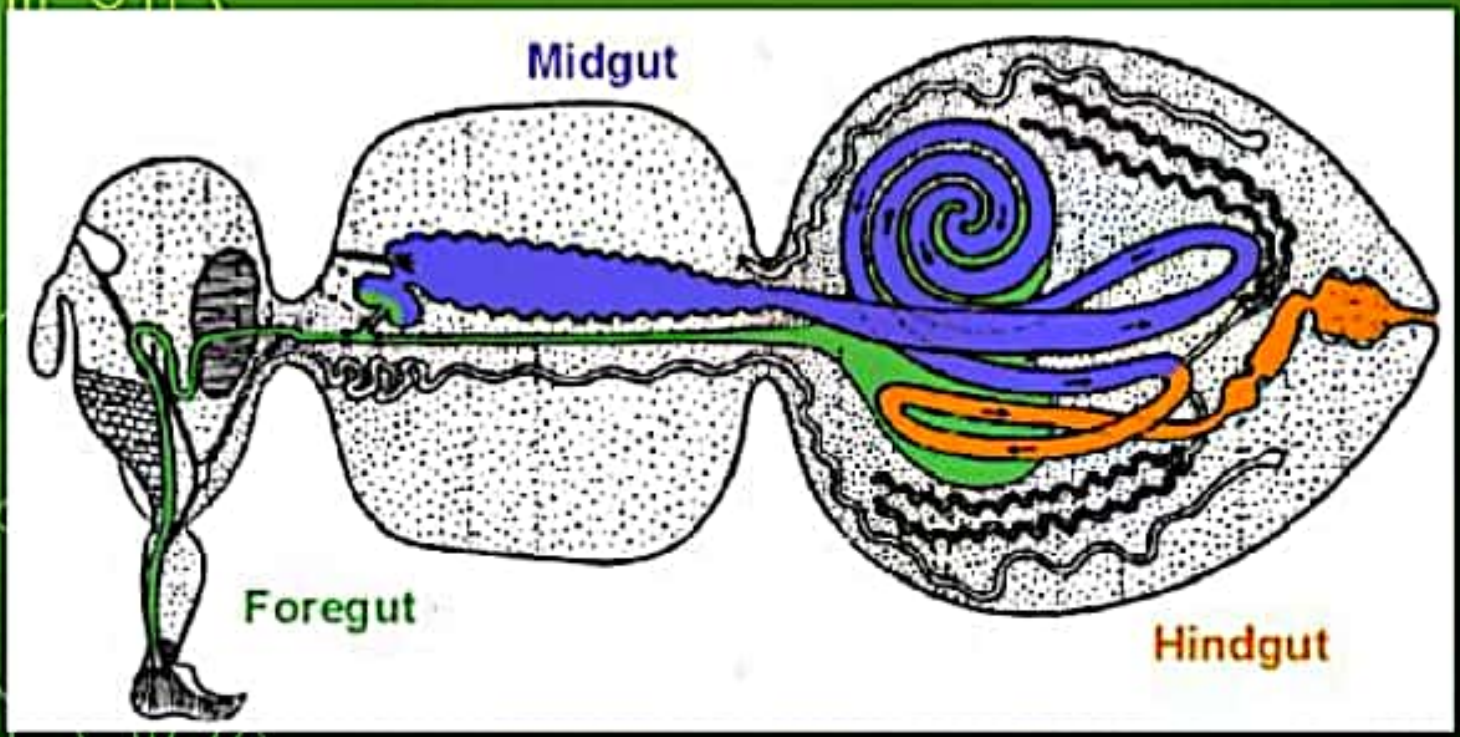
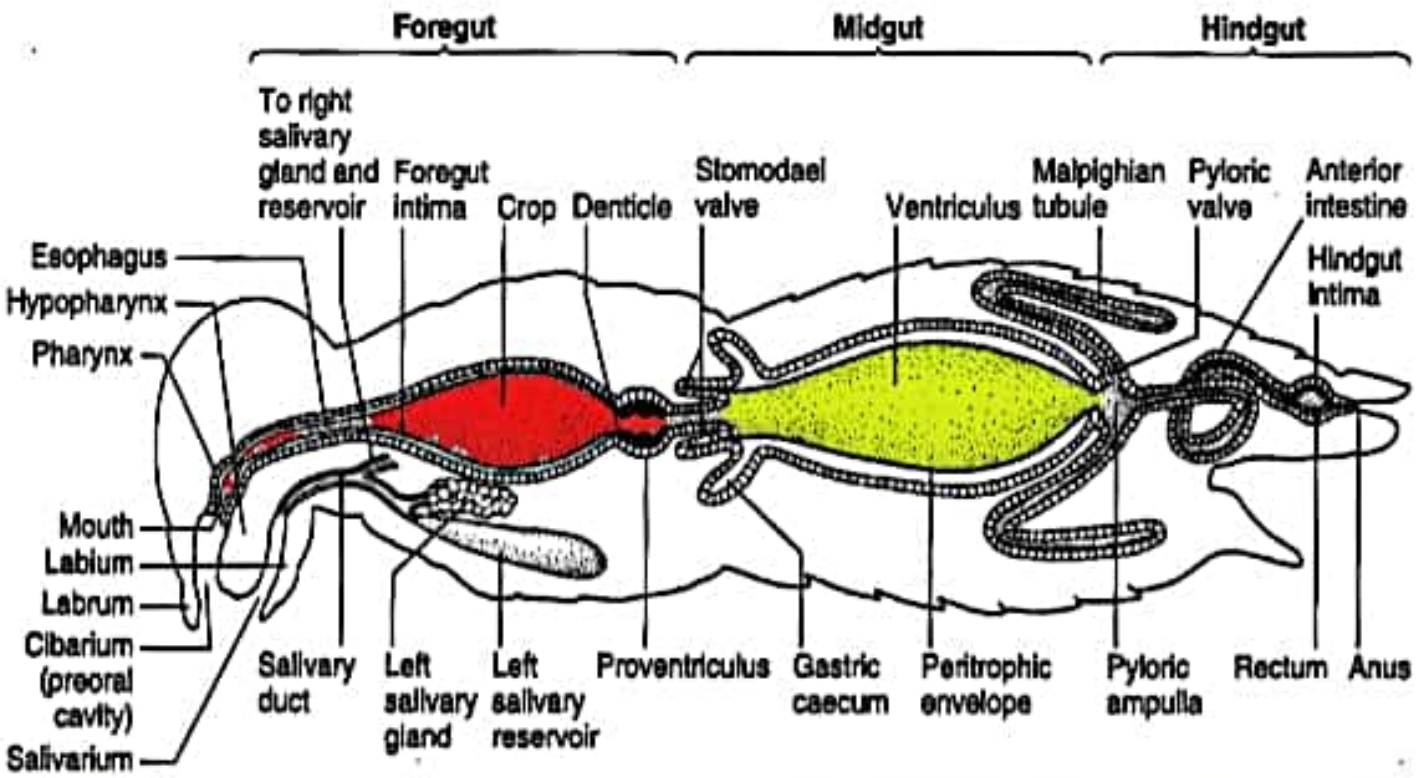
DIGESTIVE SYSTEM



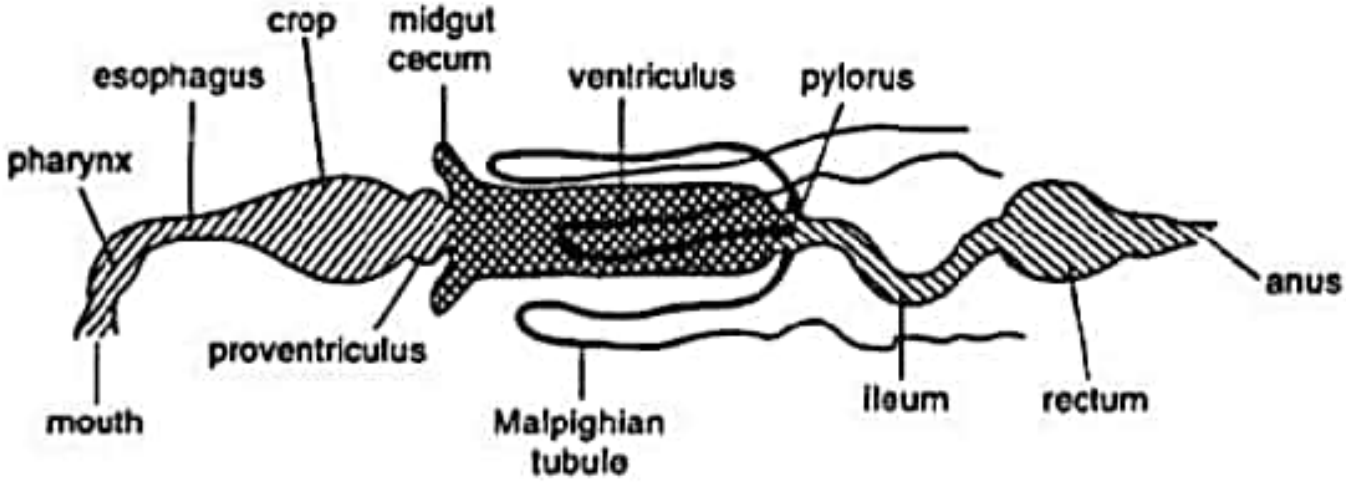
Alimentary Tract

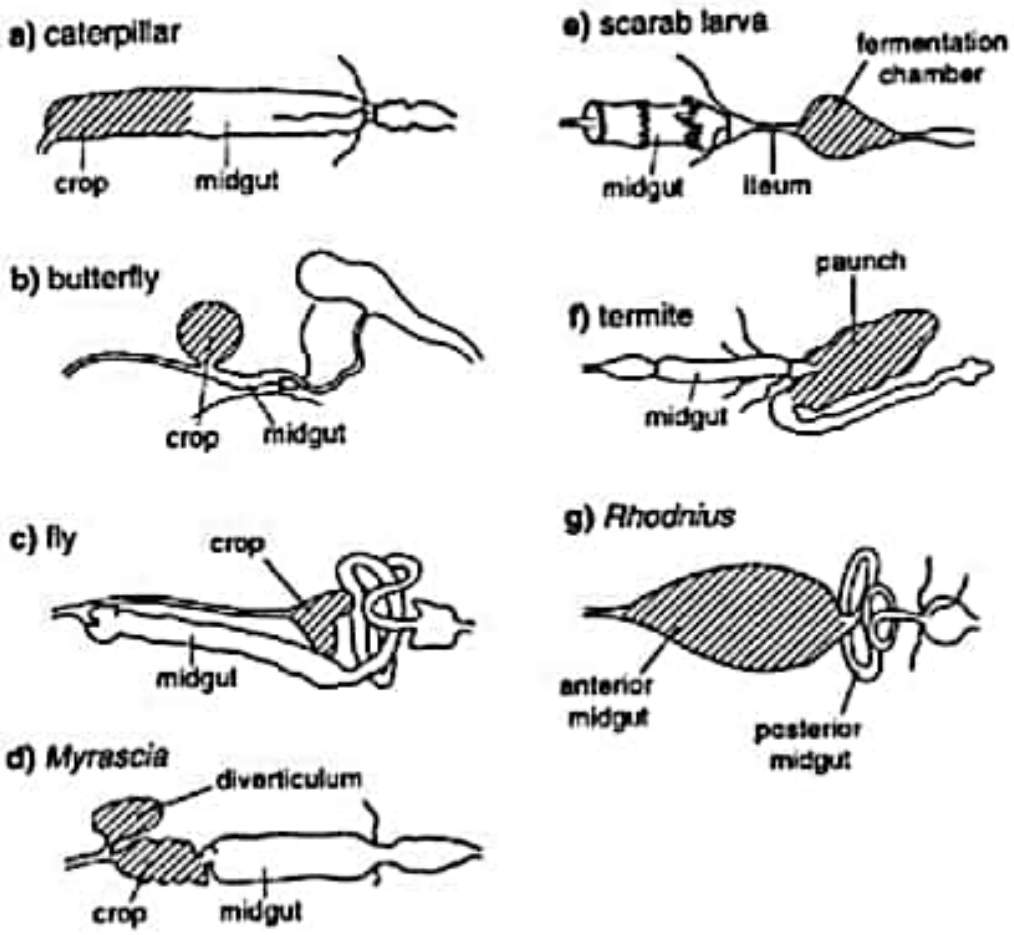
Biology 316 - General Entomology

A. Digestive system



The digestive system is just a tube within a surrounding tube called the body. It starts with a mouth and ends with the anus. What goes on in between depends on the insect, its life stage and what it eats.





DIGESTIVE SYSTEM

The digestive tract not only aids in obtaining, processing and digesting food molecules - **It is the largest endocrine tissue in both humans and insects.**

The digestive system is involved in:

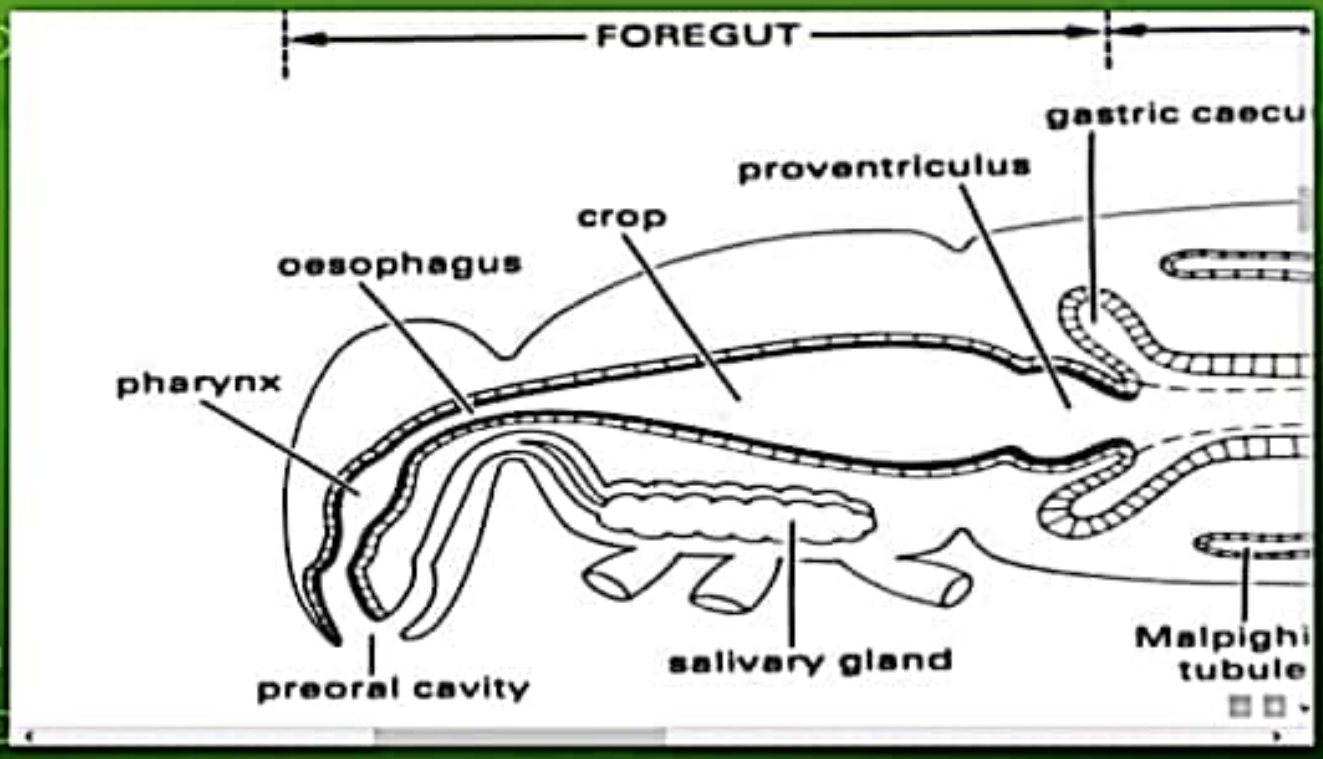
1. **Obtaining** food
2. **Mechanically** breaking it down into smaller particles that facilitate digestive enzymes acting on them
3. **Enzymatic** breakdown of larger food molecules into molecules that can pass through the digestive tract (midgut) and enter the hemolymph
4. **Produces molecules** or MESSENGERS (eg. Endocrines), that coordinate feeding and other activities of the digestive tract.

DIGESTIVE SYSTEM

1. Generalized structure of digestive tract
2. Mechanisms of ingestion
3. Pharyngeal and cibarial pumps
4. Salivary glands
   a. Sexual dimorphism in mosquitoes
   b. Types of secretions
5. Cardiac and pyloric sphincters
6. Foregut
7. Midgut
8. Hindgut
9. Basic and applied aspects of the digestive system

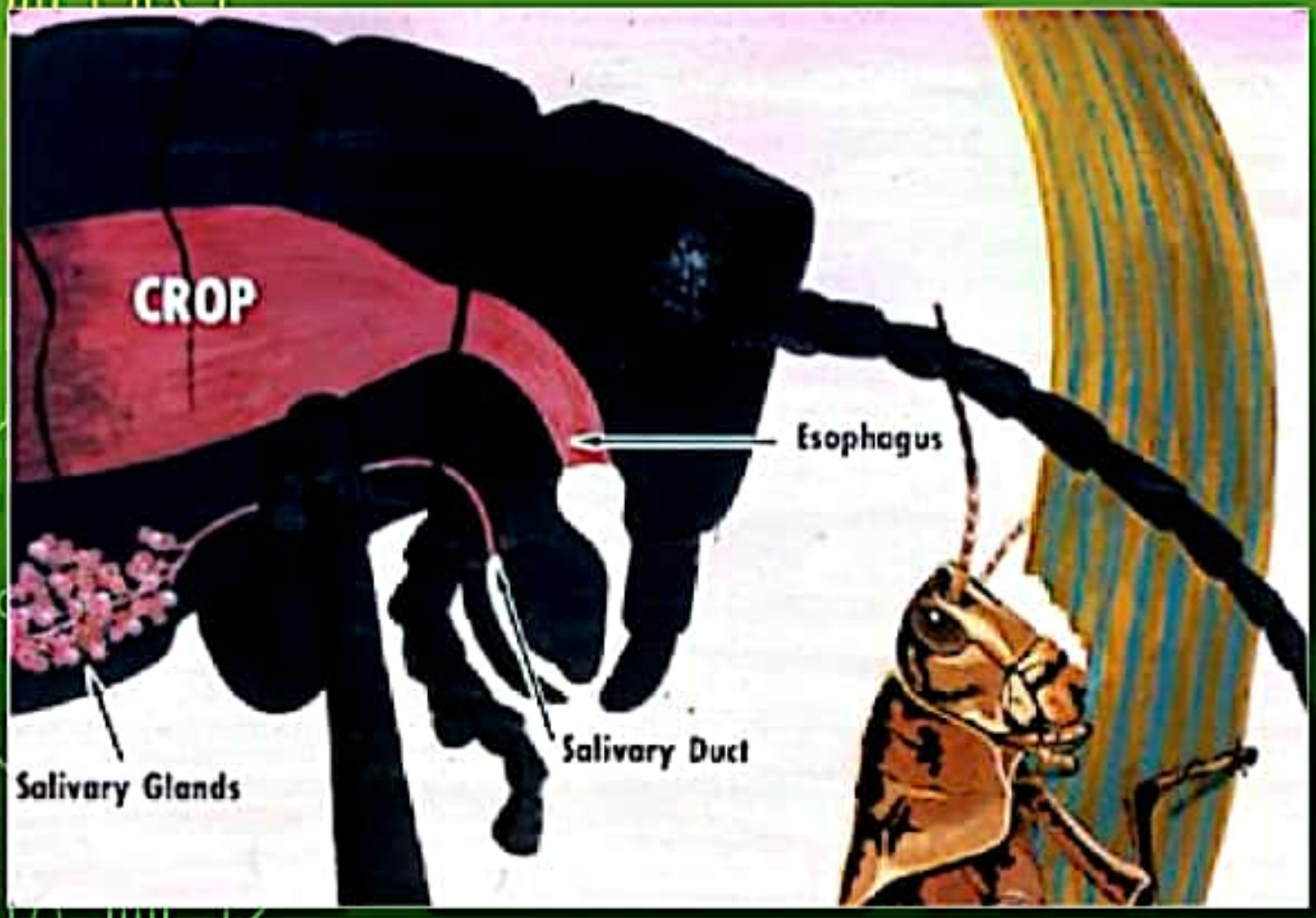
FOREGUT

1. Foregut starts at mouth and ends just after proventriculus but before the cardiac sphincter
2. Little or no digestion occurs in the foregut
3. is mainly involved in ingestion of food and the mechanical softening of it with salivary secretions and breakdown with special 'teeth' as in the cockroach or muscle-sets in other insects
4. In some insects it has a dilated structure called the crop while in other insects this crop may be diverticulated and connected by a crop duct
5. The salivary glands empty into the foregut or mouth area depending on the insect



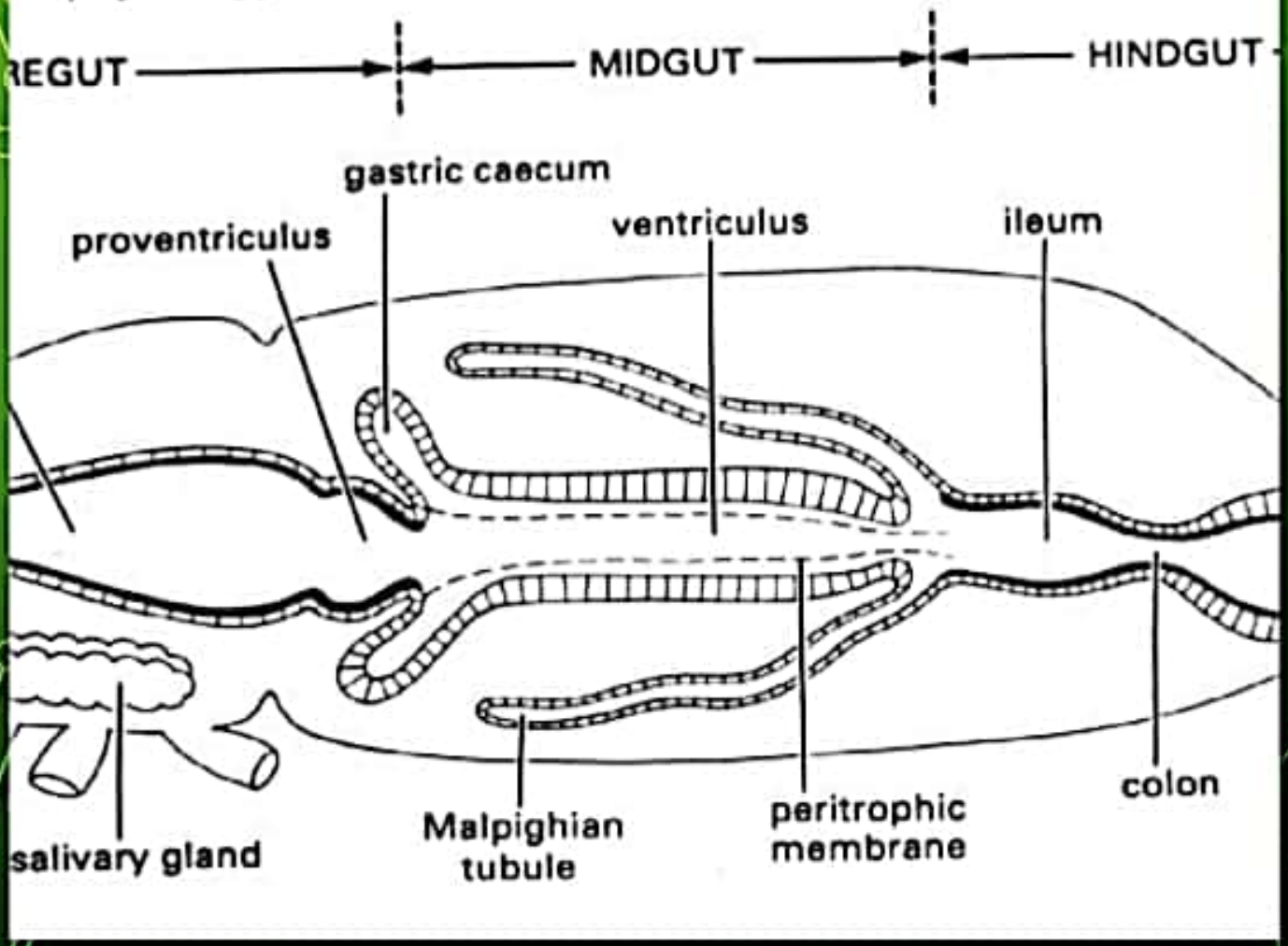
FUNCTIONS OF SALIVARY GLANDS

1. Moisten food
2. Lubricate the mouthparts
3. Contains digestive enzymes
   a. May contain enzyme amylase, which breaks down complex sugars into simpler sugars
   b. Digestive enzymes that are used by both predatory insects that inject the saliva or preoral digestion that occurs in some insects



MIDGUT

1. Midgut starts at the cardiac sphincter and ends at the pyloric sphincter
2. Midgut contains different cell types:
   a. Digestive cells
   b. Regenerative cells
   c. Endocrine cells
   d. Goblet cells
3. Midgut has a sleeve of tissue, called the peritrophic envelope or matrix that covers the microvilli and separates the food being digested from these digestive cells
4. Midgut is where the food is mainly digested



HINDGUT

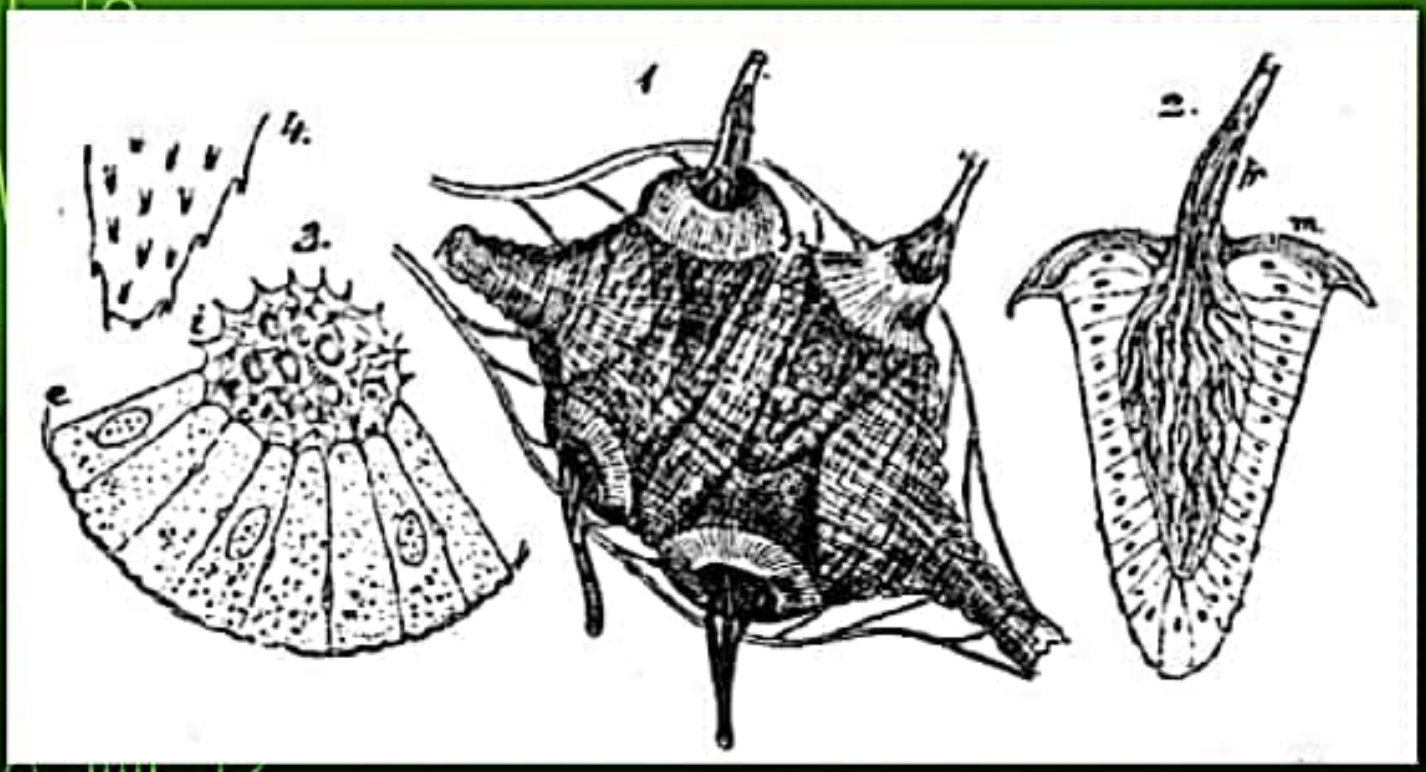
1. Major refuse dumping area for waste products from midgut and Malpighian tubules
2. In insects that feed on dilute foods (i.e., low in amino acids), such as plant saps or blood, the hindgut is involved in getting rid of excessive water and also in housing symbionts that use these waste products to produce substances the insect needs.
3. Many insects have special adaptations of the hindgut region that aid in reabsorption of certain salts and amino acids. Helps in maintaining osmotic pressure of the hemolymph.

HINDGUT

4. Water absorption from feces into the hemolymph
5. Pheromone production-Male scolytid beetles produce an aggregation pheromone. Also in *Dacus tryoni* in males
6. Respiration in larvae of Anisoptera (Dragonflies)

Rectal papillae of flies and rectum

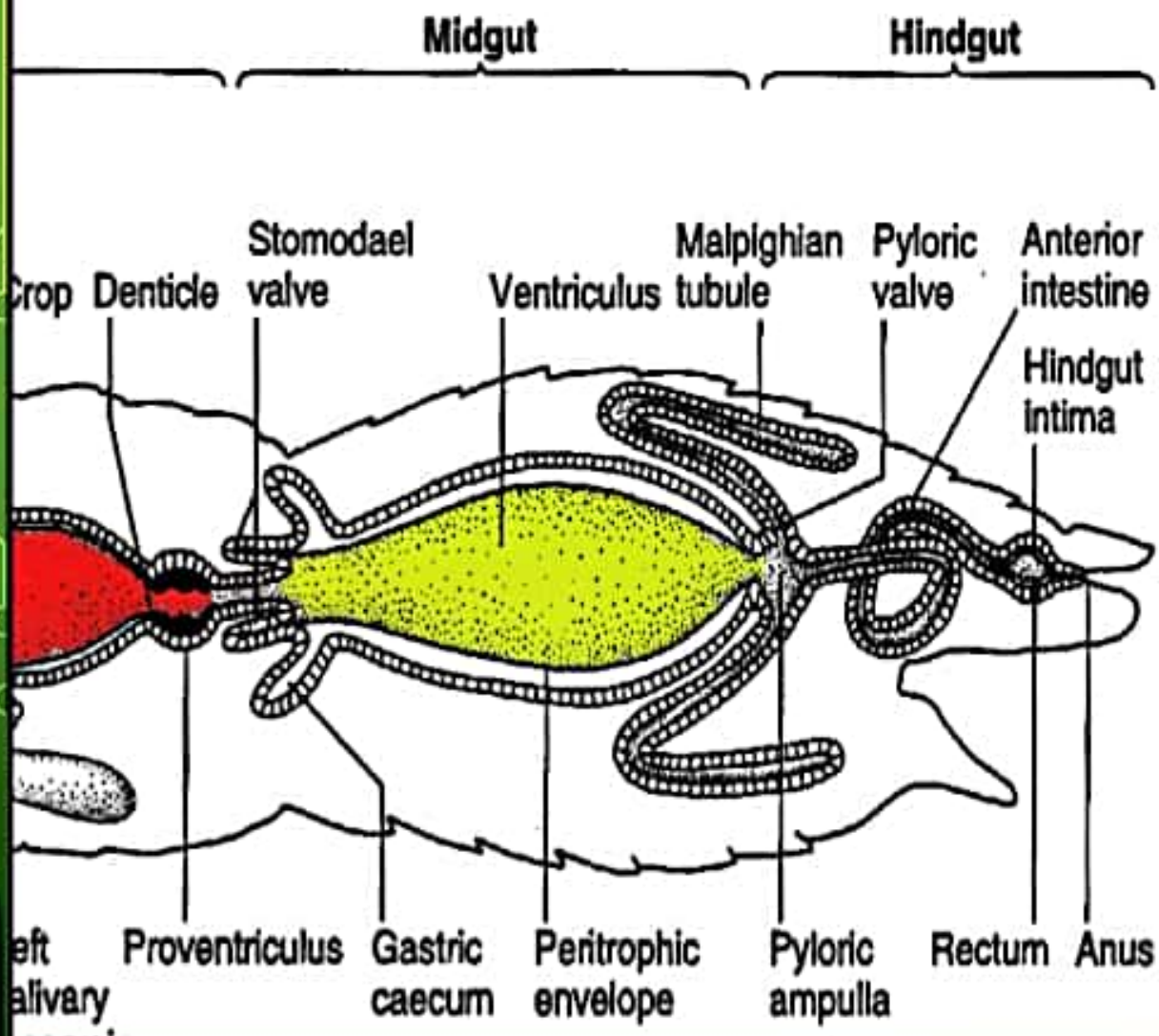
The various types of papillae in the rectum of insects are involved in reabsorption of water and the movement of ions for osmoregulation



HINDGUT AND ITS SYMBIONTS

- Because of the following foods, insects have relied upon and have taken up symbionts to either aid in digestion of molecules they can't digest (e.g., Cellulose) or provide the insect with essential nutrients, especially various vitamins, etc., that they would otherwise be unable to get from diets poor in these substances.

1. Termites and digestion of cellulose
2. Insects feeding on blood or on plant saps.



P=proboscis
C=cibarium
B=brain
A=aorta
O=oesophagus
CC=corpus cardiacum
CA=corpus allatum
CV=proventriculus
cardiac valve
CD=crop duct
C=crop
M=midgut
H=hindgut
MP=Malpighian tubule
R=rectum