

# Sipuncula

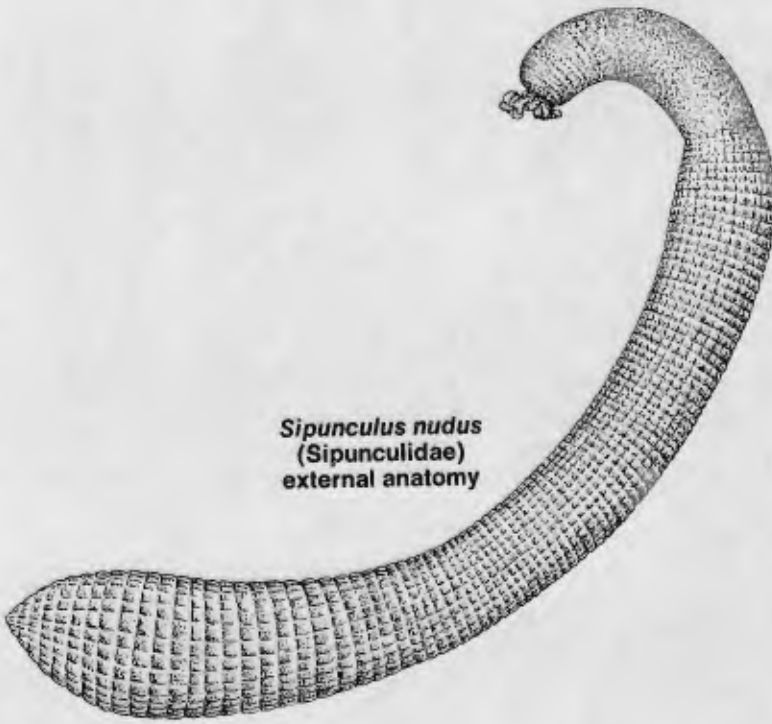
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Phylum of marine worms distinguished by a differentiation of the body into a thickened posterior trunk and a narrower, anterior, retractable introvert; by a recurved, usually coiled gut, terminating in a dorsal anus at the base of the introvert; and by a spacious, unsegmented body cavity (coelom) traversed by one to four introvert retractor muscles. The tentacles and mouth are located at the anterior extremity of the introvert. The anterior introvert is frequently ornamented by spines or hooks. Papillae or skin bodies are usually concentrated at the anterior and posterior extremities of the trunk; they have pores through which the epidermal glands and sensory organs open. The body wall is composed of an outer cuticle, an epidermis, circular and longitudinal muscle layers, and an inner peritoneal lining. The longitudinal muscle layer is sometimes divided into bundles. There are one or two tubular nephridia, each opening to the exterior through a ventrolateral nephridiopore (usually in the anterior trunk), and opening to the body cavity through an anterior ciliated funnel (nephrostome). The tentacular canals join the ring canal at the base of the tentacles; one or two blind vessels (compensatory sacs or contractile vessels), often with branches or villi, extend from the ring canal along the surface of the esophagus. The nervous system comprises an unpaired median ventral nerve cord, circumesophageal connectives, and a supraesophageal ganglion (brain). A minute gonad is present at the base of the ventral retractor muscles. Developing gametes, released from the gonad, are suspended in the coelomic fluid along with numerous coelomocytes. [See illustration page 68.]

Sipunculans are distributed throughout the oceans of the world, from the polar seas to the tropics; they occur with the greatest diversity and abundance in the tropical seas of the Indo-Pacific. They range in depth from intertidal waters to the abyssal plains. As benthic animals, sipunculans are found burrowing in sand, mud, or gravel; they occur under rocks, in crevices of rocks, and, in the tropics, in burrows of their own formation in coral rubble and other calcareous rock. In coral reefs, their boring activity is considered to be a significant factor in the natural erosion of the reef. Some species inhabit the empty shells of gastropods and scaphopods, and 1 species lives in association with a solitary coral.

On the basis of studies of gut contents and natural history observations, it appears that most sipunculans are detritus feeders. Sand-burrowing species engulf sand, digesting organic matter from the sand particles. Species dwelling in burrows in calcareous rock graze on the surface of the rock, utilizing the movement of the long introvert and introvert hooks to loosen particles of detritus which are ingested as the introvert is retracted. Those species that have elongate tentacles and inhabit more or less permanent burrows may be suspension feeders, ingesting material through the ciliary and mucus-secreting activities of the tentacles.

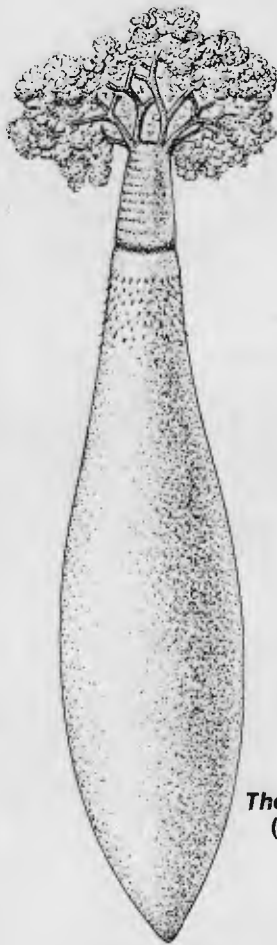
With the exception of 1 species (*Golfingia minuta*) sipunculans are dioecious, males and females releasing gametes by epidemic spawning into the seawater, where fertilization occurs. Early development resembles that of annelids and mollusks. Eggs divide by the typical pattern of spiral cleavage; usually, a trochophore larva with an apical tuft and an equatorial band of prototrochal cilia develops. In sipunculans the trochophore is a short-lived, lecithotrophic (nonfeeding) larval stage, commonly succeeded by a second larval stage which may be either lecithotrophic or planktotrophic (feeding) and which is known as the pelagosphaera. Unique to the Sipuncula, the pelagosphaera is characterized by a terminal organ by which the larva may attach temporarily to the substratum, a prominent band of metatrochal swimming cilia, and a retractable anterior body. Found in large numbers in oceanic waters, the planktotrophic pelagosphaera is thought to be a long-lived larval stage that is capable of surviving transport



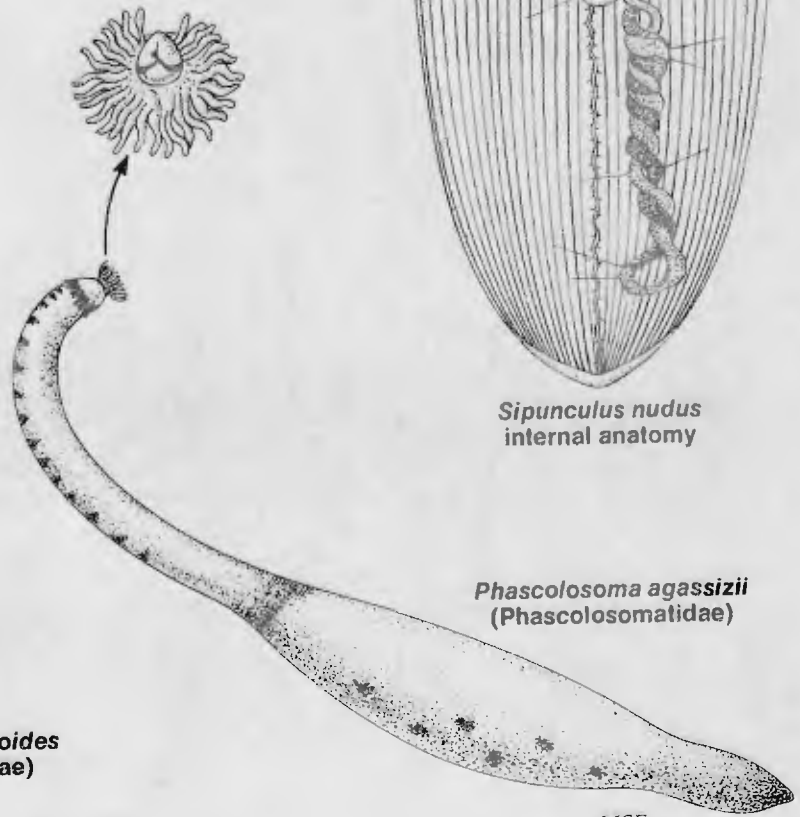
*Sipunculus nudus*  
(Sipunculidae)  
external anatomy



*Sipunculus nudus*  
internal anatomy



*Themiste pyroides*  
(Golfingiidae)



*Phascolosoma agassizii*  
(Phascolosomatidae)

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across ocean basins. Larval stages are entirely lacking in the few species in which the embryo develops directly into a juvenile worm.

The Sipuncula are generally considered closely allied to the Annelida because of similarities in early development and the morphology of the nervous system. It is assumed that the complete lack of segmentation in both larva and adult is a primitive feature, and that the sipunculans are most probably derived from the annelidan-molluskan stem.

A recent classification of the phylum, modified from A. C. Stephen and S. J. Edmonds, recognized 4 families, 16 genera, and 320 species: Sipunculidae (5 genera, 43 species), Golfingiidae (4 genera, 155 species), Aspidosiphonidae (5 genera, 58 species), and Phascolosomatidae (2 genera, 64 species).

**References.** L. H. Hyman, The protostomatous coelomates—phylum Sipunculida, *The Invertebrates*, vol. 5: *Smaller Coelomate Groups*, McGraw-Hill, New York, 1959; M. E. Rice, Sipuncula, in A. C. Giese and J. S. Pearse (eds.), *Reproduction of Marine Invertebrates*, Academic Press, New York, 1975; A. C. Stephen and S. J. Edmonds, *The Phyla Sipuncula and Echiura*, British Museum (Natural History), 1972.

**Aspidosiphonidae.** Distinguishing characters of this family are a thickened cuticular shield or calcareous cap at the anterior extremity of the trunk and, often, a thickened shield at the posterior tip. Aspidosiphonids are common in the coral rubble of tropical reefs. The family contains 5 genera and 58 species. The genera recognized by A. C. Stephen and S. J. Edmonds are: *Aspidosiphon* (24 species), *Paraspidosiphon* (24), *Lithacrosiphon* (8), *Cloeosiphon* (1), and *Centrosiphon* (1).

**Golfingiidae.** Small to moderate-sized worms. The body wall musculature is continuous and lacks bands. The tentacles are commonly filiform, and usually surround the mouth; or the tentacles may be reduced or absent. This is the largest family of the phylum, containing 4 genera and 155 species. The genera recognized by A. C. Stephen and S. J. Edmonds are: *Golfingia* (96 species), *Phascolion* (32), *Onchnesoma* (2), and *Themiste* (25). *Golfingia* with 6 subgenera, is the largest and most diverse genus, and is considered to be the most primitive genus in the phylum.

**Phascolosomatidae.** Family containing 2 genera: *Phascolosoma* and *Fisherana*. The longitudinal musculature occurs in bands in *Phascolosoma*, and is continuous in *Fisherana*. The tentacles are dorsal to the mouth in a crescent enclosing the nuchal organ. The prominent papillae are usually concentrated at the anterior and posterior extremities of the trunk. *Phascolosoma* is the larger genus, with 60 species; *Fisherana* has 4 species.

**Sipunculidae.** Usually large, elongate, sand-burrowing worms. The important characters are bands of longitudinal muscles in the body wall and coelomic canals or diverticula (with the exception of *Phascolopsis*). There are numerous tentacles or a tentacular fold around the mouth. The coelomic canals and diverticula are considered to have a respiratory function. A. C. Stephen and S. J. Edmonds recognize 5 genera in this family: *Sipunculus* (18 species), *Siphonosoma* (20), *Siphonomecus* (1), *Phascolopsis* (1), and *Xenosiphon* (3), totaling 43 species.

