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Editorial: The discovery, identification and application of marine microorganisms derived natural products

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Editorial on the Research Topic
The discovery, identification and application of marine microorganisms derived natural products

The discovery, identification and application of marine microorganisms derived natural products

Natural products are generally considered to be an important source of small molecule drugs. Almost 50% of the newly developed drugs were developed from natural products or their derivatives. However, repeated separation has become a challenge in the study of natural products. Almost 70% of the isolated compounds are repeated known compounds, which is a large waste of time and material/energy resources. In order to reduce the chance of repeated separation, some samples from special living environments have been used to discover novel compounds with significant bioactivity. Marine organisms are an abundant resource to produce novel bioactive natural products.

At present, the number of natural products obtained from the ocean has reached 40,300. More than 1000 secondary metabolites are found from the ocean each year. The special structure and biological activity of marine natural products make them a new source of lead compounds in the development of new drugs. In the last five years, more than half of the new natural products derived from microorganisms, indicating their enormous potential to produce new drug lead compounds.

This Research Topic covers the researches about novel naturals products, especially the bioactive new compounds, isolated from marine microorganisms, the bioactive mechanism or the structure-activity relationships, and the metabolomics or genomics analysis of the active compounds, and the medicinal potential of the marine microbial natural products to promote the development and utilization of marine microbial resources in biomedicine.

In the Research Topic "*The discovery, identification and application of marine microorganisms derived natural products*", four articles have been published in this field.

In the original research "*Inhibition of oil tea anthracnose by natural product extracts from Bacillus and Pseudoalteromonas isolates from mangrove soil*", Fei et al. explored the potential of secondary metabolites produced by two mangrove soil derived bacteria, *Bacillus velezensis* GP521A and *Pseudoalteromonas caenipelagi* GP3R5, in anthracnose treatment in *Camellia oleifera*. The ethyl acetate extracts of fermentation cultures of GP3R5 (FEGP3) and GP521A (FEGP5) both potently suppressed mycelial growth of *Pyricularia oryzae* P131, *Colletotrichum fructicola* CF-1 and *C. camelliae* MC171 at 200 and 100 μg/mL, respectively. In addition, FEGP3 and FEGP5 significantly restrained conidial sporulation and germination, and infection formation in *C. camelliae* MC171 at 50 μg/mL. On detached oil tea leaves, FEGP3 and FEG5 at 100 μg/mL resulted in approximately 97.5% and 98.0% decrease in infected areas, respectively, when applied prior to MC171 inoculation. While in the treatment group, the reduction was approximately 77.6% and 55.0%, respectively. In fresh fruit, FEGP3 and FEGP5 significantly inhibited disease development in both preventive and therapeutic treatments. Furthermore, both extracts were significantly less toxic to the commonly used bio-indicator *Artemia salina* than prochloraz at the same concentration. In conclusion, this research illustrates the potential of compounds isolated from marine microorganisms for the development of environmentally compatible bio-pesticides for the control of anthracnose in oil tea.

Wang et al. summarized the bioactive compounds from deep-sea derived fungi in the Research Topic "*Progress in the discovery of new bioactive substances from deep-sea associated fungi during 2020-2022*". The biological activities and chemical structures of 184 new compounds found from 46 fungi derived from deep-sea published from 2020-2022, have been reviewed. The horrible living conditions of low temperature, high pressure and oligo-nutrition mean the challenge to collect deep-sea-derived fungi, but also led to the evolution of special genes to produce novel secondary metabolites. Deep-sea derived fungi have attracted the interests of the researchers in recent years, and were considered as potential prolific sources to produce new bioactive natural products that are of comparative interest for developing new drug leads. The 184 new deep-sea fungi isolated compounds are distributed in the structural categories of polyketides, terpenoids, and nitrogen-containing compounds. Almost half of the compounds are isolated from *Aspergillus*. The bioactive of the new compounds are concentrated in cytotoxic, anti-infective and enzyme inhibitory activities, meaning the potentiality to find new drugs from deep-sea fungi. While the mechanism of the bioactivities of the new compounds are short of research. The silent gene clusters of deep-sea fungi remain unexplored in terms of habitat-based cultivation strategies, including low temperature and oxygen levels, as well as high pressure, despite the successful application of such strategies to other deep-sea microorganisms. Therefore, there is a compelling need to develop and implement habitat-simulating strategies to activate the silent gene clusters in deep-sea fungi, so as to further develop the deep-sea fungal secondary metabolic potential.

Besides fungi, the marine actinomycetes are also as the important producers of new naturals products. Ryu et al summarized the new natural products isolated from marine mudflat actinomycetes in the review "*Marine mudflat actinomycetes as a novel natural products source*". Ryu et al. found 16 reports covering 42 natural products, reported the bioactivities of the natural products, and analyzed the phylogenetics of the mudflat collected actinomycetes. The 42 mudflat actinomycetes derived compounds have different chemical structures, including polyketides, peptides, terpenoids and alkaloids. And the compounds display various bioactivities, including antimicrobial, cytotoxic, antioxidant and enzyme inhibitory activities. Some of the isolated compounds exhibited unique scaffolds, examples included the anmindenols A and B, and anithiactins A-C. These exhibited significant biological activities, and might well serve as templates for drug discovery. The phylogenetic analysis displays genetic relationship of a total of 16 mudflat derived actinomycetes. *Streptomyces* species are frequently mentioned in the phylogenetic tree to be the dominant actinomycetes in the mudflat environment. And the narrow phylogenetic diversity indicates further research is required to study the diversity of actinomycetes in mudflats. The biosynthetic gene cluster and culturing conditions exploration are also lack of study to find more new bioactive secondary metabolites.

Microorganisms are playing an important role in producing new bioactive natural products as shown in the above-mentioned three publications on this Research Topic. Li et al. also summarized the potential of microorganisms to yield novel compounds, with the Research Topic "*The natural products discovered in marine sponge-associated microorganisms: structures, activities, and mining strategy*". In this article, authors summarized 140 new natural products isolated from sponge-associated microorganisms from 2017 to 2022. The strain sources, structures, biological activities and the mining strategies of the sponge-associated microorganisms isolated compounds are systematically discussed. The compounds exhibit great chemical and bioactive diversity, while their mechanism of action and biological targets remain elusive, further study is required in the future. The potential ability of sponge derived microorganisms to produce new bioactive compounds will offer a fresh viewpoint on drug development and ecological conservation.

The Research Topic comprehensively displays the great ability of marine derived microorganisms to produce new bioactive compounds, what is also of potential interest is extending studies of marine-sourced microorganisms that require extensive genetic analyses to uncover the potential of microbes that are not amenable to normal cultivation techniques, the "so-called" un-fermentable microbes obtained from sponges and other marine organisms, with the aim of identifying agents which could be used in agriculture, industry, environmental protection and pharmaceutical medicine. These earlier results have already attracted more researchers to explore the applications of marine microorganism-derived natural products.

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TS: Writing – original draft, Writing – review & editing. BW: Writing – review & editing. DZ: Writing – review & editing. DN: Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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