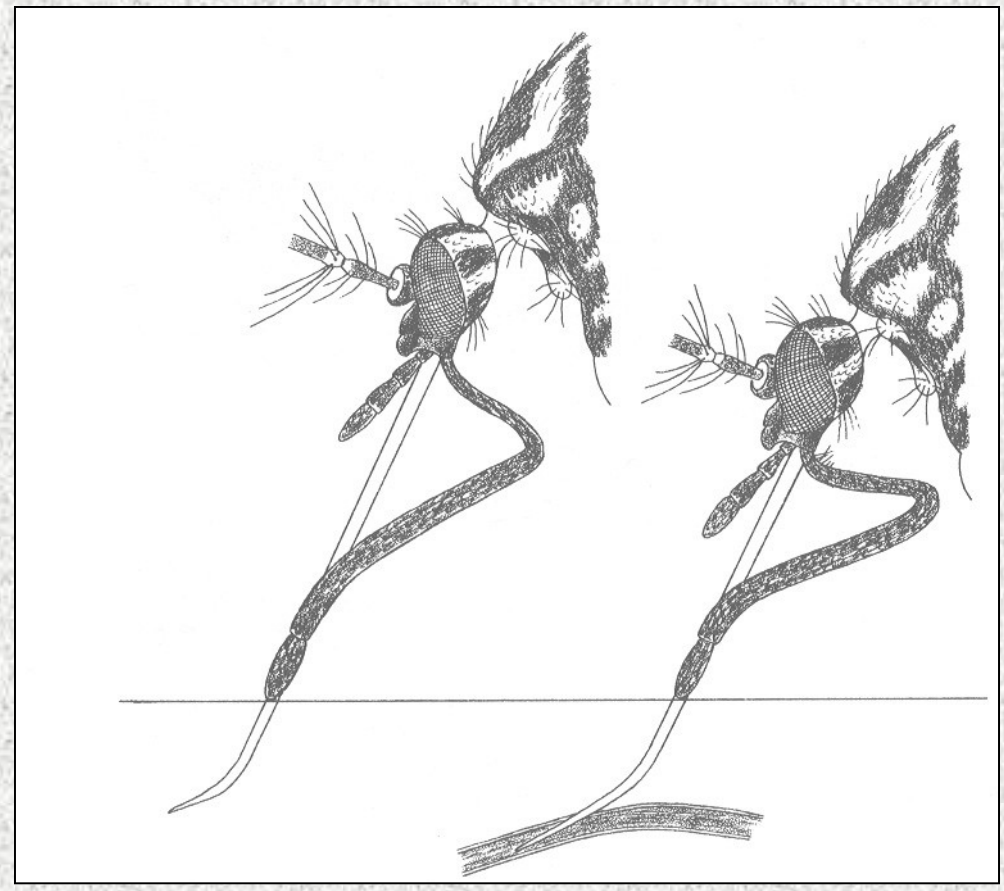
- Vary depending of food eaten and other functional needs
  - Chewing
  - Piercing and sucking
  - Sponging
  - Siphoning
  - Chewing and lapping

Chewing Mouthparts

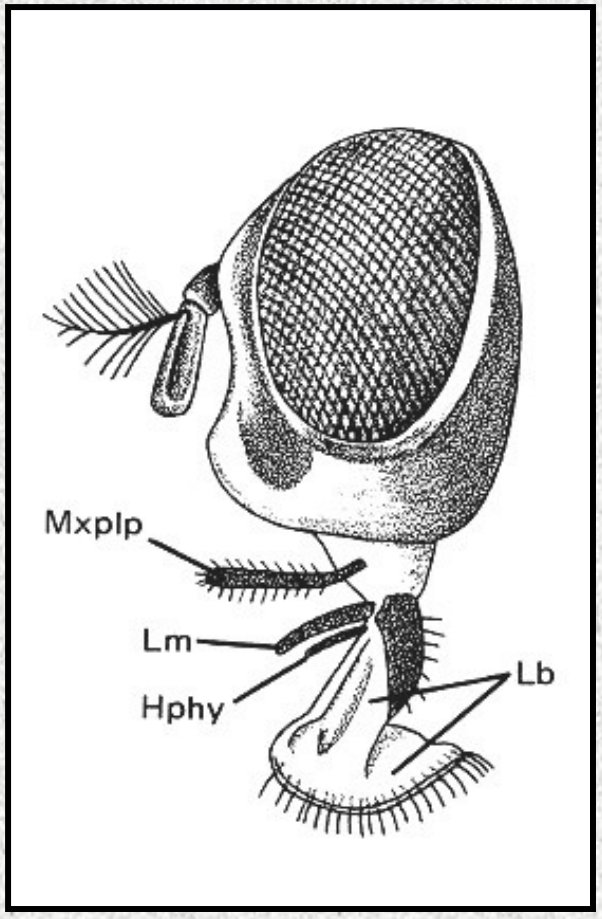
Piercing and Sucking Mouthparts

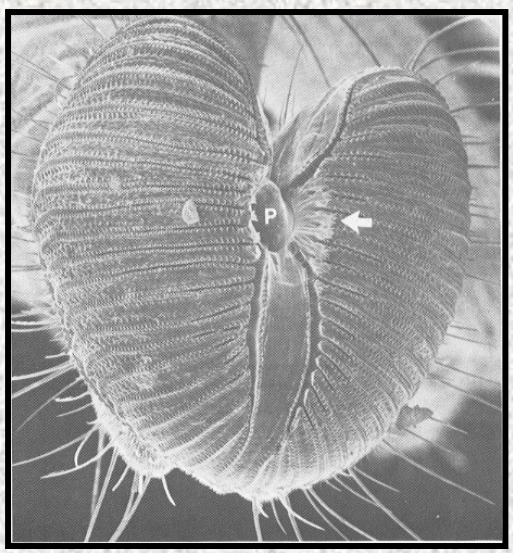


Piercing and Sucking Mouthparts Mosquito

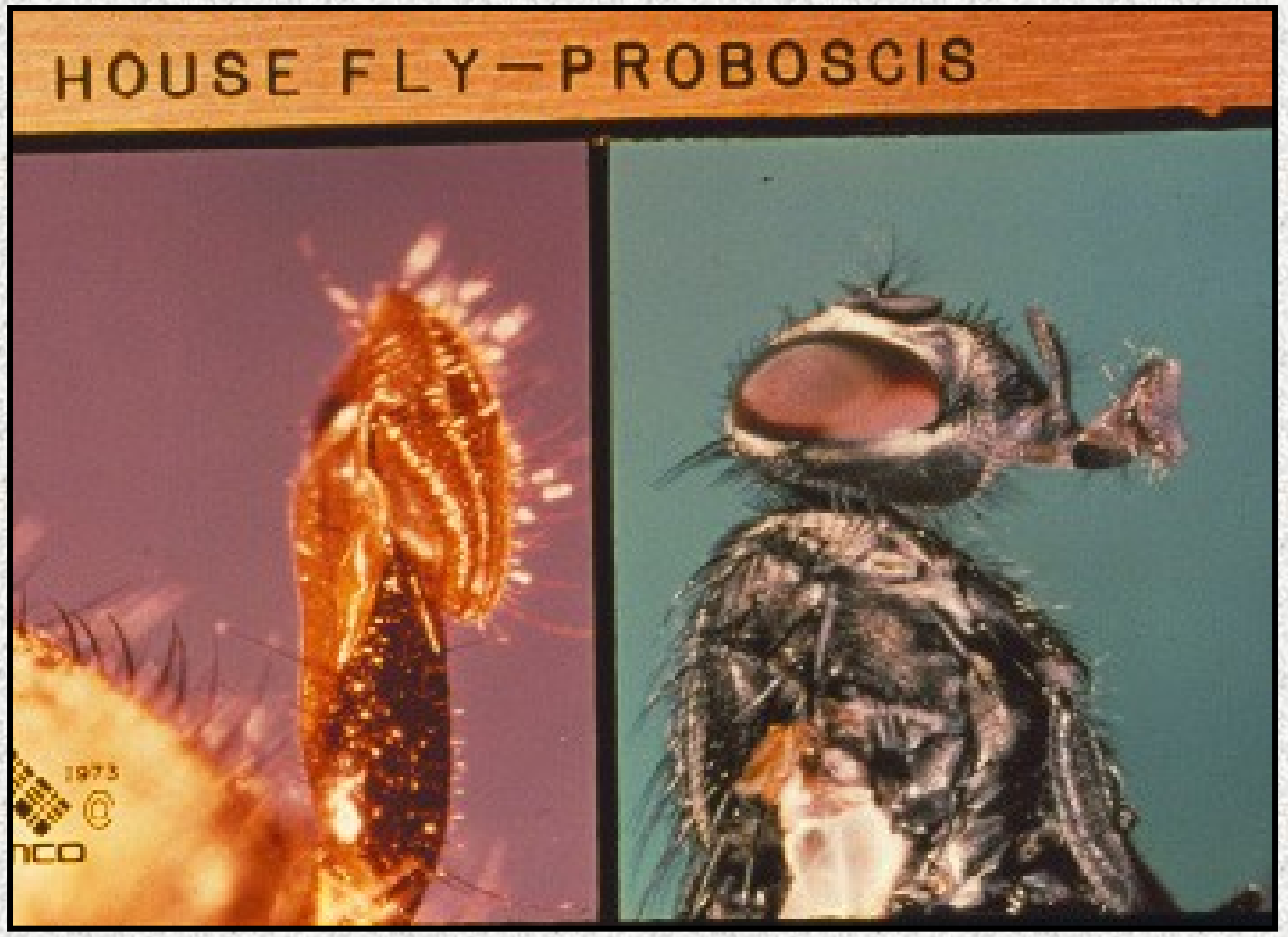


Sponging Mouthparts Some Flies

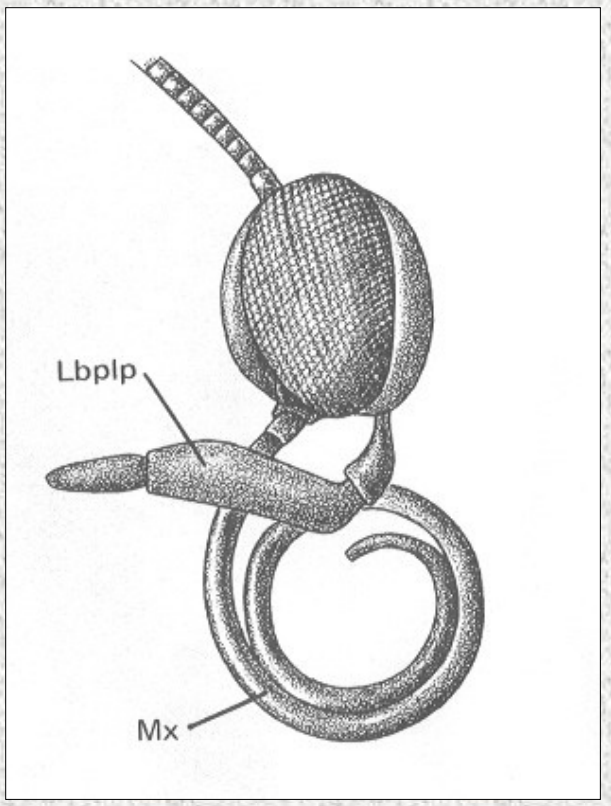




Sponging Mouthparts
Housefly



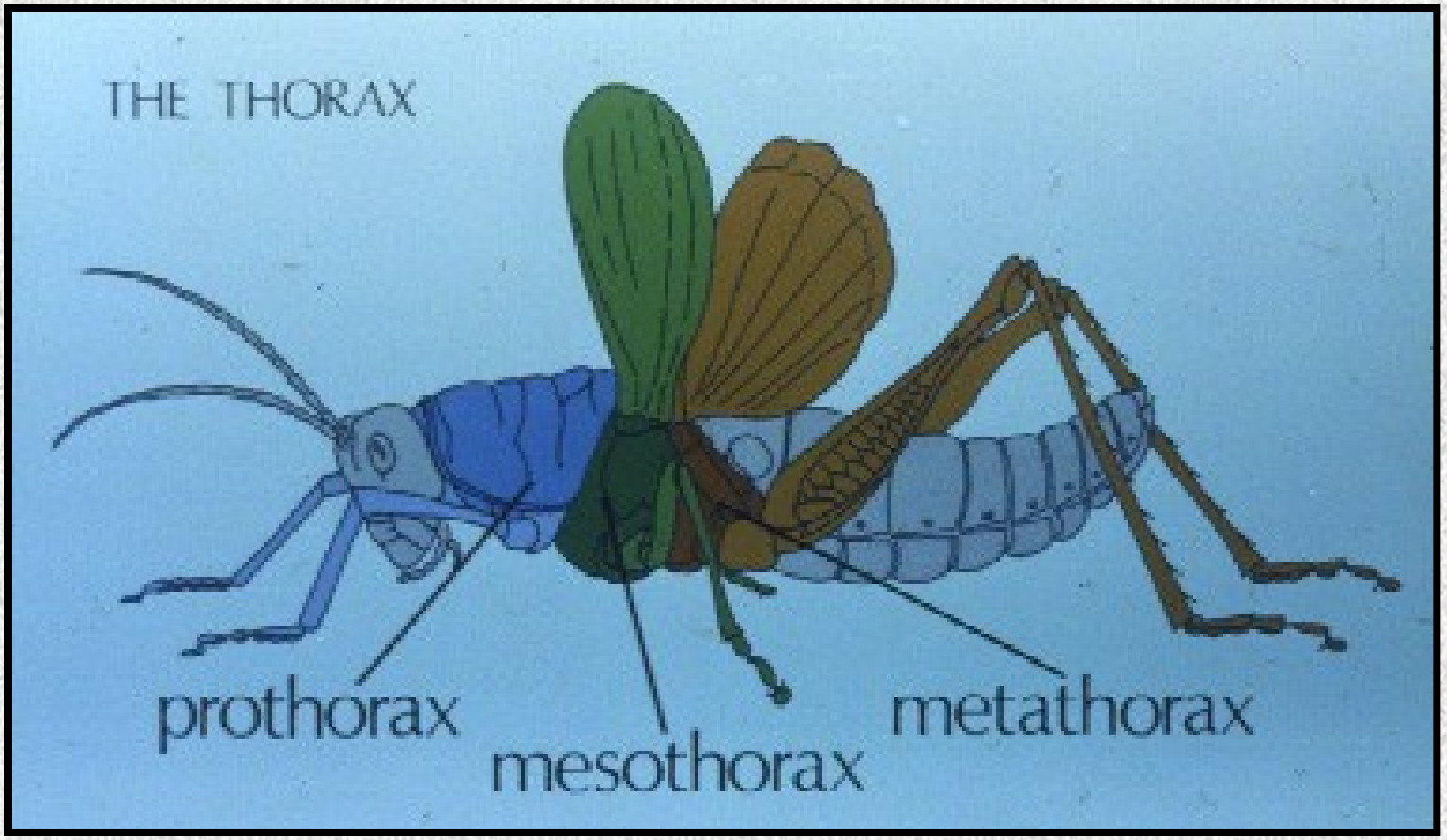
Siphoning Mouthparts
Moth and Butterfly Adults



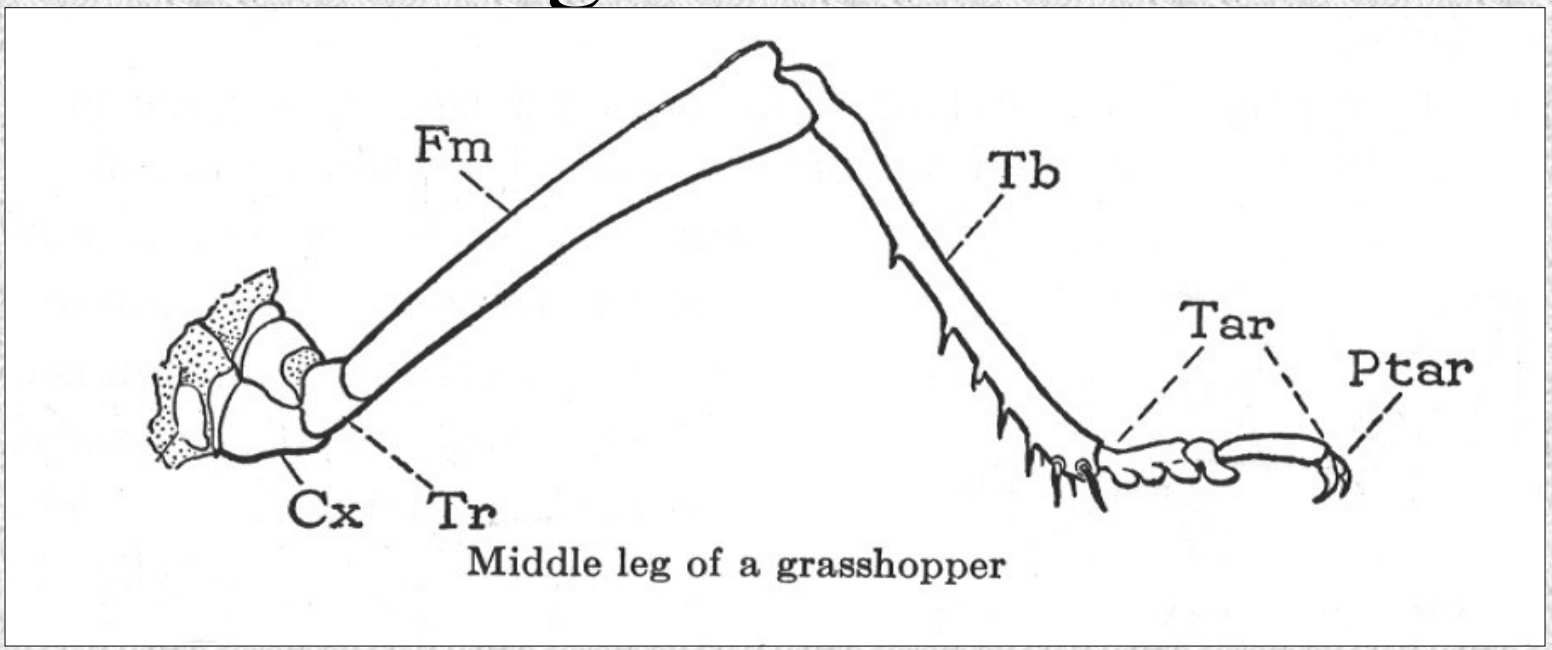
Insects and People
External Morphology

Chewing and Lapping Mouthparts
Bees

The Insect Thorax



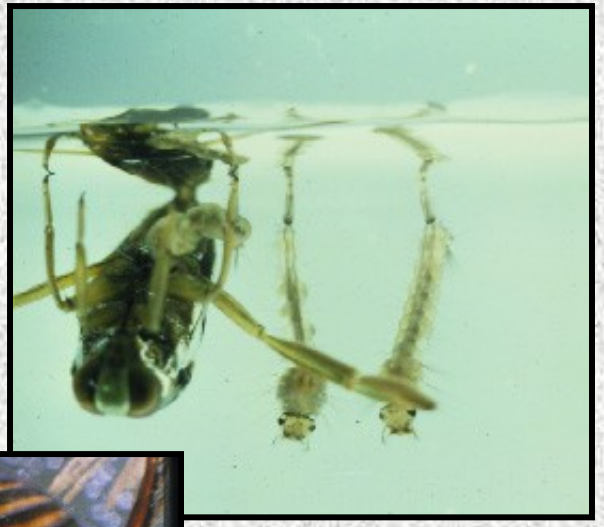
The Insect Leg



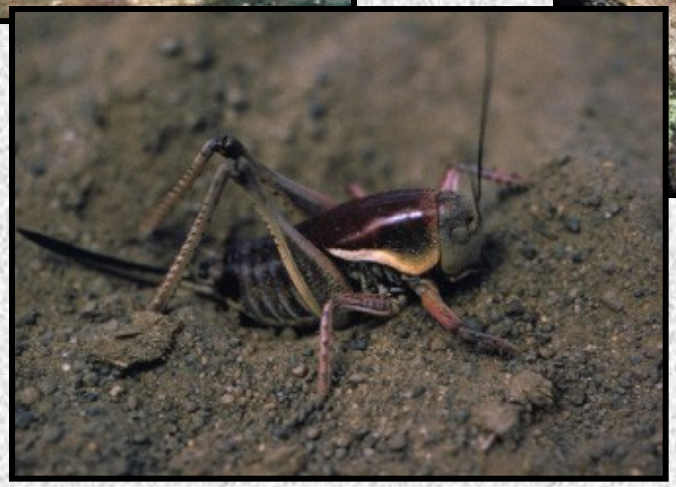
Middle leg of a grasshopper

Leg Modifications
Cursorial - Running

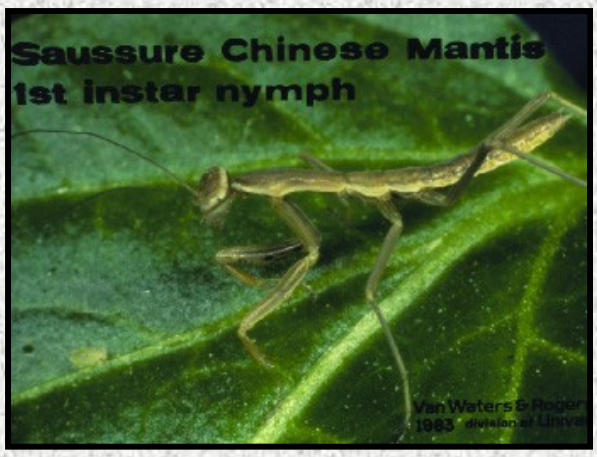
Leg Modifications
Natatorial - Swimming



Leg Modifications
Saltatorial - Jumping



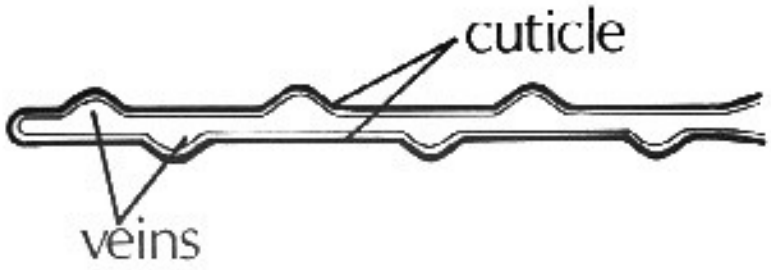
Leg Modifications
Raptorial - Grasping



Wings

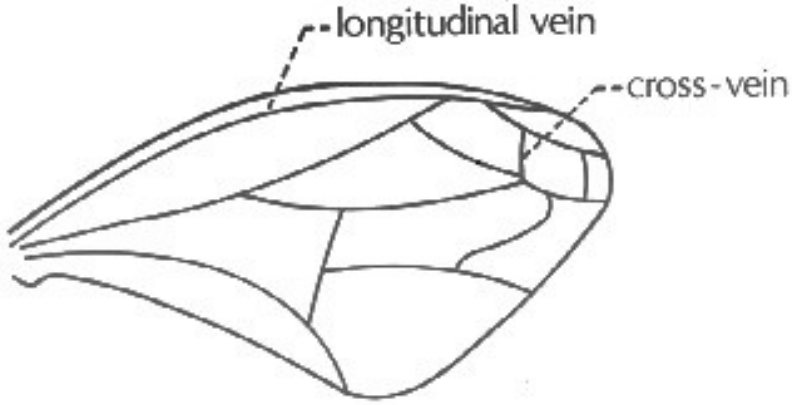
- Insects are among the few animals that can fly - an important development!
- Not all insects have wings
- Wing type varies - depends on need
- Wings are outgrowths of the cuticle

THE WING



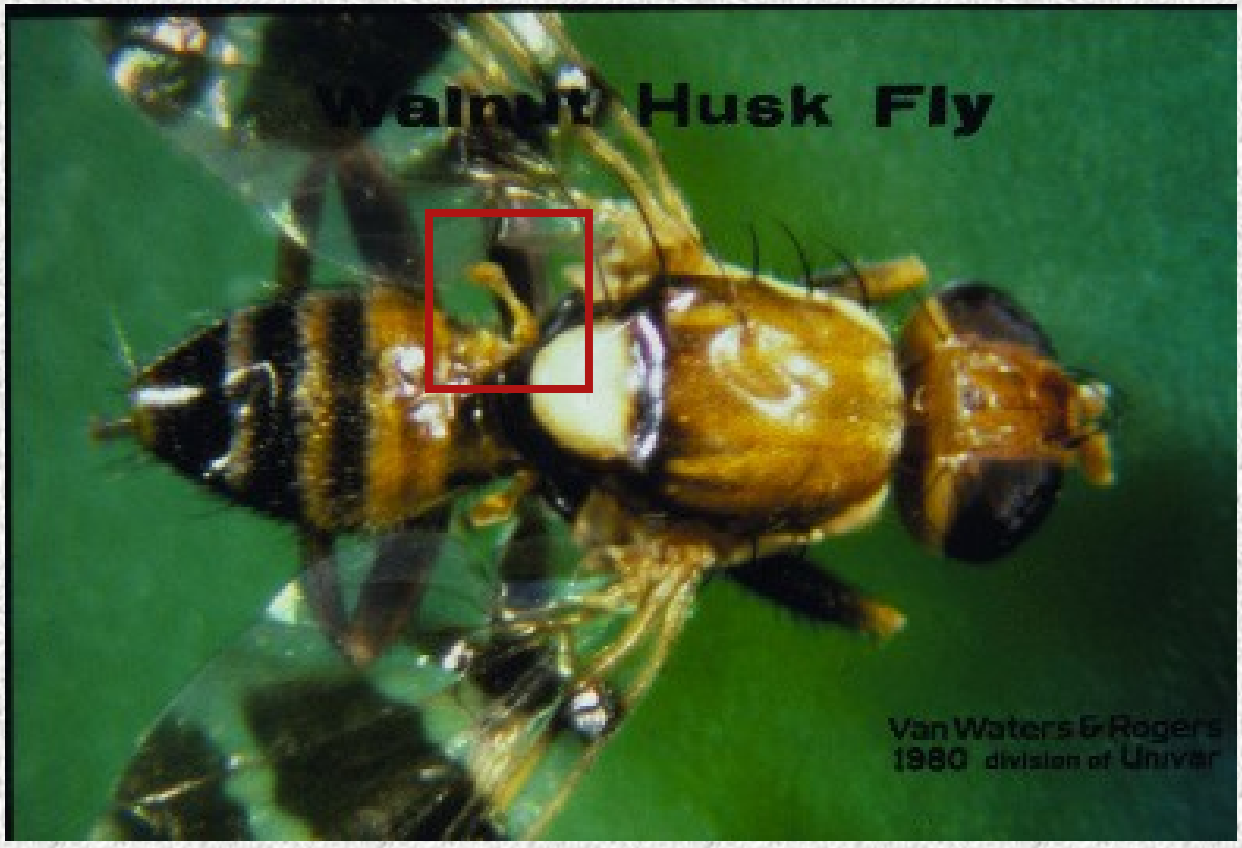
Cross-section of wing showing formation by fusion of two cuticular layers

TYPES OF VEINS



Membranous Wings

Membranous Wings
Flies with haltere

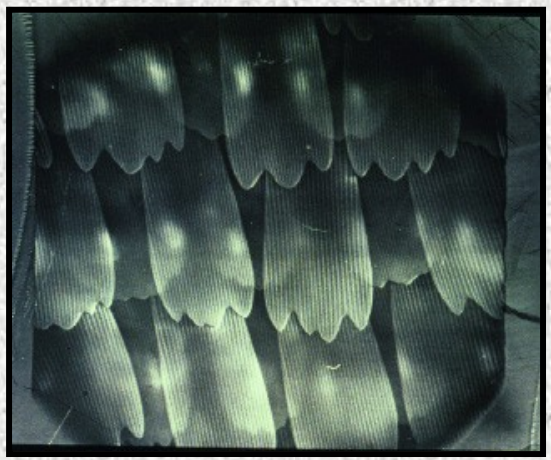


Tegmina "leather-like" forewing

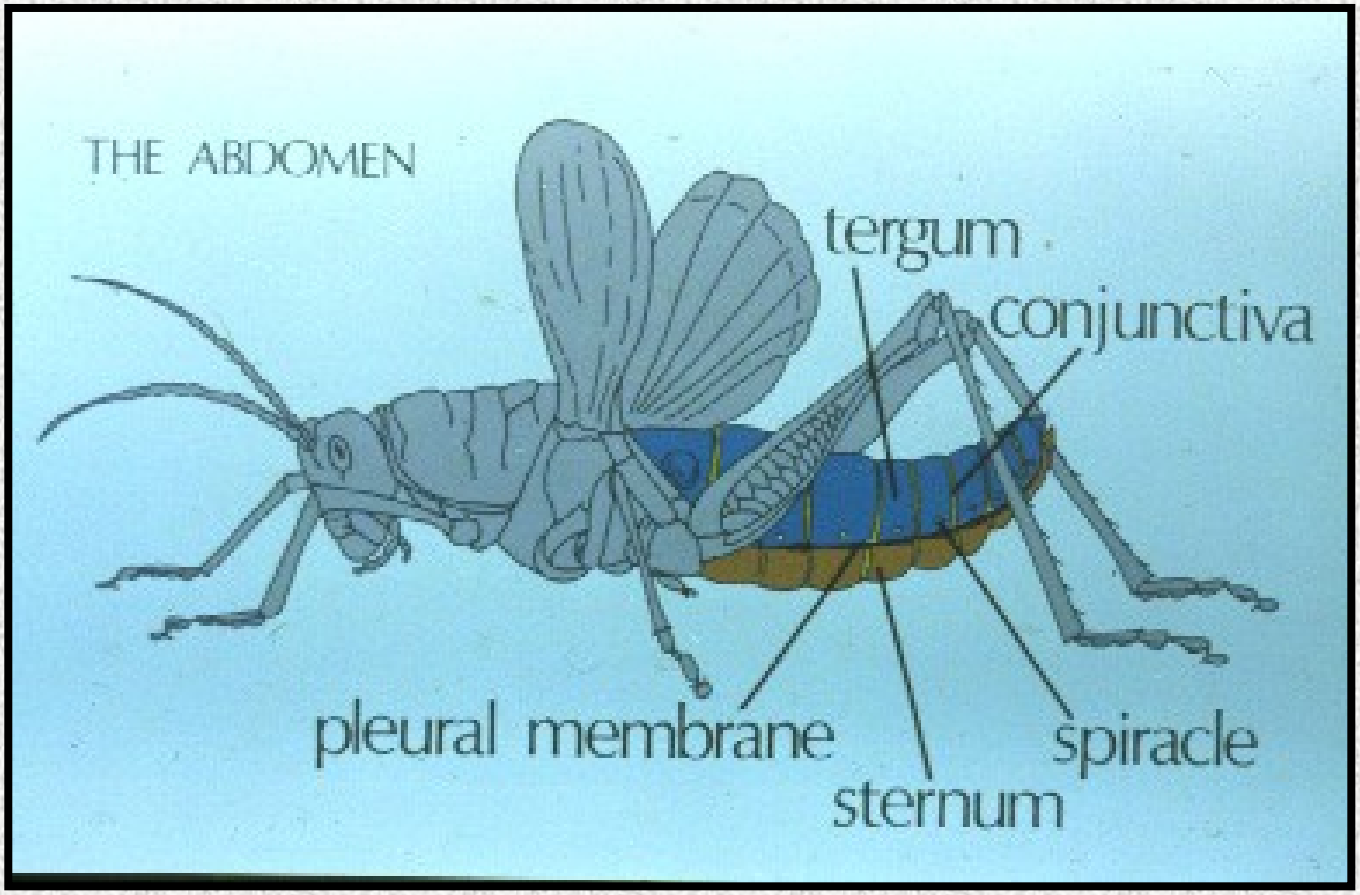
Hemelytron - “half-wing,” forewing
True Bugs

Elytron(a) - hardened front wing

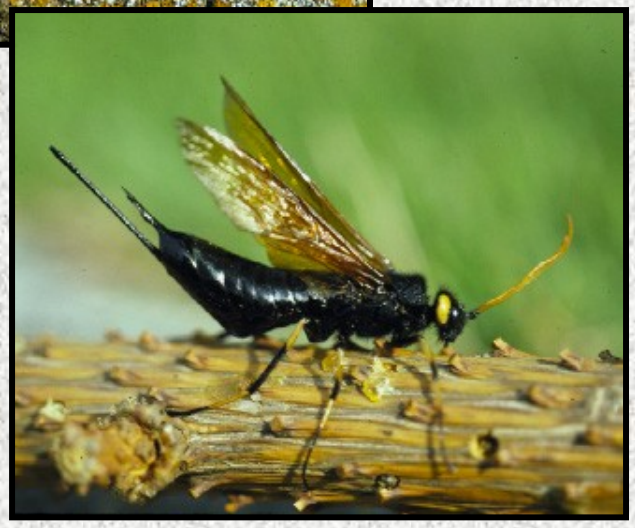
Scale covered wings



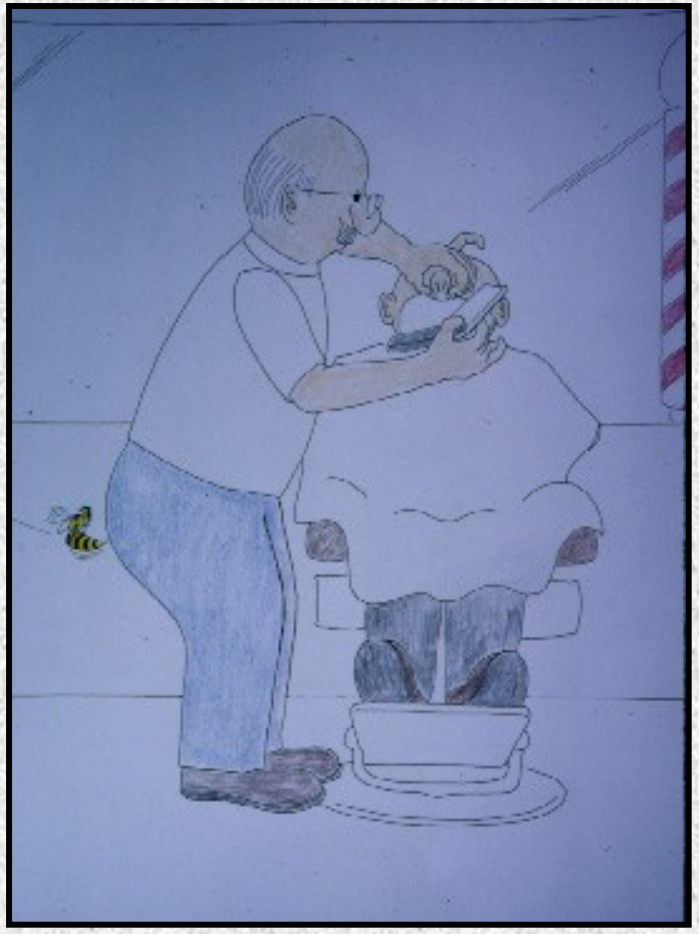
The Insect Abdomen
No walking appendages



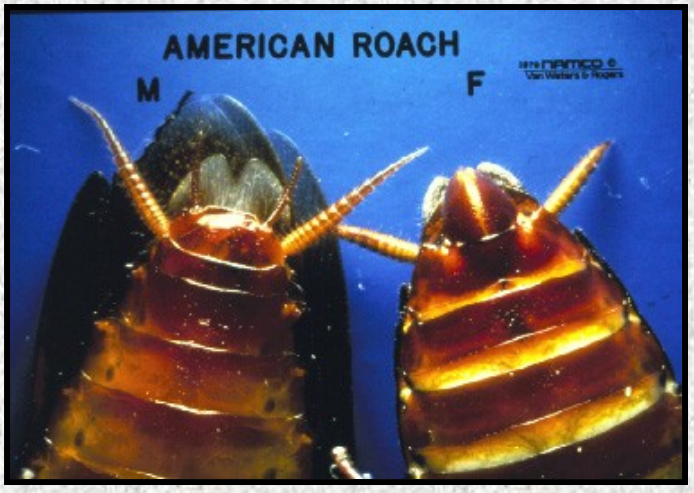
Ovipositor
Egg-laying device

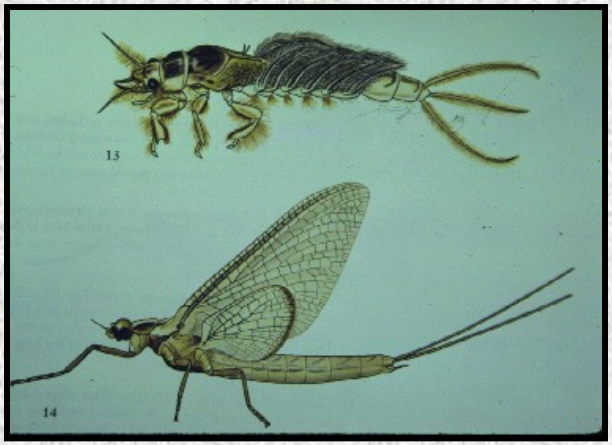


“Stinger”
A modified ovipositor



Cerci
Sensory structures





Insects and People
External Morphology