THE HEAD THE HEAD

(Source: A TEXT BOOK OF ENTOMOLOGY by HERBERT H. ROSS, *Chapman & Hall Limited, London*)

The head comprises the anterior body region of an insect. It is normally a capsule with a sclerotized upper portion, which contains the brain, and a membranous floor, in which is situated the oral opening or mouth.

ORIGIN. The insect head is a composite structure. It consists of a primeval area or prostomium anterior to the mouth, to which have fused the first four postoral segments. So complete is this fusion that little evidence remains to indicate the origin of the parts. Evidence from both phylogeny and embryology indicates clearly that in insects the first postoral segment (sometimes called the intercalary segment) has no appendages except rudimentary ones in the embryo, and that the next three postoral segments bear the mandibles, maxillae, and labium, respectively.

There is considerable difference of opinion among various investigators concerning the origin and composition of the prostomium. Some believe that it consists only of a primeval head area, but others believe that it consists of a primeval head area to which one or more primeval segments fused very early in oncopodan or arthropod evolution. These differences of opinion are based on various interpretations of embryological evidence and innervation of head structures in Annelida and Arthropoda.

POSITION. The head may assume various positions in relation to the long axis of the body. These positions are frequently used in classification. The two most important positions have been given definite names:

HYPOGNATHOUS: The mouthparts are directed downward, and the head "segments" are in the same position as the trunk segments. This is the generalized condition.

PROGNATHOUS: The head is tilted up at the neck so that the mouthparts project forward.

HEAD ORGANIZATION AND APPENDAGES. In a typical hypognathous head, the anterior region or face, the dorsal portion, and lateral portion form a continuous sclerotized capsule which is open beneath, like an inverted bowl. On this capsule are situated a pair of compound eyes, three ocelli, and a pair of antennae. The labrum hangs down from the lower front margin of the capsule to form a flap in front of the mouth. The ventral portion of the head forms a membranous floor posterior to the mouth; from this floor arises the hypopharynx, bearing the opening of the salivary duct. On each side of this floor hang down the three pairs of appendages forming the chewing organs or mouthparts, consisting of the mandibles, maxillae, and labium. These articulate with the ventral margin of the capsule. The posterior portion of the head is shaped like an inverted horse shoe,

the capsule forming the dorsal and lateral portion, the labium closing the bottom of the shoe; the open center is called the occipital foramen, through which pass the oesophagus, nerve cord, salivary duct, aorta, tracheae, and free blood. Inside the head is a series of braces called the tentorium.

SPECIAL STRUCTURES OF THE HEAD CAPSULE

COMPOUND EYES: are usually large many-faceted structures situated on the dorsolateral portion of the capsule. Each eye is situated on or surrounded by a ring like or shelf like *ocular sclerite.* In many forms, especially larvae, the eyes are reduced to a single facet. In certain larvae they are represented by a group of separate facets, and the group is called an *ocularium.* In adult insects the number of facets may be extremely large. The housefly has about four thousand facets to an eye, and some beetles about twenty-five thousand.

OCELLI are three single-faceted organs situated on the face usually between the compound eyes. The upper two are arranged as a pair, one on each side of the meson, and are called the lateral ocelli. The lower one is on the meson and is the median ocellus.

ANTENNAE are a pair of movable segmented appendages which arise from the face, usually between the eyes. They articulate in the antennal socket, which is sometimes surrounded by a narrow ring like antennal sclerite. The periphery of the socket has a small projection which the antenna articulates. Antennae are extremely varied in shape, and names have been applied to the more striking types. A few examples are listed here:

Filiform or thread like.
Setaceous or tapering.
Moniliform or bead like.
Serrate or saw like.
Clavate or clubbed.
Capitate or having a head.
Lamellate or leaf like.
Pectinate or comb like.

Labrum is the movable flap attached to the ventral edge of the face. The inner side of the labrum forms the front of the preoral cavity and is called the epipharynx. The epipharynx frequently bears raised lobes and complicated sets of sensory papillae and setae. These have proved very useful to the taxonomist as an aid in the identification of larval forms.

PRINCIPAL SUTURES AND AREAS. The head capsule is subdivided by several sutures. Most of these are considered secondary developments following the obliteration of the original segmental sutures. The principal head sutures and adjacent areas are as follows:

VERTEX is the entire dorsum of the head between and back of the eyes.

EPICRANIAL SUTURE is a Y-shaped suture whose stem begins on the back of the head, crosses the vertex, and forks on the face. The stem is called the epicranial stem; the two arms of the forked portion are the epicranial arms. These sutures are not fundamental divisions of the head but are lines of weakness associated with the bursting of the head capsule at molting. Because of their function, they are sometimes- termed *ecdysial sutures.* In different groups of insects these sutures may cross quite different regions of the head. The sutures are most pronounced in the immature stages, as would be expected, but often occur in adults also. In spite of their lack of uniformity in different groups, these sutures are often of great use as landmarks or taxonomic characters within a group.

FRONS OR FRONT is the area on the anterior face which lies between or below the epicranial arms. The median ocellus occurs on this sclerite. It is bounded ventrally by the *frontoclypeal suture.*

CLYPEUS is the liplike area between the frontoclypeal suture and the labrum. It never articulates with the frons but is joined solidly with it. The *labrum* hangs below it and articulates by means of the membranous connection between them.

GENA is the lower part of the head beneath the eyes and posterior to the frons. There is sometimes a *genal suture* on the anterior portion of the face between the frons and gena; if this suture is absent, the division between frons and gena is indefinite. The area directly posterior to the eyes is called the postgena; there is no definite division between postgena and vertex or post gena and gena.

OCCIPUT is the area comprising most of the back of the head. It is divided from the vertex and genae, by the *occipital suture;* in many groups this suture is either reduced to a crease of completely obliterated in which case the occiput can be defined only as a general area merging anteriorly with vertex and gena.

POST-OCCIPUT is the narrow ringlike sclerite which forms the margin of the occipital foramen. It is separated from the occiput by the *postoccipital suture,* almost universally present in adult insects. The postocciput bears the *occipital condyle* on which the head articulates with the cervical sclerites of the neck region.

TENTORIUM. The head is strengthened internally by a set of sclerotized apodemes or invaginations of the body wall which have evolved primarily as more rigid supports for the attachment of muscles connected with the mouthparts. In the apterygote insects and their allies the centipedes, the apodemes are more or less platelike or rodlike structures sometimes connected by ligamentous bridges. In the ancestors of the pterygote insects these structures enlarged, fused, and evolved into a strong internal skeleton of the head called the *tentorium.* Typically the tentorium is composed of four principal parts: the *anterior arms, posterior arms, corporotentorium* or central mass, and *dorsal arms.* The anterior arms are invaginated from the *anterior tentorial pits,* which usually are well defined externally as pits at each lower corner of the frons. The posterior arms are

invaginated from the *posterior tentorial pits* which almost always persist as external slits on the postoccipital suture. The corporotentorium represents the inward extension, meeting, and fusing of the anterior and posterior arms. The dorsal arms are considered as secondary outgrowths of the anterior arms, because there is no large or persistent pit associated with their point of attachment with the head capsule, which is usually between the antennal sockets and lateral ocelli. The shape and relative position of the tentorial parts are extremely different in various groups of insects.

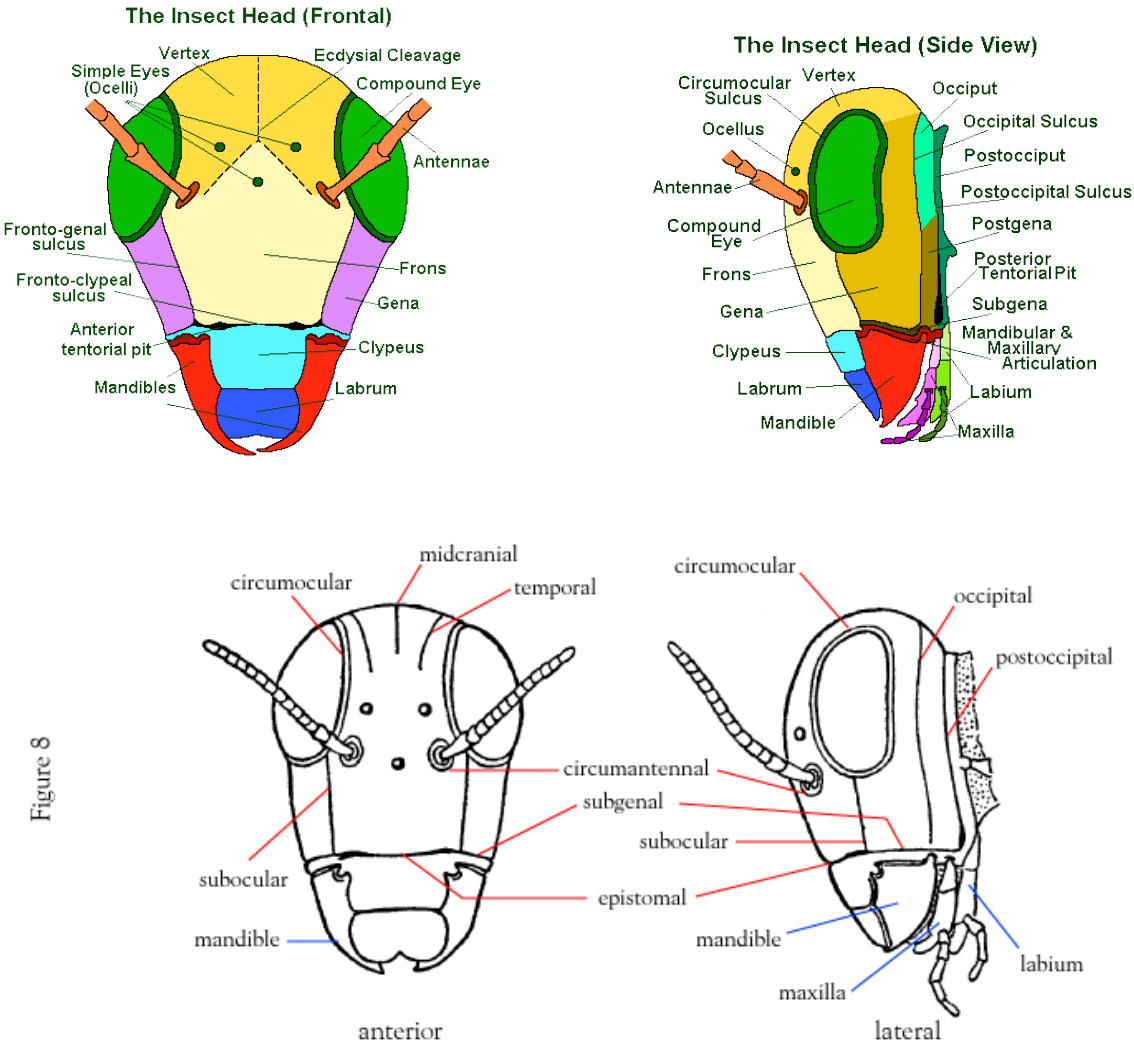
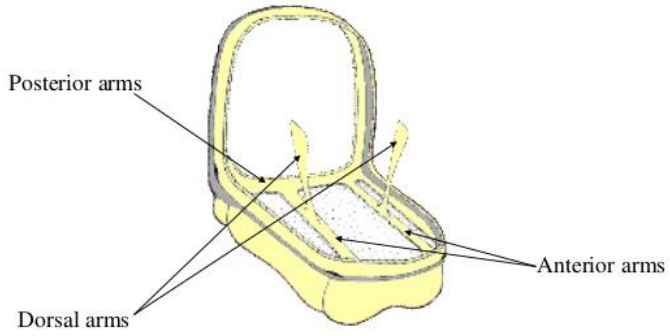


Figure 8

Generalized head of an orthopteroid insect showing major sulci or "sutures"

Tentorium

- internal support for the head capsule



Cut away view of the head capsule