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Synthesis of Marine Drugs by Using Bryozoa

Steven Wayal*

Department of Zoology, University of Gothenburg, Gothenburg, Sweden

***Corresponding author:** Steven Wayal, Department of Zoology, University of Gothenburg, Gothenburg, Sweden; E-mail: stevenwayal@zool.se

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Description

Natural products have long been used to improve the quality of human life, not only as food but also as fragrances, pigments, insecticides, and pharmaceuticals. Although most naturally occurring product-derived drugs on the market today are of terrestrial origin, marine organisms have been identified to be the vast reservoir of novel medical drugs. The phylum Bryozoa is an important source of bioactive compounds in marine invertebrates that has only been partially explored. Bryozoa, a phylum of aquatic, filter-feeding invertebrates that includes sea mats, moss animals, and lace corals, are plentiful, speciose, widespread, and significant members of many benthic ecosystems from the intertidal to the deep sea in a range of marine settings. There are currently about 6000 identified species, and new taxa are constantly being identified, especially in formerly inhospitable areas (e.g., the deep sea and Antarctica). Numerous microscopic invertebrates and microorganisms inhabit these colonies, which are nearly entirely colonial and typically sessile, generating a wide range of shapes (from encrusting sheets to upright branching chains).

Bryozoa are sessile colonial aquatic animals made up of small modules called zooids. Feeding zooids typically have a calcified body wall and a soft-bodied part called the polypide, which includes a ciliated tentacle crown (lophophore), a gut, and associated musculature and nerves. Because bryozoans are suspension feeders, their lophophores capture organic particles in the water column. Despite their diversity bryozoans are a relatively understudied group. They are suspension feeders that can be found in freshwater, brackish, and marine environments. They not only provide food for their predators (e.g., nudibranchs and sea spiders), but they also provide habitat for other animals such as small crustaceans, juvenile mussels, nematodes, entoprocts, etc.

Most bryozoans are hermaphrodites when it comes to reproduction. Their colonies exhibit zooidal gonochorism or zooidal hermaphroditism (male and female zooids). Sexual and asexual reproduction are both common in the life cycle. Self-fertilization in bryozoans is thought to occur only when cross-fertilization is impossible. Each new colony is started by a sexually produced planktonic larva that settles and metamorphoses into the founder zooid, which then buds other zooids through asexual reproduction. Most bryozoan species are brooders; their embryos typically develop into short-lived, non-feeding larvae in ovicells, which are special brood chambers.

Bryozoans as a source of novel anticancer drugs

Many cancer cell populations are thought to be sustained by Cancer Stem Cells (CSCs), resulting in therapeutic refractoriness and dormant behaviour. CSCs were previously referred to as tumor-initiating cells, but new evidence suggests that CSCs and tumor-initiating cells are distinct subsets of cell populations. The secondary metabolite bryostatin-1 significantly enhances Imatinib Mesylate's anticancer activities in the removal of Chronic Myeloid Leukaemia (CML) stem cells in bryozoans. Cancer cells must be able to withstand anoikis in order to spread. The numerous biochemical and molecular pathways that enable cancer cells to withstand pro-apoptotic stimuli (including anoikis) during their metastatic journey, including the fact that anoikis is an apoptosis-related cell death that is induced in cells that detach from the Extra Cellular Matrix (ECM) or from neighbouring cells. Drugs that use pro-apoptotic stimuli to kill cancer cells are no longer regarded as innovative because they are already crucial components of all chemotherapy regimens. However, novel anticancer medications that kill cancer cells resistant to pro-apoptotic triggers (such as metastatic cancer cells) must be developed.

Conclusion

Many pharmacologically important bioactive compounds are found in bryozoans, many of which may be ecologically relevant. Bryozoan metabolites have a high potential as anticancer agents and treatments for brain diseases, as well as viral and parasitic infections. Recent advances in the development, approval, and therapeutic use of marine drugs show that marine natural products have enormous potential. There are currently seven Food and Drug Administration (FDA) or European Medicines Agency (EMA) approved drugs derived from marine organisms on the market, the majority of which are antitumor-drugs.

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