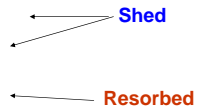


Insect Exoskeleton

View this link for a tutorial
Review both pages
<http://www.cals.ncsu.edu/8050/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



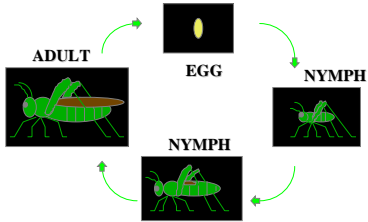
Cuticle Hardening

- 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

Kinds of Metamorphosis

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

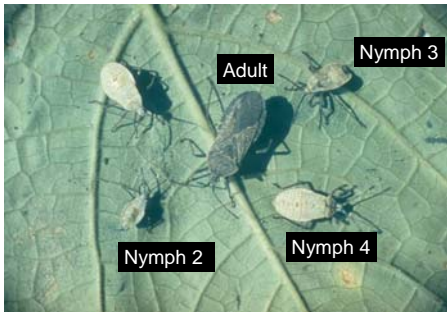
Incomplete Metamorphosis



Incomplete Metamorphosis

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

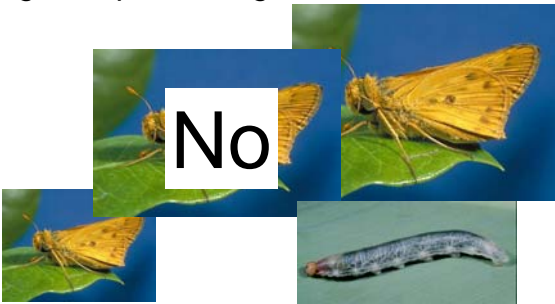
Example: Squash Bug



Do small butterflies
grow up to be big butterflies?



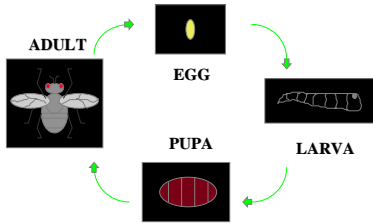
Do small butterflies
grow up to be big butterflies?



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 3rd pupa adult
instar larva

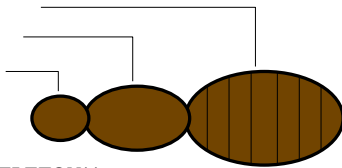
Insect Characteristics

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

Insects

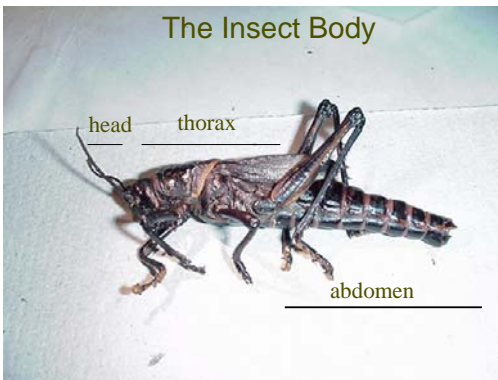
- 3 Distinct body regions

- Abdomen
- Thorax
- Head



****EXOSKELETON****

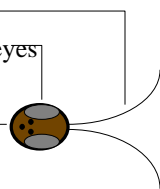
The Insect Body



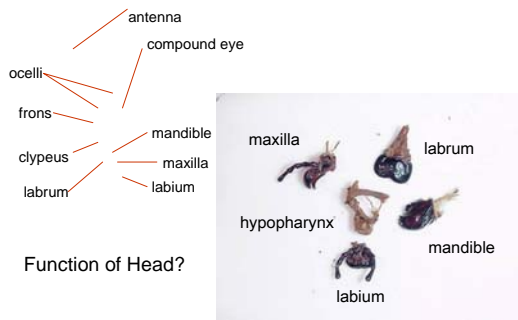
Head

(Perception and Ingestion)

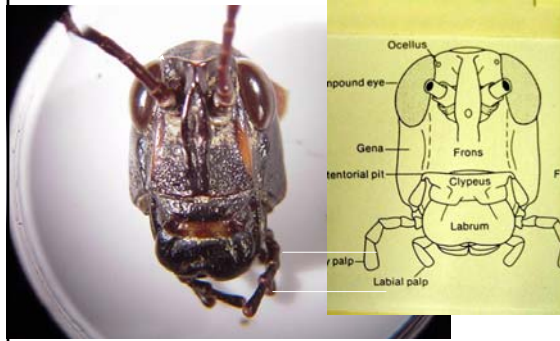
- 1 Pair of antennae
- 1 Pair of compound eyes
- Ocelli
- ****Mouthparts**



Lubber Grasshopper Head with Dissected Mouth



The Insect Head- Frontal



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 Opisthognathous



On predators, it can be folded
the posterior and extended to the
anterior to attack prey.

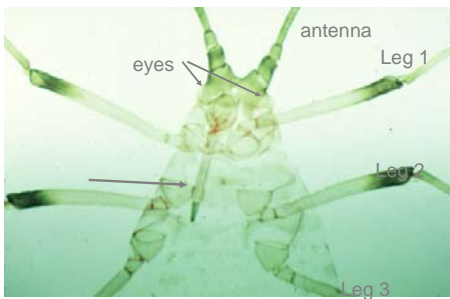


Fixed toward posterior (herbivore)

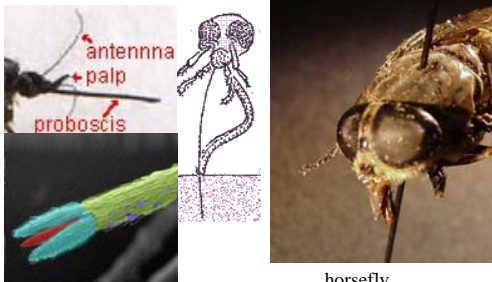
Piercing Sucking



Piercing-Sucking Mouthparts



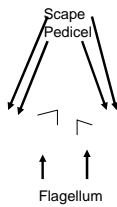
Diptera – fly mouth



Lepidoptera -- butterflies and moths



Modifications of the Antenna



<http://www.cals.ncsu.edu:8050/course/ent425/tutorial/antenna.html>

Filiform Antennae



Capitate antennae



Geniculate (bent) antennae



Lamellate Antenna of Scarab Beetle





