

by Christian C. Emig

## Lingulida

An order of inarticulated brachiopods consisting of an exclusively marine group of lophophorate animals (i.e., animals with a tentacular food-gatherer, respiratory and protective organ): sessile benthic suspension-feeders possessing a chitino-phosphatic shell. Representatives occur throughout the Phanerozoic Era (from the Early Cambrian to the present). Three superfamilies are recognized: Linguloidea among which the family Lingulidae extends from the Middle Ordovician to the present; Discinoidea with the family Discinidae extends from the Early Ordovician to the present; and, Acrotheloidea, known from the Early Cambrian to the Early Ordovician.

See BRACHIOPODA; LINGULIFORMEA

**General morphology.** Shells are tongue-shaped (linguliform) to circular in outline. The valves are separate and lack articulation but possess a complex arrangement of muscles formed by paired anterior adductor muscles and single or paired posterior adductor muscles, and three or four pairs of oblique muscles. The pedicle emerges posteriorly between valves or through foramen.

Lingulids are suspension feeders. The tentacular feeding organ (lophophore) occupies the mantle cavity. The digestive system consists of a mouth, pharynx, esophagus, stomach, digestive diverticula, pylorus, and intestine, terminating in a functional anus. Four digestive diverticula open through ducts to the stomach. The excretory system consists of a pair of ciliated funnels (metanephridia) that act as gonoducts during spawning and allow the discharge of gametes from the coelom into the lophophoral cavity. Solid waste, enmeshed in mucus, is also ejected through the nephridiopores, while other excretory product

ammonia is voided through the tissues of the mantle and lophophore.

Lingulids possess an open circulatory system of blood vessels and coelomic canals, containing a faintly pigmented fluid, which is coagulable and contains free cellular inclusions consisting of blood cells and coelomocytes. In *Lingula*, the blood cells are somewhat round in shape and contain a respiratory protein that consists of hemoerythrins.

Lingulids have a central nervous system containing unsheathed nerves with no obviously differentiated sense organs although statocysts have been reported in Lingulidae.

All extant members of this order are dioecious (that is, male and female reproductive organs on separate individuals) and their larval development is planktotrophic. They extend generally from inshore waters, mainly subtidal, to the bathyal zone.

**Lingulidoidea.** Shells are linguliform to circular in outline, generally biconvex. The two extant genera belong to the family Lingulidae: *Lingula* wrongly considered as "living fossils" from the Paleozoic, and *Glottidia*. Both genera originated at the beginning of the Tertiary. They have a long, fleshy extensible pedicle and burrow in soft sediments (*see illustration*). Their complex arrangement of muscles consists of two pairs of anterior and a single posterior adductor muscles, unpaired oblique muscles (three pairs and an single additional one), and a longitudinal lateral muscle, which help with movements of the valves.

**Discinoidea and Acrotheloidea.** Most shells are circular or subcircular in outline. The dorsal valve is usually larger than the ventral valve, and is convex and often conical. The ventral valve is flattened and disk-like. Paired anterior and posterior adductor muscles and three pairs of oblique muscles make up the complex arrangement of muscles. A short

pedicle in postlarval stage is emerging through a foramen in the ventral valve, but the adults lack a pedicle notch.

Christian C. Emig

**Bibliography.** C. C. Emig, Ecology of inarticulated brachiopods. Biogeography of inarticulated brachiopods, in R.L. Kaesler (ed.), *Treatise on Invertebrate Paleontology*. Part H revised, *Brachiopoda*, vol. 1, pp. 473-502, Geological Society of America, Boulder, and University of Kansas, Lawrence, 1997; C. C. Emig, Tools for linguloid taxonomy: the genus *Obolus* (Brachiopoda) as an example. *Carnets de Géologie-Notebooks on Geology*, Article 2002/01 (CG2002\_A01\_CCE), 2002; C. C. Emig, Proof that *Lingula* (Brachiopoda) is not a living-fossil, and emended diagnoses of the Family Lingulidae, *Carnets de Géologie-Notebooks on Geology*, Letter 2003/01 (CG2003\_L01\_CCE), 2003; R. L. Kaesler (ed.), *Treatise on Invertebrate Paleontology*, Part H revised, *Brachiopoda*, vols 1 and 2, Geological Society of America, Boulder, and University of Kansas, Lawrence, 1997 and 2000.

View of living *Lingula anatina* in its burrow (drawing from Emig C. C.).

