

Vacuolar cells seem to be a special trait of the esophagus and crop of carnivorous cephalaspideans (Euopisthobranchia)

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Cells with a very large vacuole surrounded by a very thin layer of cytoplasm were observed in the connective tissue of the crop or esophagus of the cephalaspideans *Philinopsis depicta*, *Aglaja tricolorata* and *Philine quadripartita*. These vacuolar cells can be abundant close to the epithelium, but they were never seen in direct contact with the lumen of the digestive tract. In *P. depicta* and *P. quadripartita* just small amounts of dispersed flocculent material were observed by transmission electron microscopy (TEM) within the electron-lucent vacuole. Nevertheless, in *A. tricolorata* the central vacuole and the vesicles in the peripheral cytoplasm contained electron-dense loops. The flat nucleus is located at the periphery of the cell and cell membrane invaginations are common.

Using the pyroantimonate method for TEM, calcium was detected in the vacuole and vesicles of vacuolar cells. With this technique, electron-dense deposits are formed in structures that contain calcium, even if present in very low quantity. Control sections were treated with an EGTA solution, which removes the electron-dense deposits containing calcium. Additionally, the presence of calcium was investigated with an electron microprobe equipped with WDS detectors. The X-ray intensity maps confirmed the presence of low amounts of calcium in the electron-dense pyroantimonate the deposits. Calcium detection in the vacuolar cells supports a relationship with the calcium cells of the connective tissue of pulmonate gastropods. These cells could provide ions for buffering the pH of body fluids. So far, similar cells were not found in the digestive tract of herbivorous cephalaspideans. Thus, the presence of vacuolar cells might be an apomorphy of the esophagus and crop developed in carnivorous cephalaspideans.