LABORATORY EXERCISE 28:
Insect Development and Life History

As you are all aware, the winged or pterygote insects may be further subdivided into those with complete metamorphosis (**Endopterygota** or **Holometabola**) and those with incomplete metamorphosis (**Exopterygota** or **Hemimetabola**); the formal names refer to the fact that the latter group exhibits wing development by evagination -- i.e., of the external type, while the former group shows wing development by invagination -- i.e., of the internal type.

Examine a few of the life stages of an insect of the hemimetabolous type. All orthopteroids, including cockroaches and grasshoppers, fall into this category. The young stages or **nymphs** of such insects closely resemble the adults; the wings of the adult stage may be seen as external wing pads present on the body of the final nymphal instar (an instar is considered to be the time interval spent between molts). Live colonies with all life stages, including eggs encased in oothecae, of *Blaberus* spp. and *Periplaneta americana*, are available for examination. The ecological niche of the nymph is identical to that of the adult in these particular insects.

Some insects of the hemimetabolous type show greater disparity of both morphology and niche between nymph and adult. Examples of these include insects like stoneflies (Neoptera: Orthopteroidea: Plecoptera), damselflies and dragonflies (Paleoptera: Odonata), and mayflies (Paleoptera: Ephemeroptera), all of which have aquatic nymphs or **naiads**. Examine some examples of such special life cycles, on demonstration. Some non-aquatic insects also show divergent nymphal forms, for example, the "17-year locust" (Hemiptera: Homoptera: Cicadidae: *Magicicada*). Immatures of the cicada burrow about within the soil feeding on the xylem fluids in roots, while adults are arboreal and feed on stem fluids. Make a drawing (**Drawing #53**) of the head and thoracic region of *Magicicada* nymphs (**part A**) and adults (**part B**), lateral view, showing especially the difference between the front legs of the two life stages.

Primitively wingless insects or Apterygota, including zygentomid and microcoryphian thysanurans, are classified as **Ametabola**, because they have no metamorphosis *per se*.

Insects with complete metamorphosis (Holometabola or Endopterygota) pass through a dormant or semi-dormant extra life stage known as the **pupa**; during this stage extensive tissue reorganization takes place. More primitive insects of this type display "free" or **exarate** pupal forms that are often capable of walking: examine specimens of a dobsonfly (Neuropteroidea: Megaloptera: Corydalidae: *Corydalus*) on demonstration. Exarate pupae with biting mandibles for escaping from the cocoon are called **decticous** pupae. Some Diptera have exarate pupae that pupate in the hardened larval skin or puparium; these are referred to as **coarctate**. Some higher insects have immoveable or **obtect** pupae with appendages glued tightly against the body. All obtect pupae and some exarate ones are **adecticous**, lacking functional cutting mandibles. Examine the obtect pupae of some lepidopterans (butterflies & moths).

True holometabolous immatures or **larvae** may be distinguished from nymphs or naiads by the possession of stemmata (rather than compound eye) and invaginated wing pads. Examine the larval stages of a white-faced hornet (Hymenoptera: Vespidae); note the wing pads that are visible in **pharate** specimens -- i.e., those in which the pupa is fully formed beneath the larval skin. Also, make a drawing (**Drawing #54!**), lateral view, of the head of a lepidopteran larva, showing the clump of lateral stemmata.