# Bryozoans, brachiopods, and phoronida originate from the common ancestor

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Different types of animals from the Lophophorata group. From left to right: bryozoans (Bryozoa), brachiopods (Brachiopoda), phoronids (Phoronida). Credit: Alexander Semyonov/MSU

A biologist from Lomonosov Moscow State University has studied the nervous system of the adult phoronida using modern methods and presented new facts regarding the taxonomy of invertebrates, proving that phoronids, barchiopods and bryozoans are relatives contrary to earlier conclusions. The results of the work were published in *Scientific Reports*.

Phoronida is a poorly studied phylum of invertebrates. Although it only contains about a dozen species, these animals are widespread and can be

found in all areas of the ocean except for the Antarctic region. Phoronids live at most depths down to 400-600 meters. Their size varies from six millimeters to 50 centimeters. The soft body is covered by a chitinous tube, which is embedded into soft or hard substrata. The anterior end of the body terminates in the lophophore—a tentacular structure, which is exposed into water and used for many functions such as collection of food particles, brooding and sense perception.

All animals with the lophophore (Phoronida, Brachiopoda, and Bryozoa) were traditionally categorized in one large group called Lophophorata. However, animals of these three phyla look completely different—bryozoans are similar to cnidarian polyps and sometimes form moss-like carpets; Phoronida resemble annelid worms, and brachiopods have shells that make them look like clams. Even the lophophore organs are organized differently—some have just a crown of tentacles; in others, tentacles are located spirally or form a helicoidal coils. But all these animals have a sessile lifestyle, are attached to substrate, and feed in similar manner.

For many years, scientists have argued whether these types are related. In the past 20 years, genetics and molecular biology were included into the range of zoological methods. The genomes of bryozoans were slightly different from those of Phoronida and brachiopds, and biologists started to believe that the former type was unlikely to be closely related to the latter two. Still, they did not know how to regard bryozoans. Some considered them as sister group of all bilaterians, which have symmetrical bodies, and others included them with other small, colonial animals.

Elena Temereva used modern methods of immunocytochemistry and studied the innervation of the lophophore and tentacles in adult phoronid Phoronis ovalis. Comparative analysis of the organization of the lophophore nervous system in species of all three phyla of

Lophophorates has revealed the presence of homological nerve elements in the lophophore and allowed to conclude the homology of the lophophore.

"Based on these data we've supposed an idea that Phoronida and moss animals had originated from the common protophoronid ancestor. This conclusion based on morphological data contradicts the results of molecular and genetic studies conducted by other scientists," said Elena Temereva, doctor of biology, professor of Russian Academy of Sciences, and leading research associate of the department of invertebrate zoology at the Faculty of Biology, MSU.

The scientist studied the lophophoral nervous system using transmission electron microscopy, and immunocytochemistry and laser confocal microscopy. "This work establishes the phylogeny of bryozoans. It is a conceptually important achievement for the understanding of the whole animal kingdom system and reconstruction of early evolutionary pathways of Bilateria," concluded Elena Temereva.

**More information:** Elena N. Temereva, Innervation of the lophophore suggests that the phoronid Phoronis ovalis is a link between phoronids and bryozoans, *Scientific Reports* (2017). DOI: 10.1038/s41598-017-14590-8

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