EVIDENCE OF A NON-PHOTORECEPTIVE FUNCTION OF THE SENSORY UNITS OF THE ORGAN OF BELLONCI IN MACROBRACHIUM ROSENBERGII (DECAPODA, CARIDEA)

BY

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INTRODUCTION

The organ of Bellonci is ubiquitous among crustaceans, associated with the anterior part of the brain (Chaigneau, 1978). The internal unit is built up by peripheral glial cells that surround a cavity into which ciliated cells project. The ciliated cells have a presumed sensory function and their transformed cilia exhibit surface amplifications, either as lamellae or as microvilli (Chaigneau, 1978). The presence and the fine structural variations of the organ of Bellonci are well established in crustaceans, but its functional significance is still enigmatic. As mentioned above a sensory function has been assigned to this organ complex. It has been proposed that the active sensory modes might be photo- and chemoreception (Chaigneau, 1978). In addition to the sensory function secretion may take place in some species (Steele, 1984).

To determine if photosensitive pigments are present in the membranes of the sensory cells, the internal unit of the organ of Bellonci of Macrobrachium rosenbergii (De Man, 1879) was incubated in a saline containing digitonin. Collapse of photosensitive membranes after digitonin treatment has been demonstrated in the compound eyes of the crustacean Procambarus clarkii (Girard, 1852) (cf. Fernandez & Nickel, 1976), as well as in vertebrate eyes (Mason et al., 1974). This effect is evidently depending on the extraction of visual pigments from the membranes (Wald, 1967).
MATERIALS AND METHODS

Commercially reared specimens of *Macrobrachium rosenbergii* from Simontorp Aquatic Laboratories, measuring 50 to 70 mm from rostrum to uropod were used in this study.

The eyestalk of dark adapted (three hours) animals were dissected in infrared light thus exposing the organ of Bellonci and the retinal layer. The eyestalks were incubated for 20 minutes either in a solution of 0.1% digitonin in Van Harreveld's Ringer (1936), or in a plain ringer solution as a control.

After incubation the organ of Bellonci and small portions of the retina were fixed overnight according to Karnovsky (1965), and postfixed in 1% osmium tetroxide for two hours. Dehydration was carried out in an alcohol series, followed by embedding in Vestopal W. Sections cut with glass knives were examined in a Zeiss EM 10 electron microscope.

RESULTS

The organ of Bellonci in *Macrobrachium rosenbergii* is located in the haemocoel in the distal part of the eyestalk. The organ is bipartite and is built up by subunits consisting of cavities surrounded by glial cells. The transformed cilia, which exhibit a lamellar pattern project into the cavities that are surrounded by glial cells.

The membranes of the transformed cilia of the digitonin-treated organs displayed the same pattern as those of the controls which were incubated in a Ringer solution, exhibiting regular stacks of membranes which are about 30 to 40 nm thick and tubular processes emanating from the lamellae (figs. 1, 2). The tubular extensions evidently give rise to vesicles that bud from their distal parts.

In contrast to the weak response in the organ of Bellonci, the retina reacted strongly to digitonin treatment. The untreated retinas displayed the regular microvillar pattern of the rhabdom, which in its middle part consist of layered stacks built up by seven retinular cells (fig. 3), whereas the rhabdoms of the digitonin-treated retinas exhibited an almost complete disruption of the microvillar membranes, but in limited areas structurally recognizable remnants of rhabdomeric microvilli could be found (fig. 4). Compared to the control retinas the digitonin-treated ones appear to have increased in volume indicating that the disruption has spread outside the rhabdom itself, and that its integrity has been lost due to the collapse of the microvilli. The other membrane surfaces of the retinular cells also appear destroyed, as does the total cellular order.

DISCUSSION

The transformed cilia of the sensory cells of the organ of Bellonci in *Macrobrachium rosenbergii* have lamellar patterns and are in this respect similar