INSECT MORPHOLOGY
Lab 4 - Insect Mouthparts.

A. Chewing Mouthparts - Grasshopper.

1. Carefully remove the mouthparts from a grasshopper head left from last week's laboratory by using the following procedure:

- Place the grasshopper under the microscope with the face downward and the foramen magnum towards you. Using a sharp scalpel or razor blade cut through the membrane separating the foramen magnum from the labium. Then cut along each side of the labium being careful to stay in the membranous area between the labium and each maxilla. The labium should then come free. It is in one piece, but represents a pair of mouthparts that have fused together.

- Then cut around each maxilla also being careful to stay in the membranous area so that you do not damage the mouthparts. Each maxilla should then come free.

- The next pair of mouthparts is the mandibles. These are the toughest to remove. They are firmly attached by strong muscles for chewing. But if you carefully work the scalpel or razor blade around all sides and particularly around the lateral corners the each mandible should then come free.

- Finally, turn the grasshopper head over so the face is towards you. Carefully cut the labrum free by cutting just above the clypeo-labral suture.

2. Examine the **labrum** under the microscope and **prepare a drawing of the anterior view of the labrum.**

3. Examine the **mandibles** under the microscope. Notice that each mandible is divided into 2 regions. Distally the teeth form a more or less single sharp-edged row and forms the **incisor area**. Proximally, there are several irregular rows of teeth with flattened areas between them; this is the **molar area. Prepare a drawing of the left mandible in anterior view labeling the 2 different areas described above.**

3. Prepare a drawing of the anterior view of the left maxilla labeling the underlined structures discussed below:

- Distally the maxilla is divided into 2 lobes. The lateral (distal) lobe with a rounded apex is the **galea**, while the medial lobe with the 2-3 sharp teeth is the **lacinia.** The large sclerite that the galea and the lacinia are attached to is the **stipes.** The smaller sclerite that is proximal to the stipes and attaches to the head of the grasshopper is the **cardo.** Laterally is the 5-segmented **maxillary palpus.** The basal region where the maxillary palpus attaches to the stipes is called the **palpifer.**

4. Prepare a drawing of the posterior (external) view of the labium labeling the underlined structures discussed below:

- Near the middle of the labium is a transverse membranous area or suture that divides the labium into a proximal half and distal half. This suture is called the **labial suture.** The proximal half of the labium is called the **postlabium**, while the distal half is called the **prelabium.** The postlabium itself can divided into 2 parts by another transverse impressed line near its middle. The basal half of the postlabium which attaches to the grasshopper head near the foramen magnum is called the **submentum**, while the distal portion that is located between the submentum and the prelabium is the **mentum.**

- The prelabium is divided into 3 basic regions. The large basal plates connecting with postlabium is called the **prementum.** The prementum has 4 lobes coming off its distal margin. the 2 large lateral lobes are called the **paraglossae**, while the 2 very small medial lobes are called the **glossae**. Together

the glossae and paraglossae are known as the **ligula.** The 3rd region is the **labial palps** that originate near the base of the prementum. The basal region where each labial palpus attaches to the prementum is called the **palpiger**.

B. Chewing-Lapping Mouthparts - Honey Bee.

- The honey bees are in alcohol. Select a specimen that has the mouthparts extending straight downward (Note - many of the specimens have the mouthparts extending posteriorly below the body - you will not be able to draw them properly). Carefully remove the head and place it under the microscope with its anterior face towards you. See demonstration on how all of the different mouthparts should be separated. **Prepare a drawing of the honey bee mouthparts labeling the following underlined characters:**

- The frontal aspect of the honey bee head bears a short, wide sclerotized plate ventrally called the **labrum.** Laterad on each side of the labrum are triangular structures which curve around the labrum and nearly meet medially. These are the **mandibles**; the mandibles will be rather stout basally, narrower medially, and then somewhat expanded distally - the distal region is not toothed, but rather is more knife-like, and is used for modeling and shaping was in the hive.

- Protruding ventrally from within and just behind the mandibles are 5 long thin structures that are collectively called a **proboscis**. The extreme lateral pair, one on each side, are the **maxillae**. It will be difficult to see the cardo, but you should be able to see the basal **stipes** and then the more distal, mesally concave **galea**. The remaining maxillary parts are very reduced or obsolete - the lacinia is represented by a small membranous lobe on the mesal edge of the stipes, and the palpus consists of two minute segments on the lateral edge near the origin of the galea.

- The remaining 3 central structures are all part of the **labium.** The lateral structures of the labium, also one on each side, are the **labial palps** (the area where they attach to the prementum is called the **palpiger**), while the central structure corresponds with the postlabium and prelabium of the grasshopper labium. The labial palps are composed of 4 segments - the first segment is the longest, the second is shorter, and the distal 2 segments are quite small. The basal portion of this central structure (which is often covered by the mandibles) is the **mentum**. Just distad of the mentum is the **prementum**, and then just distad of where the labial palps are attached to the labium there are 2 flap-like structures which seem to curve around the labium. Each flap-like structure is the **paraglossa.** The portion of the labium distad to the paraglossae are the **glossae** (0r sometimes called the tongue) which ends in a small fleshy lobe called the **flabellum.**

C. Siphoning Mouthparts - Moth

- Prepare a frontal view of a moth head and mouthparts. The mouthparts of the typical lepidopteran are quite simple. The **labrum** is always reduced, sometimes barely visible below the large clypeus. In most species, including the one used in this laboratory, the mandibles are entirely lacking. The **proboscis** is a long coiled affair composed of two lateral pieces, the greatly enlarged terminal lobes of the maxillae, probably the **galeae**. If you remove the proboscis carefully, you may see the small cardo and stipes. A rudimentary palpus is often present but the laciniae are absent. The food canal is produced between the galeae. The **labium** is reduced to at most a small flap. The **labial palpi** are well developed and are 3-segmented.

D. Sucking Mouthparts - Cicada

- Prepare a drawing of the Cicada mouthparts with the stylets teased apart. The cicada is best studied when recently emerged specimens are available. As ours are preserved, the dissection of the four slender stylets held within the labial gutter may be difficult. The anterior face of the cicada bears a large bulging median sclerite usually called the “postclypeus,” but is probably more correctly composed of two fused sclerites and should be called the frontoclypeal sclerite (composed of the frons and the postclypeus). Ventral to this is a smaller median sclerite, the **anteclypeus**. Lateral to these two sclerites there is a pair of elongated sclerites known as the lora or mandibular plates. Lateral

and posterior to the lora on each side is a large scleritized plate which extends ventrally from the compound eyes, called the maxillary plate. Evidence indicates that the maxillary plates are derived from the maxillary stipites which are completely fused with the postgena.

- The **labrum** of the cicada is small, elongate, and somewhat triangular, and it attaches to the **anteclypeus** and closes the opening at the base of the labium. The long beak or **proboscis** projects ventrally and posteriorly. From developmental studies, we know that the maxillary plate immediately posterior to the lorum is derived from the maxilla, specifically the stipes. The maxillary palpus is not present. The lorum is a sclerite between the maxillary plate and the clypeus; it has no morphological significance when compared, for example, with the lorum in *Apis*. The beak, itself, is composed of four very slender stylets and the cylindrical **labium**; in the cicada the labium is 3-segmented, in some Heteroptera it will be 4-segmented. The lateral stylets are extensions of the **mandibles**. The median pair of stylets belong to the **maxillae**. The stylets at rest lie within a groove or gutter along the midline of the labium. When the insect is feeding, it is only the stylets that are inserted into the plant (or animal in the case of predators) tissue; the labium folds back on itself and does not penetrate into the tissue. The maxillary stylets come together to form two canals, the food canal and the salivary canal. There is a small median hypopharynx which will not be visible in our specimens. It should be noted, however, that according to Snodgrass, the lorum is an upward extension of the hypopharynx.

E. Sponging Mouthparts - House Fly (*Musca domestica*)

- You will be provided with fly heads that have been treated in KOH to soften the tissues, and to make the mouthparts a little easier to see. To help orient yourself: the antennae lie, at rest, in a median depression of the face which is bound laterally by two sutures running from the antennal sockets to the ventral edge of the cranium; this depressed medial sclerite is the frons, and the sutures are the frontogenal sulci (or frontal suture). The proboscis consists of three parts: 1) the proximal rostrum, 2) the haustellum, and 3) the distal labellum.

- The **rostrum** is largely membranous, broadest at the base, and tapering distally. There is a somewhat horseshoe-shaped sclerite basally that is thought to be the **clypeus**. The exact homologies of the rostral parts are still very obscure. It is thought to be composed of both clypeal, labial, genal and postgenal elements. Just beyond the tips of the arms of the clypeus are attached a pair of small unsegmented appendages, the **maxillary palpi**. The stipites are very small and obsolete, the remainder of the maxillae and the mandibles are completely absent.

- The **haustellum** is primarily the **prementum**, the anterior wall is excavated to form the labial gutter. The **labrum** is attached to the distal edge of the rostrum and forms a cover over the labial gutter. The food channel is formed on the inner surface of the labrum.

- The **labellum** is a pair of lobes attached to the distal end of the haustellum. They are united posteriorly, but are unattached anteriorly.