General Entomology **College of Education**

Lecture: 8

The abdomen:

Abdomen forms the posterior part of the insect body. Atypical abdominal segment, consist of a sclerotized tergum and sternum jointed by membranous pleural region which are commonly hidden beneath the sides of the tergum. The basic number of segments in the abdomen is 11, plus the post segmental telson, which bears the anus. In general, more segments are visible in the more generalized hemimetabolous orders than in the more specialized holometabolous insects. Thus, in Acrididae all 11 segments are visible (Fig. 1a), whereas in adult Muscidae only segments 2–5 are visible and segments 6–9 are normally telescoped within the others (Fig. 1b). Collembola are exceptional in having only six abdominal segments, even in the embryo.

Abdominal Segments from 1 to 7 are **pregenital** segments, eighth and ninth are known as **genital** segments as they form genital appendages i.e. ovipositor in females and aedeagus or penis in males. Tenth and eleventh segments are known as **postgenital** segments.

The definitive number of segments is present at hatching in all hexapods except Protura. All the segments differentiate in the embryo and this type of development is called **epimorphic**. In Protura, on the `other hand, the first-stage larva hatches with only eight abdominal segments plus the telson; the remaining three segments are added at subsequent molts, arising behind the last abdominal segment, but in front of the telson. This type of development iscalled **anamorphic**.

In general, the abdomen is clearly marked off from the thorax, but this is not the case in Hymenoptera, the 1st abdominal segment get fused to metathorax forming propodeum whereas 2nd abdominal segment forms a narrow pedicel or petiole followed by enlarged gaster (rest of the abdominal segments) in hymenoptera (Fig.2).

The more anterior segments have a spiracle on either side. This may be set in the pleural membrane (Fig. 1), or in a small sclerite within the membrane, or on the side of the tergum or sternum. The reproductive opening in male insects is usually on segment 9, while in the majority of female insects the opening of the oviduct is on or behind segment 8 or 9**. The Ephemeroptera and Dermaptera** are unusual in having the opening behind segment 7. These genital segments may be highly modified, in the male to produce copulatory apparatus and in the females of some orders to form an ovipositor. This may be formed by the sclerotization and telescoping of the posterior abdominal segments or it may involve modified abdominal appendages. **Pre genital appendages are absent in pterygotes and present in Apterygotes.**

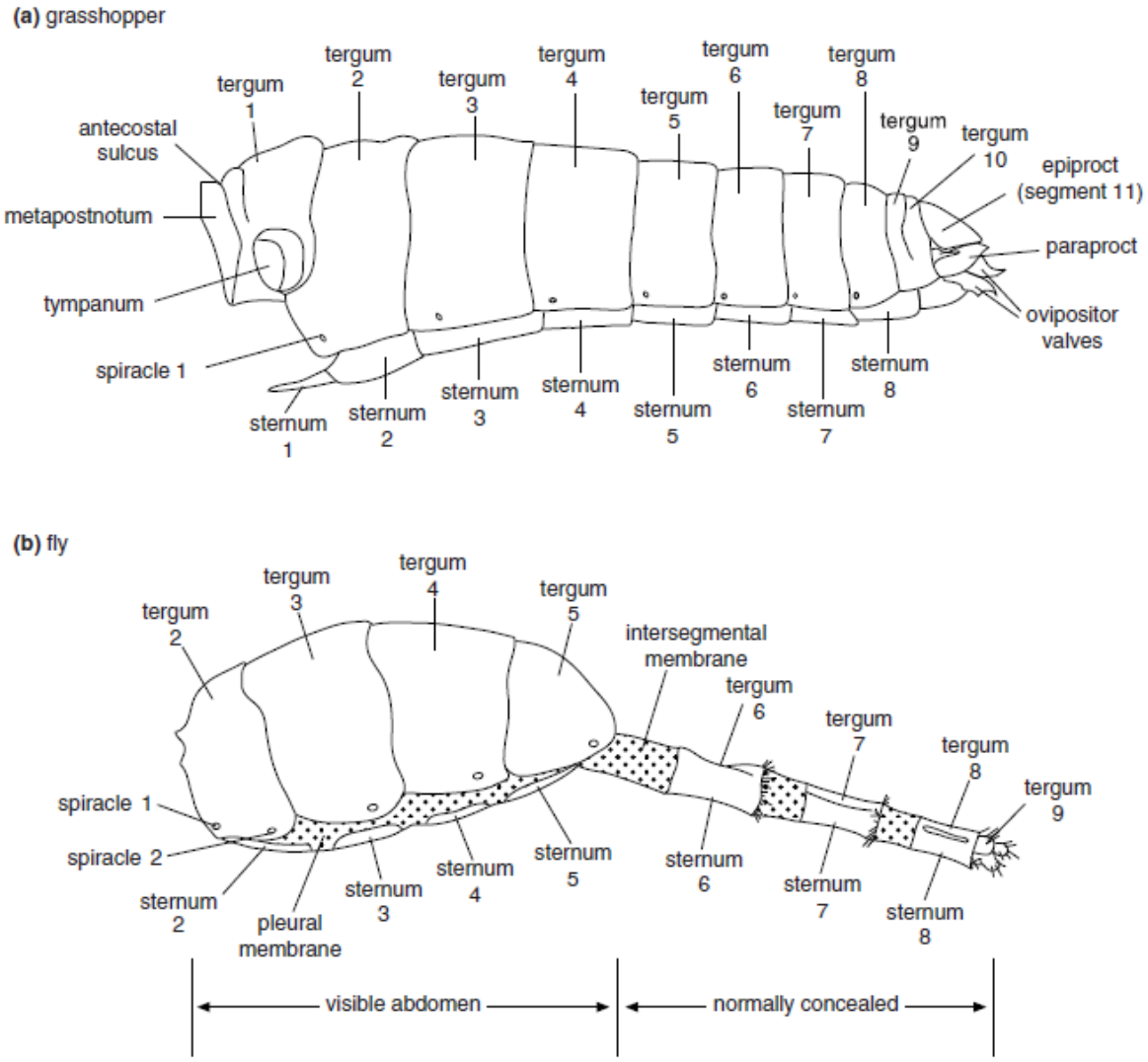


Figure 1 Abdomen in lateral view. (a) An insect in which parts of all 11 segments are present in the adult (femalered locust, Nomadacris [Orthoptera]). (b) An insect with a reduced number of segments in the adult.Segments 6–9, which form the ovipositor, are normally retracted within the anterior segments (female housefly, Musca[Diptera]).

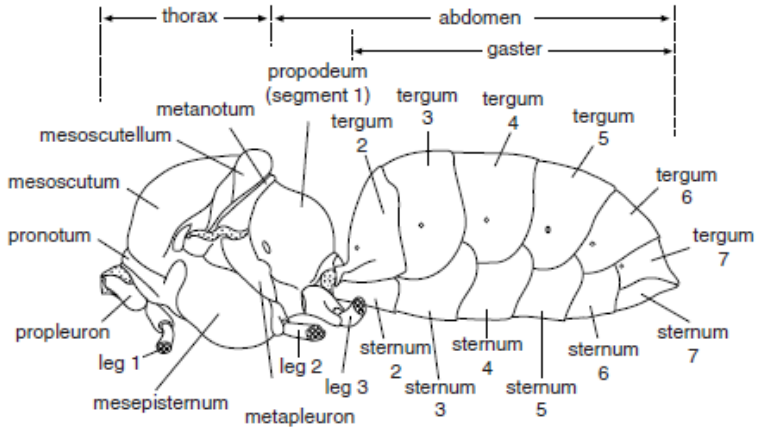


Figure 2.Thorax and abdomen of Hymenoptera.

Abdominal appendages of primitive hexapoda.
Styli and Eversible Vesicles (Fig. 3).
Styli: often associated with eversible vesicles, are present on the abdomin segments of Apterygota and some related non-insect hexapoda. On abdominal segments 2-9 of Machilidae, 7-9 or 8-9 of Lepismatidae, 1-7 of Japygidae and 2-7 of Campodeidae there are pairs of small, unjointed styli In some bristletails the styli are articulated with a distinct coxal plate (Figure 5),but generally the original coxal segment is fused with the sternum. In bristletails, at least, **the styli serve to raise the abdomen off the ground during locomotion.**
Eversible vesicles: are short cylindrical structures found on some pregenital segments of apterygotes. They are closely associated with the styli when present, buttheir homology is unclear. They are believed to have the **ability to take up water from the environment**. These are present on segment1-7ofMachilidae and 2-7 of Campodea (Diplura), but inLepismatidae and Japygidae there are generally fewer or none.

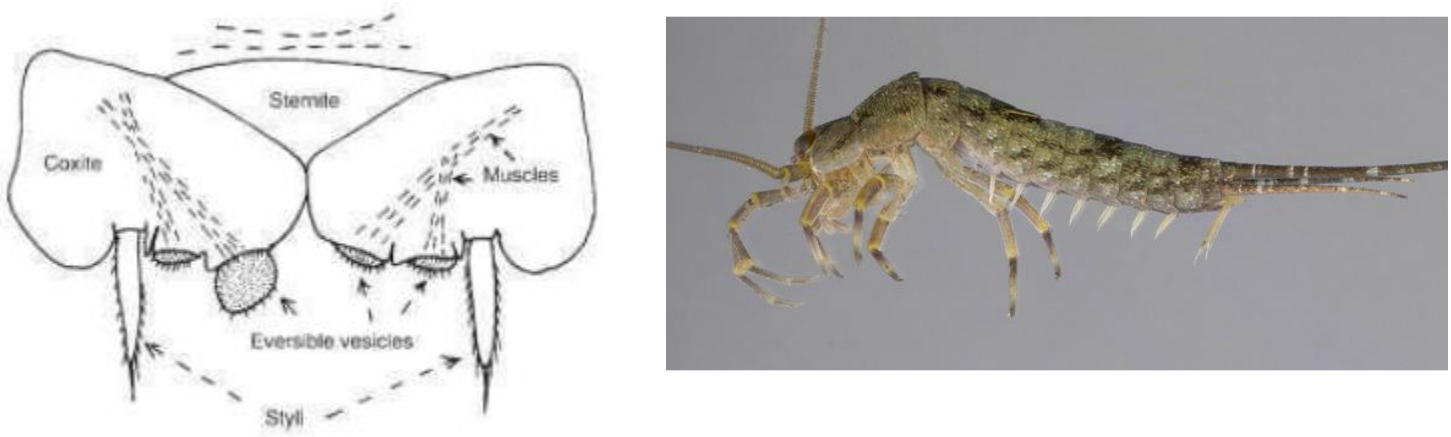


Figure 3. Styli and Eversible Vesicles.

Abdomenal appendage in Collembola (Fig.4).
The abdomen in collembola is short, with only 6 segments, have pregenital appendage on three abdominal segments.The first abdominal segment bears a ventral collophore and at its tip are pair of eversible vesicles which in some Symphypleona are long and tubular. The vesicles are everted by blood pressure from within the body and are withdrawn by retractor muscles.The ventral tube that have two functions, in some it functions as an **adhesive organ** enabling the insect to walk over smooth surface. To facilitate this on a dry surface the vesicles are moistened by secretion from cephalic glands opening on to the labium and connecting with the ventral tube by a groove in the cuticle in the midline of the

thorax. The second function of the vesicles of the ventral tube is the **absorption of water from the substratum**. The appendage of third and fourth segments of the abdomen of many collembolan forms the retinaculum and the furca, which are used in locomotion.

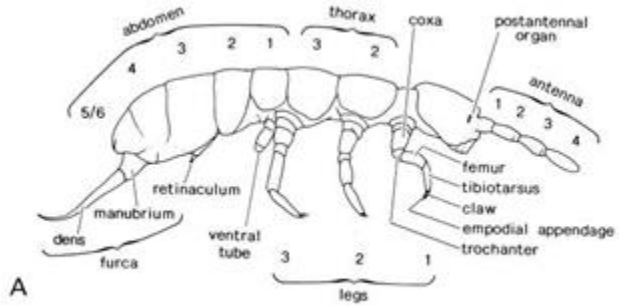


Figure 4.Collembola –abdominalappendages

Larval structures associated with locomotion and attachment.

Prolegs. Segmentally arranged, leg like structures are present on the abdomen of many endopterygote **larvae** (Fig. 5). They are known as prolegs (pseudopods orlarvapods). These appendages are expanded by blood pressure and moved mainly by the muscles of the adjacent body wall together with others inserted at the base of the proleg and aretractor muscle extending to the sole or planta. Well-developed prolegs are a feature of lepidopterous larvae, which usually have a pair on each of abdominal segments 3–6 and 10.

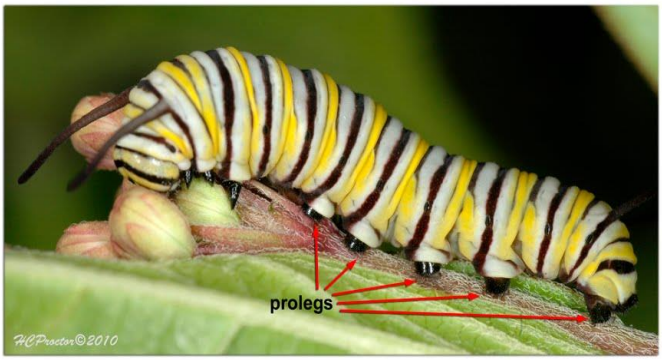


Figure 5. Prolegs

Sensory structure.

Most insects have mechanosensitive sensilla on the abdominal segments, and grasshoppers also have small contact chemoreceptors scattered among the mechanoreceptors**. In addition, the appendages of segment 11 often form a pair of structures called cerci, which usually function as sense organs**. Cerci are present and well developed in the Apterygota and the hemimetabolous orders other than the hemipteroids. In holometabolous insects, cerci are present in the adults of

Mecoptera and some Diptera; they are not present in holometabolous larvae. The cerci may be simple, unsegmented structures as in Orthoptera (Fig. 6a), or multi-segmented as in Blattodea and Mantodea (Fig. 6b). They may be very short and barely visible or long and filamentous – as long as or longer than the body, as in Thysanura, Ephemeroptera and Plecoptera. Sometimes the cerci differ in the two sexes of a species, and they may play a role in copulation. Thus the cerci of female Calliptamus (Orthoptera) are simple cones, but in the male they are elongate, flattened structures with two or three lobes at the apex armed with strong inwardly directed points. **There is similar dimorphism in Embioptera, where the male cerci are generally asymmetrical with the basal segment of the left cercus, forming a clasping organ** (Fig. 6c). Among the **earwigs** the cerci form powerful forceps which are usually straight and unarmed in the female, but incurved and toothed in the male (Fig. 6d). Similar forceps-like cerci in the Japygidae are used in catching prey. The cerci of larval Zygoptera are modified to form the two lateral gills, while in the ephemeropteran Prosopistoma the long, feather-like cerci, together with the median caudal filament (Fig. 6e), can be used to drive the insect forwards by beating against the water.

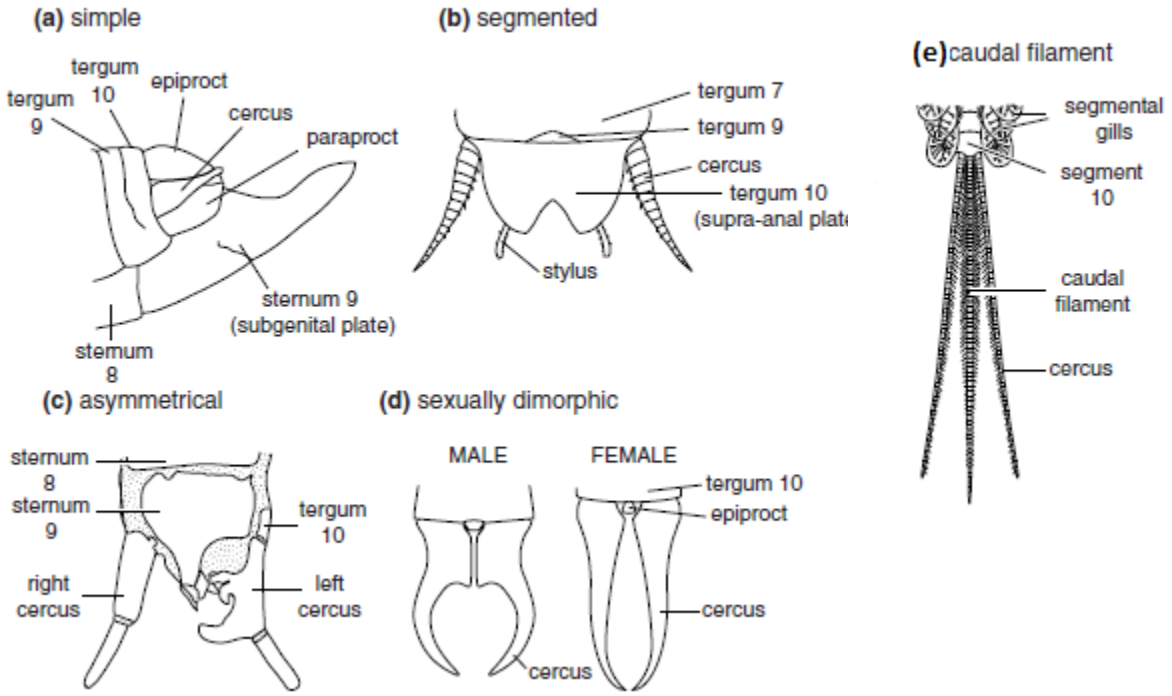
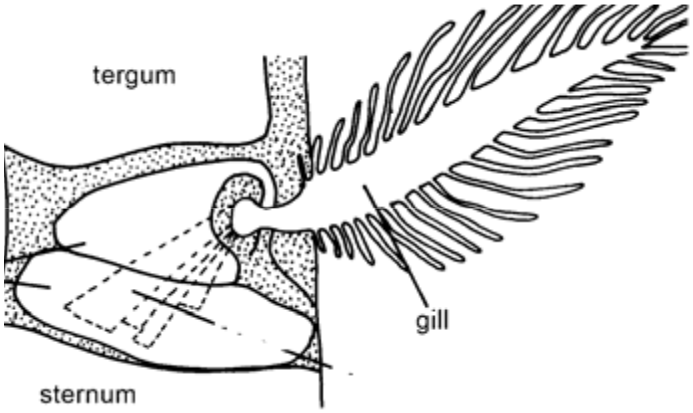
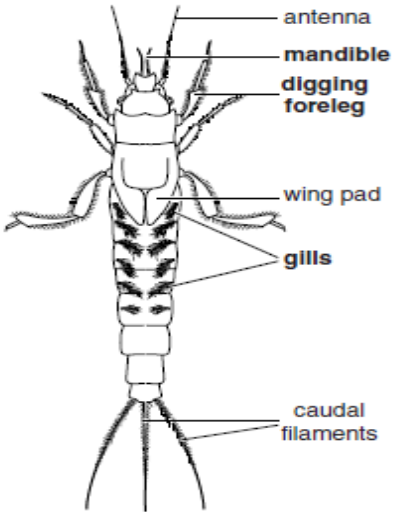


Figure 6. Different types of cerci: (a) Simple cercus (Orthoptera). (b) Segmented (Blattodea). (c) Asymmetrical (Embioptera). (d) Sexually dimorphic (male and female forceps cerci Forficula [Dermaptera]). (e) Caudal filament and segmented cerci (Ephemeroptera).

Gills (Fig. 7a). Are present on the abdominal segments of the larvae of many aquatic insects. Ephemeroptera usually have six or seven pairs of plate-like or filamentous gills (Figs. 8b) which are moved by muscles. They may play a direct role in gaseous exchange, but perhaps are more important in maintaining a flow of water over the body.



A



B

Figure 7. (A) Gill (B) larval instar of an aquatic hemimetabolous insect showing conspicuous adaptive features in the larva. (Ephemera, Ephemeroptera)

Secretary structure.

Some insect hive gland opening on the abdomen which probably have defensive function in most cases. Most **aphids** have a pair of tubes, known **as sphunculi**, or cornicles, projecting from dorsum of segment 5or 6 or from between them. Aphid release an alarm pheromone from the cornicles if they are attacked by parasite or predator.