

Members' Notebook

All Microscopists meet items of special interest in the course of collecting and preparing material, in the manipulation or construction of apparatus, and in making observations and conclusions from such efforts. Notes of such activities will not only interest other members, but will also provide an accurate and intimate record of the general activities of the Club.

Members are invited to offer contributions at any time. These should be addressed to the Editor for consideration by the Editorial Sub-committee. Each letter should treat of one subject only, and a suggested length is 100-1000 words. Where necessary line illustrations may be included.

The Malpighian Tubules of the Honey-Bee

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In a note on the Malpighian tubules of bees, by Mr E. R. Martin (1945), in this *Journal*, attention is drawn to what the author regards as an erroneously accepted view on the site of insertion of these organs on the alimentary canal.

I suggest that there is, in fact, no difference of opinion here, but only a confusion caused by somewhat obscure language in Snodgrass's account. Snodgrass (1925) states that the tubules open 'into the anterior end of the intestine behind the base of the ventricular valve'. Mr Martin describes them as entering 'the lower end of the ventriculus'.

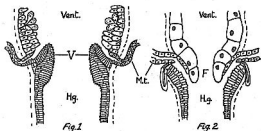
Snodgrass must accept responsibility for the ambiguous word 'behind', but by that he obviously does not mean 'posterior to' or 'caudad of'. Nobody can suppose that so great an authority on insect morphology believed that the tubules enter the alimentary canal in rear of the ventricular valve. Unfortunately, his figure, which is fragmentary and does not show the whole of the valve, leaves much to be desired. His intention in using the word 'behind' was undoubtedly to denote the fact that the openings of the tubules are covered by the rim of the valve, which projects into the lumen of the gut and turns upwards towards the ventriculus (Fig. 1).

Though there is no doubt as to the relative positions of the tubules and the ventricular valve, there is, in fact, still some confusion based on undefined terminology. Do the tubules enter the ventriculus or the small intestine? We have here to distinguish between (i) the conception of the ventriculus as including the ventricular valve, and (ii) the very different conception provided by embryology. The mid-gut (mesenteron) of the embryo is derived from the endoderm, and its lumen does not connect with that of the hind-gut until the end of the larval stage. The hind-gut (proctodeum) is derived from ectoderm, and so are the Malpighian tubules, which are inserted round its anterior extremity.

In the adult bee the tubules still occupy this position: they open into the alimentary canal *at the junction* of the mid- and hind-guts. The ventricular valve (perhaps unfortunately named) is actually composed of hind-gut tissue, and does not belong to the mid-gut at all. It is composed of columnar

epithelium like that of the small intestine, and bears chitinized setae indicating its ectodermal origin. The muscles which operate the valve have no relevant significance.

If we regard the adult ventriculus as including the valve, and therefore as being composed of a mixture of structures of endodermal and ectodermal origin and not homologous with the mesenteron, then we shall be correct in saying that the tubules enter the ventriculus. But if, like Snodgrass, we use the term ventriculus in the sense in which it is usually employed, i.e. as including only the portion of the canal derived from the mesenteron, it is then natural to describe the tubules as opening into the intestine.



Longitudinal sections of junction of mid- and hind-guts of adult bee (Fig. 1) and fully grown larva (Fig. 2); both diagrammatic. *Vent.*, ventriculus or mid-gut; *Hg.*, hind-gut or small intestine; *M.E.*, Malpighian tubules; *V.*, 'ventricular valve'; *F.*, ruptured fundus of larval mid-gut.

There is one other point. In the larva, when connexion between the mid- and the hind-guts is established, the ruptured fundus of the ventriculus projects into the anterior end of the small intestine (Fig. 2), as described by Nelson (1915). This produces the appearance of a valve-like structure which, in section, looks somewhat like the ventricular valve. It has, however, nothing to do with the latter structure.

Though we cannot have any doubt of Snodgrass's intention, his wording is likely to mislead, and Mr Martin, a keen observer who very properly takes nothing on trust, has performed a useful service in bringing that fact to light.

REFERENCES

- MARTIN, E. R. (1945). The Malpighian tubes of Bees. *J. Quekett Micro. Cl. Soc.* 4, 2, 96.
 NELSON, J. A. (1915). *The Embryology of the Honey Bee*. Princeton, N.J.
 SNODGRASS, R. E. (1922). *The Anatomy and Physiology of the Honey Bee*, p. 163. New York: McGraw-Hill.