P.G. Sem I, CC-1, Unit-IV [14/08/20]

Submit - 4.2.

Organs of Excretion: Malpighian tubules and Kidney (Part I)

By

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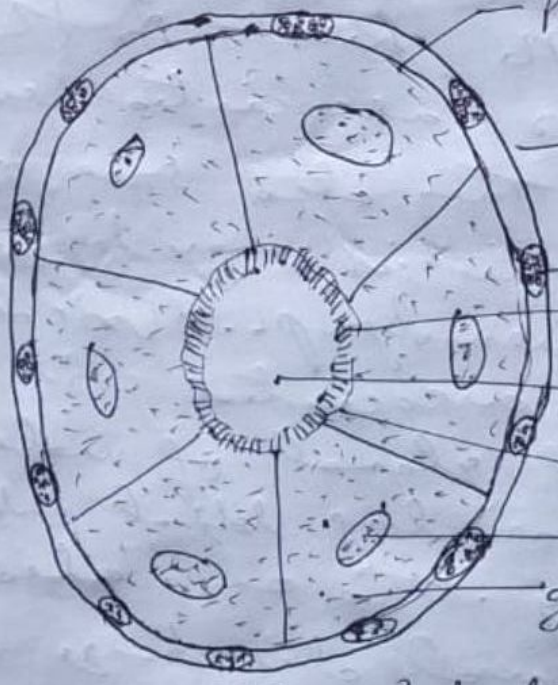
Malpighian Tubules :- Malpighian tubules are the main excretory organs in class Insecta of Phylum Arthropoda. In a typical member of class Insecta, *Periplaneta americana* i.e. Cockroach, malpighian tubules are found at the junction of midgut and hindgut, a large no. of thin, long, filamentous, thread like yellow coloured structures are found attached. They arise in six groups and hang freely in the haemocoel without any external opening into it. These are ectodermal in origin like the nephridia of Annelida. Each Malpighian tubule is formed of a single layer of glandular ciliated cells having a characteristic brush border formed of cilia. These tubules

excrete the nitrogenous wastes from the haemolymph of the haemocoel and empty the excreted substance into the gut. There are also osmoregulatory functions.

Wigglesworth has noticed two distinct regions in each tubule; a distal ~~dilated~~ dilated excretory region which hangs freely in the haemocoel and a proximal absorptive region which opens into the gut. The inner cells lining the distal region have well-developed brush border, while in the proximal region they are less differentiated and called honey comb border.

The Insects produce nitrogenous wastes in the form of soluble potassium urate which is liberated into the haemolymph. These along with water are taken up by the glandular cells lining the distal region of the Malpighian tubule. In the cells of the tubule the potassium urate reacts with water and CO_2 present in the cells as a result of respiration to form potassium bicarbonate and uric acid. The potassium bicarbonate absorbed locally into the haemolymph but uric acid is left out in the lumen of the tubule. As the uric acid is dissolved conditions,

back is to the proximal region of the malpighian tubule, the water is reabsorbed in it and passed on in to the haemolymph. The reabsorption of water occurs to such an extent that the basal part of this region becomes filled with solid crystals of Uric Acid. Water is further reabsorbed in the rectum, so that the passing out urine contains very little water and the bulk of it being nitrogenous wastes as uric acid. As the insects are Psychologically called Uricotelic animals. Thus the malpighian tubules are excretory as well as osmoregulatory in function because they help in conserving sufficient amount of water which has helped the insect in leading effective life activities in terrestrial habitat.



T.S. of Malpighian tubule is Peripleuretic

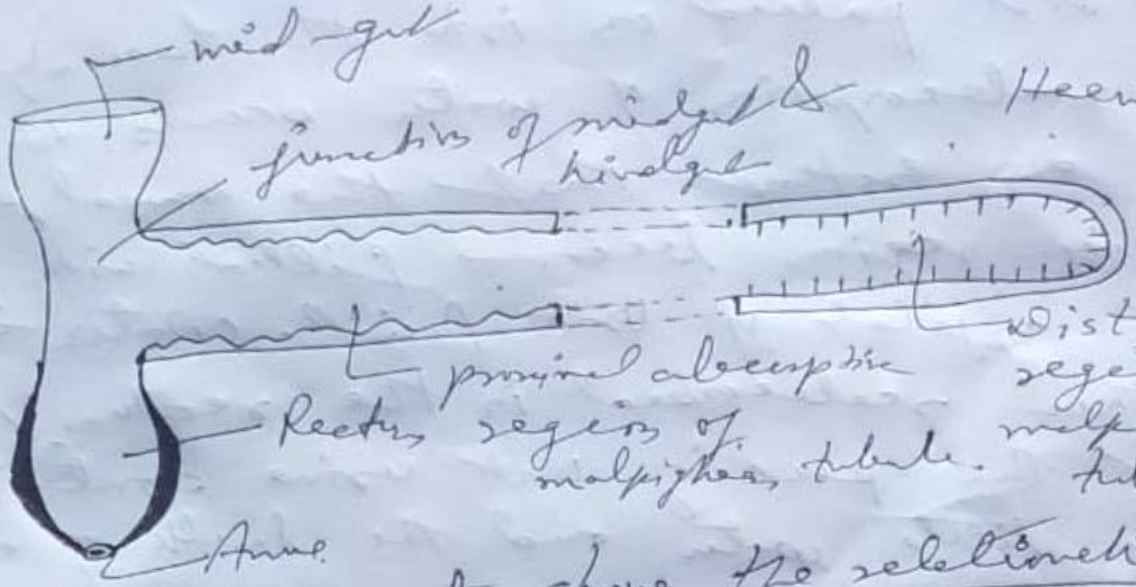


Diagram to show the relationship of malpighian tubule with the gut.

In addition to these, fat bodies completely fills the haemocoel and consist of many lobules. The lobules are formed of different kinds of cells, some of them are urate cells which store uric acid and urate granules. Nephrocytes present in malpighian tubules, are chains of cells found along the heart & the pericardial sinus or associated with the fat body. They also store nitrogenous wastes which may be removed later by haemolymph. Vesicular glands are found associated with the mushroom shaped gland of male reproductive organs as long blind tubules at its periphery. They can also store uric acid and discharge it at the time of copulation over the epiproct. They are also called utriculli majors.

Central Rod