

# Basic Morphology of an Insect Head

Elsayed Metwally\*

Department of Cytology and Histology, Suez Canal University, Suez Canal, Egypt

## Editorial Note

An arthropod is an invertebrate animal having an exoskeleton, a segmented body, and paired jointed appendages. Arthropods form the phylum Euarthropoda, which includes insects, arachnids, myriapods, and crustaceans.

All arthropods possess exoskeleton which is a hard protective covering around the outside of the body, divided by sutures into plates called sclerites; A Segmented body; Jointed limbs and jointed mouthparts- that allow extensive specialization; Bilateral symmetry is a central line that can divide the body into two identical halves-left and right; Ventral nerve cord is opposed to a vertebrate nerve cord which is dorsal; A Dorsal blood pump.

## Head

The head of an insect is composed of mainly rigid sclerites or sclerotized segments. The insect head is a capsule that contains the compound eyes, simple eyes (ocelli), mouthparts, and antennae.

### Compound eyes and ocelli

In most insects there is one pair of large, prominent compound eyes composed of units called ommatidia. There may be up to 30,000 ommatidia in a compound eye. This type of eye gives less resolution than the vertebrate eye, but it gives acute perception of movement. When present, ocelli, detect lowlight or small changes in light intensity.

### Mouthparts

The four main mouthparts are the labrum, mandibles, maxillae (plural maxilla) and labium. The labrum is a simple fused sclerite, often called the upper lip, and moves longitudinally. It is hinged to the clypeus. The mandibles, or jaws, are highly sclerotized paired structures that move at right angles to the body. They are used for biting, chewing and severing food. The maxillae are paired structures that can move at right angles to the body and possess segmented palps. The labium often called the lower lip, is a fused structure that moves longitudinally and possesses a pair of segmented palps. Mouthparts vary greatly among insects of different orders but there are two main functional groups: mandibulate and haustellate. Haustellate mouthparts can be further classified as piercing-sucking, sponging, and siphoning.

Mandibulate mouthparts are used for biting and grinding solid foods. Examples: Dragonflies and damselflies of order Odonata, termites of order

Isoptera, adult lacewings of order Neuroptera, beetles of order Coleoptera, ants of order Hymenoptera, cockroaches of order Blattaria, grasshoppers, crickets and katydids of order Orthoptera, and caterpillars of order Lepidoptera. Adult Lepidoptera have siphoning mouthparts. Haustellate mouthparts are primarily used for sucking liquids and can be broken down into two subgroups: those that possess stylets and those that do not. Stylets are needle-like projections used to penetrate plant and animal tissue. The modified mandibles, maxilla, and hypopharynx form the stylets and the feeding tube. After piercing solid tissue, insects use the modified mouthparts to suck liquids from the host. To the left is a diagram of cicada mouthparts. Some haustellate mouthparts lack stylets. Unable to pierce tissues, these insects must rely on easily accessible food sources such as nectar at the base of a flower. One example of non-styletate mouthparts are long siphoning proboscis of butterflies and moths. Although the method of liquid transport differs from that of the Lepidopteran proboscis, the rasping-sucking rostrum of some flies is also considered to be haustellate without stylets. Piercing-sucking mouthparts are used to penetrate solid tissue and then suck up liquid food. Examples: Cicadas, aphids, and other bugs of order Hemiptera, sucking lice of order Phthiraptera, stable flies and mosquitoes of order Diptera. Siphoning mouthparts lack stylets and are used to suck liquids. Examples: Butterflies, moths and skippers of order Lepidoptera, bees of order Hymenoptera. Larval Lepidoptera have chewing mouthparts. Sponging mouthparts are used to sponge and suck liquids. Examples: House flies and blow flies of order Diptera.

### Antennae

Antennae function almost exclusively in sensory perception. Some of the information that can be detected by insect antennae includes: motion and orientation, odor, sound, humidity, and a variety of chemical cues. Antennae vary greatly among insects, but all follow a basic plan: segments 1 and 2 are termed the scape and pedicel, respectively. The remaining antennal segments (flagellomeres) are jointly called the flagellum. Aristate antennae are pouch-like with a lateral bristle. Examples: House and shore flies. Capitate antennae are abruptly clubbed at the end. Examples: Butterflies of order Lepidoptera. Clavate antennae are gradually clubbed at the end. Examples: Carrion beetles of order Coleoptera. Adult carrion beetles feed on decaying animal matter or maggots. Filiform antennae have a thread-like shape. Examples: Ground and long horned beetles, cockroaches. Geniculate antennae are hinged or bent like an elbow. Examples: Bees and ants of order Hymenoptera. Lamellate or clubbed antennae end in nested plates. Examples: Scarab beetles, Moniliform have a bead like shape. Examples: Termites, Pectinate antennae have a comb-like shape. Examples: Fire-colored beetles and fireflies, plumose antennae have a feather-like shape. Examples: Moths and mosquitoes.

\*Address for Correspondence: Elsayed Metwally, Department of Cytology and Histology, Suez Canal University, Suez Canal, Egypt; Email: sydmetwally220@yahoo.com

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