

Food and Feeding

Most common, polyclads are active carnivorous predators and scavengers and can be found feeding on various sessile invertebrates. Some species are herbivores and have specialized on green algae or benthic diatoms. In a few flatworm species of the order *Acoela* (an old [taxonomic order](#) which is distinct from the order

Polycladida), ingested microalgae are not degraded but become endosymbionts (*Zoochlorella*). In this symbiotic relationship algae remain photosynthetically active in gut and parenchyma cells and significantly contribute to the energy intake of the worms. In some species of the genus *Convoluta* (*Convoluta roscoffensis* - PHOTO to the right © Arthur Hauck), juvenile worms acquire a high number of green algae (*Tetraselmis convolutae*, about 25000 per individuuum). After entering the adult phase, they completely rely on their endosymbionts being reflected in crucial anatomical changes. Their pharynx and mouth loose function. For feeding, *C. roscoffensis* comes to the surface in the bright light of low tide, where the symbiotic algae distributed throughout the epidermis of the body, actively photosynthesize (Holligan et al., 1977). Food produced by the algae (mannit sugar) is used by the flatworms. This [phenomenon can be observed](#) on sheltered sandy beaches of France and parts of England when under optimal environmental conditions these worms form great green streaks across the sand at low tide. Many species of the *Pseudocerotidae* family are thought to prefer colonial and solitary ascidians (see photos below), sponges, and bryozoans showing no regular specificity in their diet. For feeding, the highly ruffled pharynx (pharynx plicatus) which, when not in use is retracted in a pocket, protrudes and can be expanded into the individual zooids of colonial ascidians. While discharging proteolytic secretions by accessory glands the muscular pharynx is used like a pestle to macerate the prey's tissue. Partially digested tissue is then drawn into the intestine which acts as a reservoir while further digestion takes place in the highly branched gut. The gastrovascular cavity also transports food particles to all parts of the body.

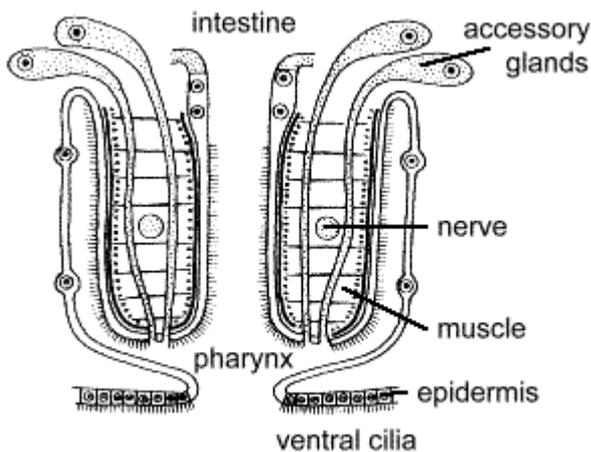




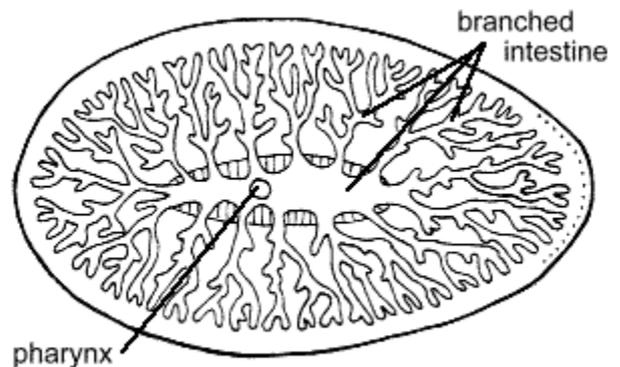
Eurylepta leoparda (Freeman, 1933) feeds on the solitary ascidian *Corella willmeriana*. Several juveniles are inside of each tunicate. After they have eaten the entire contents, they crawl around for another victim (PHOTO © Sandra Millen).



Prostheceraeus moseleyi (Lang, 1884) reaches a length of up to 3 cm. It is distributed throughout the Mediterranean Sea and the temperate eastern Atlantic and apparently feeds on tunicates of the genus *Clavelina* (PHOTO © Peter Wirtz).



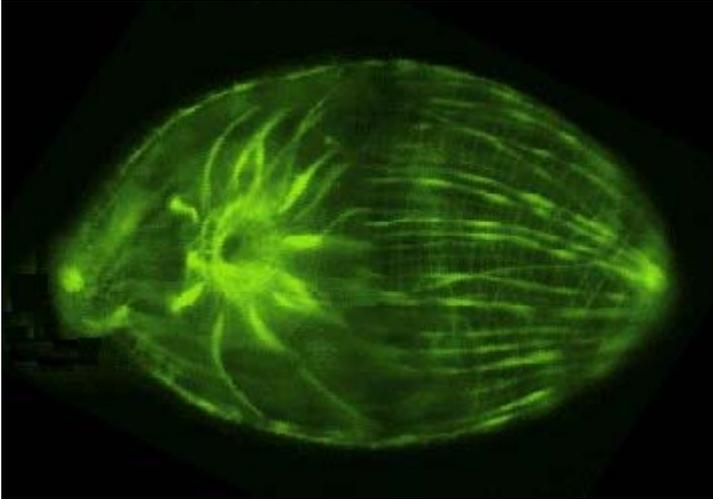
Schematic organization of the *pharynx plicatus* of a polyclad (longitudinal section)



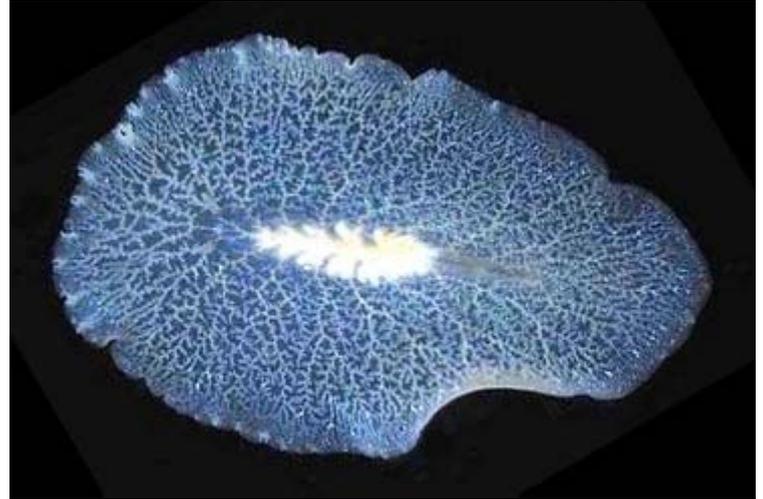
Organization of the blind digestive cavity of polyclads with highly branched diverticles (ventral view)

Observations on *Pseudobiceros* species suggest that prey can also be engulfed by the muscular pharynx (see left image below), which can expand to the same size as the whole animal. Digestions is then started outside of the body allowing the pharyngeal muscles to break up the prey which is then sucked, whole, into the intestine. Yet another technique has been observed for *Eurylepta leoparda*. This species penetrates the mantle of the solitary ascidian *Corella willmeriana* and by using these drill holes, they suck its complete content within several hours. Juveniles even can be found inside the tunicate. After they have eaten

the entire contents, they crawl across the rocks to another tunicate. When occurring in masses flatworms can have disastrous impact on human aquaculture. Tropical polyclads are known as pests of oysters and giant clams (*Stylochus matatasi*).



Muscle filament staining of a turbellarian flatworm reveals a meshwork of longitudinal, circular and diagonal muscles. The large, bright ring with muscle fibers radiating outward is the muscular *pharynx plicatus* (Image courtesy of M. D. Hooge and S. Tyler, Department of Biological Sciences, University of Maine).



The highly branched intestine of the translucent species *Aquaplana/Paraplanocera sp.* extends throughout the entire body (PHOTO © [Robert F. Bolland](#)).

After further enzymatic degradation of food particles in the gastrovascular cavity nutrients are transported into the intestinal branches resembling a highly absorptive surface. Most food particles are engulfed by phagocytosis of the gastrodermal cell layer and further enzymatic breakdown occurs intracellularly. Undigested material is egested through the pharynx, the same opening through which food enters, because flatworms have a blind digestive system. In some species it has been observed, that after complete digestion the gut was cleaned by flushing it with water.

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