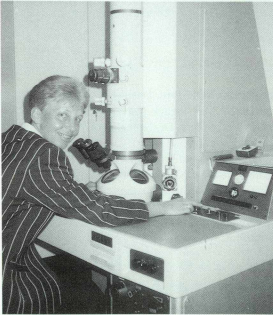


Ultrastructural Research and Electron Microscopy

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Our tasks are threefold: teaching, research, and service for colleagues and students.



Research

Reproductive biology

Two aspects of reproduction are addressed using light microscopy and TEM. In the cirripedes, the functional morphology of insemination is investigated, as well as the anatomy of dwarf- and complementary males (Fig. 1). This study deals with the reduction of the males in comparison with the females and/or hermaphrodites, in comparison with the males of other species of the Cirripedia s.str. and in comparison with the males of the Cirripedia s.l. Our interest focuses on the degeneration and regeneration of organisms, organs, cells, and organelles. The second topic is the spermatogenesis of invertebrates in relation to their reproductive biology and the different modes of fertilization.

Ontogeny of Crustacea

a) Ontogeny of the shells of Cirripedia Balanomorpha. Interlaminar figures in the basal part of the wall plates show a varying degree of complexity. They are species-specific and may be used for the identification of recent and fossil species. The main question to be answered is whether the ontogeny of highly complex interlaminar figures recapitulates the phylogeny of the barnacles that possess them.

b) Metamorphosis of Cirripedia Scalpellomorpha. Six nauplius stages and one cyprid stage may be distinguished in the ontogeny of a cirripede. As development progresses from one stage to the next, degeneration and regeneration of organs, cells, and organelles take place. The most drastic changes occur from the sixth nauplius stage to the cyprid and during the metamorphosis from the cyprid to the adult animal. We are mainly interested in the de-differentiation of the tissues and cells, the occurrence of apoptosis, and the sequence of steps during the differentiation of the tissues (Fig. 2).

Cuticle and cuticular structures of Crustacea

Here the morphogenesis and diversity of the cuticular structures of Anostraca and Cirripedia are the main topics. Research in the Anostraca includes a comparison of the cuticular structures of the larval stages with those of the adult male and female, and studies in the Cirripedia involve the development of cuticular structures in males, females, or hermaphrodites and a comparison of the cuticular structures of adult specimens of various species of Cirripedia Scalpellomorpha. Another interesting problem is the possible value of cuticular structures in the systematics of cirripedes.

Improvement of methods for SEM, especially of arthropods. Various methods of specimen preparation (such as microwave fixation and the application of cryo-technology) are tested and compared

with each other. Emphasis is placed on in-situ preparation of specimens.

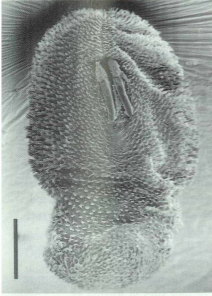


Fig. 1. SEM-picture of reduced male of a species of Cirripedia Scalpellomorpha. The body is covered with cuticular structures. Scale bar: 200µm

Teaching

We teach students how to use scanning (SEM) and transmission (TEM) electron microscopy. The theoretical background of ultrastructural research is given in lectures like "Ultrastructures, a Basis for New Concepts" (L,2h) or "Comparative Anatomy at the Ultrastructural Level" (L, 2h). Practical training is offered in courses like "Submicroscopical Anatomy and Techniques for Specimen Preparation" (L+P,6h) or "Methods for Ultrastructural Research and their Application in Biology" (L+P,6h). Students are also taught how to apply elemental analysis in an advanced course, "Specialized Methods in Electron Microscopy" (L+P,8h). After completing these courses the students are qualified and able to carry out their own research programs using electron microscopy.

International Cooperations

Reproductive biology: the Scottish Marine Biological Association, Oban (Dr. M. Barnes), the University of Sydney, Australia (Prof. D. T. Anderson), the Bar-Ilan University, Israel (Prof. Y. Aчитув), and the Institute of Marine Biology, Russian Academy of Sciences, Vladivostok (Dr. A. A. Reunov). Ontogeny of Crustacea: the University

of Copenhagen (Dr. J. T. Hoeg) and the Scripps Institution of Oceanography, La Jolla, USA (Prof. W. A. Newman). A collaborative project on cuticular structures is being carried out with Dr. M. J. Grygier (Maryland, USA).

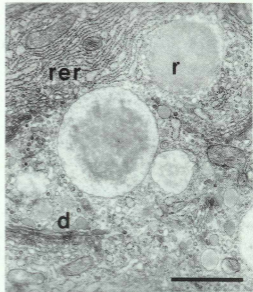


Fig. 2. TEM-picture of differentiating tissue of a male of Cirripedia Scalpellomorpha. The cell is full of dictyosomes (d), vesicles with reserve material (r) and densely arranged rough endoplasmatic reticulum (rer). Scale bar: 2µm

Selected References

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