



FACULTY OF AGRICULTURAL SCIENCES & ALLIED INDUSTRIES

ENT-121: Fundamentals of Entomology

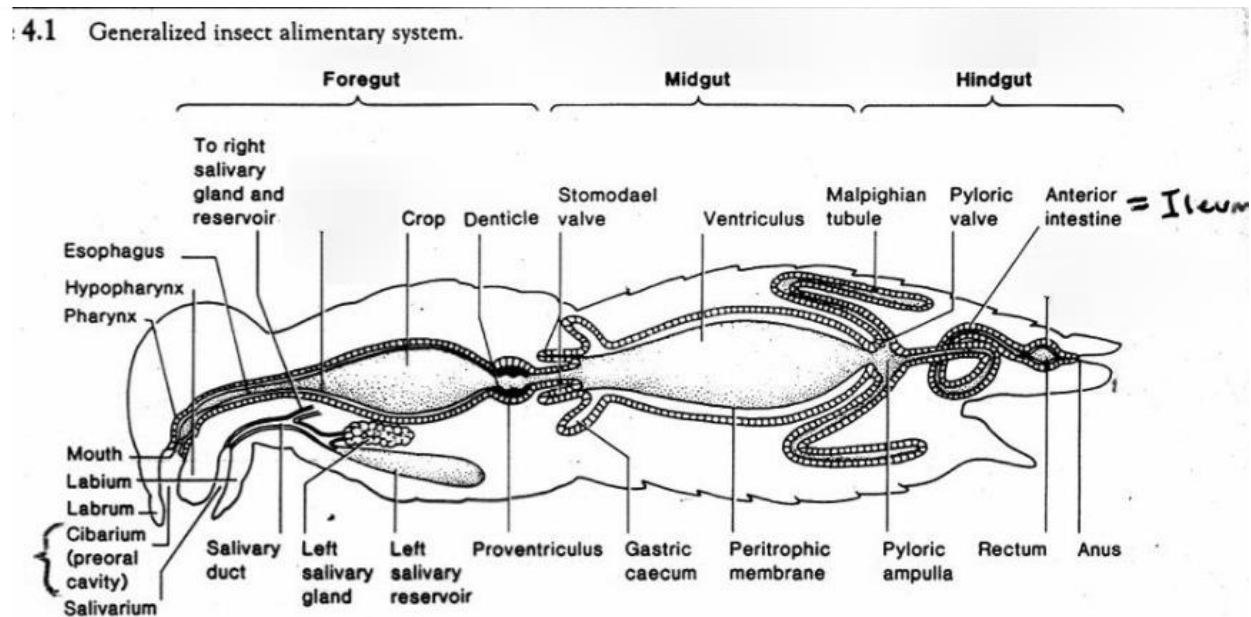
Lecture 16: Insect Anatomy: Digestive System:

The alimentary canal of insects is a long, muscular and tubular structure extending from mouth to anus. It is differentiated into three regions viz., Foregut, midgut and hindgut.

Foregut: It is ectodermal in origin. Anterior invagination of ectoderm forms foregut (Stomodaeum). Internal cuticular lining is present. Terminal mouthparts lead into a preoral cavity. Preoral cavity between epipharynx and hypopharynx is called as Cibarium. Preoral cavity between hypopharynx and salivary duct is Salivarium. Behind the mouth a well muscled organ called Pharynx is present which pushes the food into oesophagus. Pharynx acts as a sucking pump in sap feeders.

The internal cuticle of gizzard is variously modified as follows.

- i. Teeth like in cockroach to grind and strain food.
- ii. Plate like in honey bee to separate pollen grains from nectar
- iii. Spine like in flea to break the blood corpuscles



Midgut: It is endodermal in origin and also called as mesenteron. This part contains no cuticular lining. Midgut is made up of three types of epithelial cells.

- (i) Secretory cells (Columnar cells) (ii) Goblet cells (aged secretory cells),
(iii) Regenerative cells which replaces secretory cells.

Peritrophic membrane: It is the internal lining of midgut, secreted by anterior or entire layer of midgut epithelial cells. Present in solid feeders and absent in sap feeders.

Gastric caecae: (Enteric caecae or Hepatic caecae) Finger like outgrowths found in anterior or posterior ends of midgut.

Pyloric valve: (Proctodeal valve) Midgut opens into hindgut through pyloric valve, which regulate food flow.

Filter chamber: It is a complex organ in which two ends of ventriculus and the beginning of hindgut are enclosed in a sac. This is useful to short circuit excess water found in liquid food in homopteran insects.

Hindgut: It is ectodermal in origin and produced by the posterior invagination of ectoderm. Internal cuticular lining is present, which is permeable to salts, ions, aminoacids and water. The main functions of hindgut are the absorption of water, salt and other useful substances from the faeces and urine. Hindgut is differentiated into three regions viz., ileum, colon and rectum.

Digestive glands:

Salivary glands: In Cockroach a pair of labial glands acts as salivary gland where the salivary ducts open into salivarium. In caterpillars mandibular glands are modified to secrete saliva, where the salivary glands are modified for silk production. Functions of saliva:

1. To moisten and to dissolve food
2. To lubricate mouthparts
3. To add flavour to gustatory receptors
4. In cockroach the saliva contains amylase for the digestion of starch.
5. In honey bee saliva contains invertase for sucrose digestion
6. In Jassid saliva contains lipase and protease for lipids and protein digestion. Jassid saliva also contains toxins which produces tissue necrosis and phytotoxemia on the plant parts.
7. In plant bug saliva contains pectinase which helps in stylet penetration and extra intestinal digestion.
8. In mosquito, saliva contains anticoagulin which prevents blood clotting.
9. In gall producing midge's saliva contains Indole Acetic Acid (IAA).

10. In disease transmitting vectors the saliva paves way for the entry of pathogens.

Microbes in digestion: In the insect body few cells were housing symbiotic

Microorganisms called as mycetocyte. These mycetocytes aggregate to form an organ called mycetome.

(i) Flagellate protozoa - It produces cellulase for cellulose digestion in termites and wood cockroach.

(ii) Bacteria - It helps in wax digestion in wax moth.

Absorption: In many insects absorption of nutrients occurs through microvilli of midgut epithelial cells by diffusion. Absorption of water and ions occur through rectum. In cockroach lipid absorption occurs through crop. In termites and scarabaeids (White grubs) absorption occurs through ileum.