unambiguous results. The aim of this study is to fill some of the gaps mentioned above. This was done by means of transmisson electron microscopy and fluorescent staining with subsequent confocal laser scanning microscopy on members of nearly all higher subtaxa of Nemertea. We can show that planktonic larvae have protonephridia and apical serotonergic neurons. The morphology of eyes and musculature differ among the species studied. Eyes are either epidermal or subepidermal, and the body wall musculature differs in its formation in the larvae of different species. Our results lead to the conlcusion that a sister group relation of nemerteans and platyhelminths can be ruled out and that so far there is no hint at a sister-group relationship of Nemertea and Annelida.

Morphological Changes Accompanying Anhydrobiosis in the Rotifer *Macrotrachela quadricornifera* (Rotifera, Bdelloidea)

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Bdelloid rotifers are aquatic microinvertebrates able to cope with the loss of environmental water by entering dormancy, and thus capable to live in temporary habitats. When water is evaporating, bdelloids contract into "tuns," silence metabolism and lose water from the body: a condition known as anhydrobiosis. Under controlled conditions *Macrotrachela quadricornifera* was made anhydrobiotic, and its morphology was studied by light and electron microscopy. For comparison, the same study has been carried out on hydrated active animals. A very compact anatomy characterizes the anhydrobiotic rotifer, resulting in a considerable reduction of its body volume: the internal organs, strictly packed together, occupy the body cavity almost completely and the lumen of hollow organs disappears. Remarkable ultrastructural changes characterize the anhydrobiotic condition. The mitochondria in the epidermis are wholly surrounded by a ring of electron dense particles; and the epidermal pores, that are open in hydrated specimens, become gradually closed by structures similar to epithelial junctions. The cilia are densely packed: their microtubules are still identifiable, but the axonemal organization appears disrupted. Inside the vitellarium, the yolk granules coalesce, and the gland cytoplasm is filled with extensive membrane networks, similar to RER. The gastric gland is also reduced in size: its cytoplasm is filled with digestive vesicles and large secretory granules. This is the first extensive comparative study on the morphological changes associated with the anhydrobiosis process in a rotifer. In describing the *M. quadricornifera* anhydrobiont morphology, we provide the basis to the understanding of the processes involved in this extreme adaptation.

Nervous and Muscle System Development in a Basal Bilaterian

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The anatomy and ontogeny of the nervous and muscular system of the acoel flatworm *Symsagittifera roscoffensis* were studied by immunocytochemistry and confocal laser scanning microscopy and 3D reconstruction software. Antibodies against serotonin and RFamide reveal a neural concentration around the statocyst. We found over 100 serotonergic perikarya and 6 longitudinal nerve cords in the juvenile. The nerve cords are interconnected by commissures. The adult nervous system consists of the same elements, but is much more elaborated. At 50 percent of development between egg-deposition and hatching, a grid of longitudinal and circular muscles is present in the embryos. Diagonal muscles are initially rare but their number increases with time. Juveniles show very distinct patterns of the ventral and dorsal body-wall musculature. The ventral side bears U-shaped muscles around the mouth, which in addition is surrounded by a sphincter muscle. The number of circular and longitudinal muscles increases with age. In the adult, the female and male gonopores with their associated sexual organs show distinct associated muscles. No specific statocyst muscles could be found. The muscle mantles of the needle-shaped sagittocysts are situated along the lateral edges of the animal and in the posterior end close to the male gonopore. In both juveniles and adults, microvilli associated with certain sensory cells are labeled with phalloidin. As the acoels are members of the earliest extant bilaterian offshoot, the data presented herein add considerably to our understanding of bilaterian bodyplan ground patterns.

From Stem Cell to Complex Sperm in the Rhabditophoran *Macrostomum lignano*

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Macrostomum lignano possesses a unique stem cell system (neoblasts) responsible for tissue-turnover, growth, regeneration, and germ line formation. Its somatic gonads as well as the germ line are formed during postembryonic development. This study was aimed at assessing the germ line formation in *M. lignano*. We mainly focused on the differentiation of primordial germ line stem cells to sperm using different techniques such as a light microscopical analysis and a transmission electron microscopic study mainly of the adult testis. 3D reconstructions were made based on TEM sections. The spermatozoa have a complex morphology with bristles, a terminal brush and an undulating shaft. It is still unclear how these morphological features develop. We found new intracellular structures associated with the bristles, which are transiently developed through spermiogenesis. Spermiogenesis of *M. lignano* will be discussed and compared to data on spermiogenesis in other species of *Macrostomum* and other platyhelminth taxa. More specifically, the developmental implications of bristle formation will also be discussed.

Symposia: Poster Presentations

Symposium A—Invertebrates as Stem Group Vertebrates: Poster Abstract

Hemichordata as the Closest Relatives of Chordata

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In the nineteenth century, chordates were assumed to be related to arthropods or annelids. This assumption necessitated that the articulate ancestors were turned upside down. After the hemichordate concept of the origin of the Chordata became widely accepted, the upside-down idea was almost forgotten. In fact, hemichordates can be regarded as the closest relatives of Chordata only if we accept the upside-down origin of chordates. Usually, the collar nerve tube of Enteropneusta is considered to be the homologue of the chordate nerve tube, but actually, it is homologous to the ganglion innervating the lophophore arms in Pterobranchia. The true homologue of the chordate nerve tube is the ventral nerve trunk of hemichordates (which is much stronger than the dorsal one). In hemichordates and echinoderms, the left preoral coelom is larger than the right one, whereas in chordates the right preoral coelom is larger than left one. In hemichordates, the coelomic pores open on the dorsal side, whereas in chordates they open on the ventral side. In chordates, the blood flows in the opposite direction to that seen in the hemichordates. The preoral heart of Hemichordata is homologous to the heart of Tunicata (but not to the heart of Vertebrata), although in the former the heart is dorsal while in the latter it is ventral. The ventral intestinal groove of enteropneusts is the true homologue of the "chorda dorsalis." If we accept the upside-down origin of chordates, the genital wings of enteropneusts can be regarded as homologues to the metapleural folds in lancelet and to the paired fins (paired limbs) of vertebrates.

Symposium B—Neurophylogeny—Evolution of Invertebrate Nervous Systems: Poster Abstracts

Immunohistochemical Study and 3D Reconstruction of the Central Nervous System of Mystacocarida (Arthropoda, Crustacea)

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The Tetraconata concept which unites Crustacea and Hexapoda is nowadays almost generally accepted. However, the question of monophyletic or paraphyletic Crustacea remains inconclusive. To resolve this issue, additional data on several smaller crustacean subtaxa is urgently needed, the enigmatic Mystacocarida being one of these groups. Because of several putativley plesiomorphic features, the "primitiveness"of these minute animals has been suggested. This even led to their interpretation as sister group to Mandibulata, thereby, implying paraphyletic Crustacea.