Announcements- lab quiz nov 9, lec quiz nov 11, factsheet nov 16, exam nov 18

Reading on life history evolution (Freeman and Heron pp359-362; pp382-386)

Developmental stages in detail

embryo

development triggered by activation
example from drosophila
division of nuclei (stage 1-4)
formation of blastoderm (stage 5)
gastrulation
segment formation
differentiation and migration of cells
formation of larva in egg

larva or nymph

habitat and food differentiation from adult depends on kind of metamorphosis
larvae of holometabolous insects can be classified into functional groups
polypod
thoracic legs
abdominal prolegs
many herbivores
lepidoptera/hymenoptera/scorpion flies

oligopod
thoracic legs
no abdominal prolegs
often have prognathous mouthparts
food habits
some predaceous with compound eyes
some herbivores
detritivores

apod
lack legs
hard to identify to order
sometimes predaceous, live in decaying material, parasitic
pupa
resting stages
non-feeding
sometimes enclosed
cacoon
puparium
metamorphosis or rearrangement of body plan occurs in pupa
at end of pupal stage, pupal skin encloses adult
pupal types
exarate
most pupae
appendages not closely pressed to body
decticous—articulated mandibles to cut out of pupa
adecticous—no mandibles, pupal cuticle shed first
obect
appendages cemented to body
cuticle heavily sclerotized
adult
wings
reproductive organs mature
may be long lived or may lack mouthparts
Overwintering stages
quiescence
halted or slowed development in response to environment
activity returns when environment becomes favorable
may occur during summer or winter
diapause
extended period of inactivity
physiological changes occur
slowing metabolism so feeding is not required
hemolymph changes so that freezing does not harm the insect
return to activity only after physiological changes
kinds

**obligatory**
- found in univoltine insects
- diapause may occur before mating and reproduction

**facultative**
- optional diapause
- generation that undergoes diapause changes from one year to another

stages

**egg, e.g. tent caterpillars**

**larva**

**pupa**—occurs in many insects, where the pupa is a closed system

**adult, e.g. leaf beetles**

environmental cues

- photoperiod
- temperature
- food quality
- moisture