THE STOMACH CELL OF ROTIFER

Electron Microscope Observations of the Terminal Web

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Some details of the ultrastructure of the syncytial stomach cell of the rotifer have been presented by Lansing (1). He has described the luminal membrane of the stomach cell as consisting of a thick reticular layer beneath a unit membrane 60 A thick. He noted a similarity between this layer and the terminal web of the intestinal epithelium. Lansing further observed goblet-shaped pockets in the gastric luminal surface. Ingested colloidal gold particles were observed in these pockets and in cytoplasmic food vacuoles which led Lansing to postulate that the gold particles entered the cell cytoplasm through the gobletlike structures.

This communication will present details of a fine "crystalline" organization of a region immediately surrounding the gobletlike projection.

A *Philodina* species was selected from a mixed rotifer culture obtained from Turtox Products General Biological Supply House, Inc.

Organisms were fixed in a contracted state by 1% osmium tetroxide buffered to pH 7.5 in McEwen's saline (2). Some of these rotifers were prefixed in 6% glutaraldehyde and postfixed in osmium tetroxide. In order to fix rotifers in an extended state, some animals were "paralyzed" in 0.5% neosynephrine (3), and subsequently fixed in 2% unbuffered osmium tetroxide. It has been somewhat more difficult to obtain details of ultrastructure with the last procedure as compared to the former methods; however, fixation in extension is desirable for orientation purposes.

All fixed specimens were dehydrated in ethanol and embedded in Maraglas (4). Thin sections were cut on a Porter Blum microtome, stained with lead citrate (5), and examined in an RCA EMU-3E.

Fig. 1 depicts an oblique section through the lumen of the syncytial stomach of a rotifer. The lumen of the gut contains cilia, and it is bounded by a unit membrane (Fig. 2) as described by Lansing (1). Beneath the membrane is a relatively homogeneous region which stains rather lightly. In cross-sections of the gut (Fig. 2), this region appears finely granular or amorphous, whereas in longitudinal sections (Fig. 1) it appears to consist of thin fibers approximately 30 A in diameter. In keeping with the terminology employed by Lansing (1), this area will be called the terminal web.

Scattered within the terminal web are the roughly cylindrical "goblet-shaped" bodies described by Lansing (1). Their appearance is somewhat variable. Some appear to open into the stomach lumen (Fig. 1), whereas others appear separated from the lumen by one or two unit membranes (Fig. 2). Still others appear to be extruding small vacuoles into the syncytial cytoplasm by pinocytosis, these vacuoles apparently being food vacuoles, also described by Lansing (1) (Fig. 2).

Surrounding the goblet-shaped vacuoles is a very densely staining cylindrical collar of material which, at high magnification, can be resolved into elements periodically spaced at 50 to 150 A (Figs.

FIGURE 1 An oblique section through the lumen of the stomach cell. *C*, cilia within the lumen; *F*, fibrillar material in the terminal web; *G*, goblet-shaped protrusions from lumen, communicating with lumen in upper right corner; *P*, periodic structure of collars of goblet structures; *K*, kinetosomes or ciliary basal bodies. × 47,000.

1 and 2). In some sections (Fig. 2), the collar appears to consist of either "spherical macromolecules" or beaded filaments.

The only other identifiable structures found in the terminal web are ciliary basal bodies or kinetosomes, seen in Fig. 3 in cross-section and in longitudinal section. In a number of sections, there is an apparent physical continuity between the kinetosomes and the collars of the goblet vacuole (Figs. 4 and 5). This occasional, apparent association of kinetosome and goblet collar is either coincidental or the result of some structural or functional relationship. The wide variety of ciliary rootlets showing a periodic structure and the existence, almost without exception, of some sort of rootlet structure associated with cilia (6) provides some reason to suspect a structural-functional relationship rather than an occasional coincidental proximity between these two entities. However, this question cannot be settled at this time.

On the morphological grounds alone presented here, one can only speculate as to the function of the goblet collar. It would appear reasonable to venture that it provides either support or, less likely, contractility or both to the goblet vacuole. The former function might simply prevent gastric herniation or limit the size of pinocytosed particles. The latter function might provide assistance in the process of pinocytosis.

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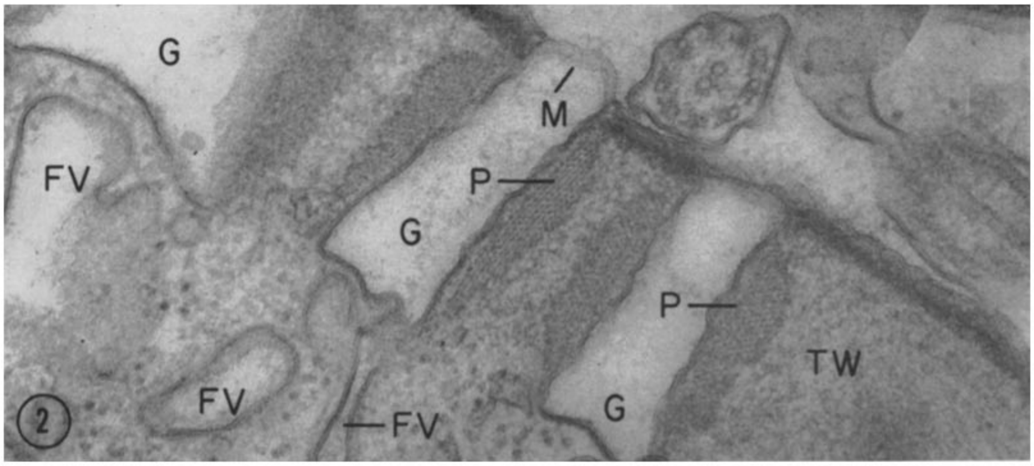
FIGURE 2 Similar to Fig. 1, but showing the double unit membrane (*M*) structure of the stomach luminal membrane. FV, food vacuoles; *P*, periodic material of collar of goblet structure (*G*). Terminal web, *TW*. × 75,000.

FIGURE 3 Kinetosomes of stomach cilia seen in longitudinal (K_2) and cross-section (K_1). × 29,500.

FIGURE 4 A kinetosome (*K*) seen end-on in proximity to a portion of a goblet structure (*G*). × 44,000.

FIGURE 5 An oblique section through a kinetosome (*K*) in association with a goblet structure (*G*). × 40,500.


G
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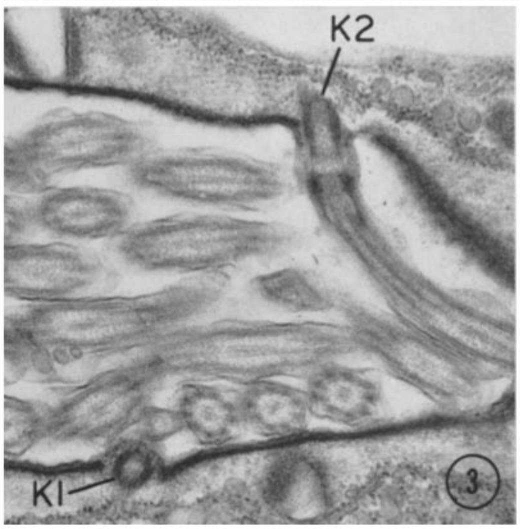
2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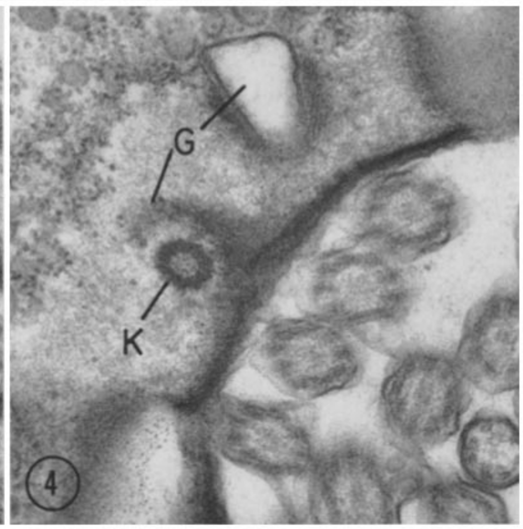
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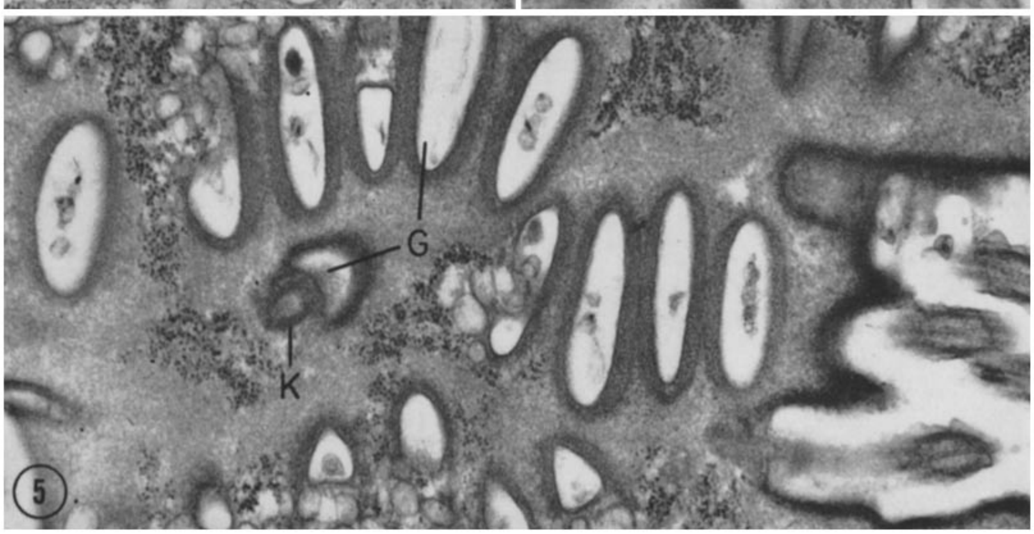
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