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EDITED AND REVIEWED BY
Wei Zhang,
Marine Bioproducts Cooperative Research Centre, Australia

*CORRESPONDENCE
Bin Wang
wangbin4159@hotmail.com
Zhongshan Zhang
01959@zjhu.edu.cn

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Editorial: Biological macromolecules from marine organisms: isolation, characterization and pharmacological activities

Bin Wang[1]*, Zhe-Sheng Chen[2], Zedong Jiang[3] and Zhongshan Zhang[4]*

[1]Zhejiang Provincial Engineering Technology Research Center of Marine Biomedical Products, College of Food Science and Pharmacy, Zhejiang Ocean University, Zhoushan, China, [2]Department of Pharmaceutical Sciences, College of Pharmacy and Health Sciences, St. John's University, Queens, NY, United States, [3]College of Ocean Food and Biological Engineering, Jimei University, Xiamen, Fujian, China, [4]Key Laboratory of Vector Biology and Pathogen Control of Zhejiang Province, Huzhou University, Huzhou, China

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Editorial on the Research Topic
Biological macromolecules from marine organisms: isolation, characterization and pharmacological activities

A large number of bioactive compounds have been effectively separated and purified from marine organisms with the deepening of human research on marine drugs (Carroll et al., 2023; Luan et al., 2023). These bioactive compounds showed anti-virus, antitumor, anti-inflammatory, immunoenhancing, antioxidant, and antihypertensive activities, as well as multiple functions on the blood and nervous system (Manoharan and Perumal, 2022; Laasri et al., 2023). As vital marine active components, marine biomacromolecules have attracted much attention due to their extensive sources, varied types, significant functionality, excellent productions, and important application potential (Geahchan et al., 2022; Hu et al., 2023; Kumar et al., 2023).

This Research Topic "*Biological Macromolecules from Marine Organisms: Isolation, Characterization and Pharmacological Activities*" published 5 peer review papers including one comprehensive review and four research articles on different objectives in marine biological macromolecules. We will briefly introduce the key scientific contributions of each study.

Antibiotic resistance has been regarded as a mortal threat to human health and social development by the World Health Organization (WHO). Antimicrobial peptides (AMPs) can make it harder for bacteria to develop resistance because they can act exclusively on the phospholipids, especially the acidic head group (Javia et al., 2018; Xuan et al., 2023). Thus, AMPs are considered a promising alternative to antibiotics. A review by Wang et al. systematically summarizes the chemical structures, biological activity, and mechanisms of action of AMPs generated from marine organisms, such as mammals, invertebrates, amphibians, fish, and reptiles. Through comparative analysis of AMPs

from marine organisms in different circumstances, the authors found that Arg and Leu are rich in marine AMPs. This phenomenon may be due to bacteria having formed a unique bacterial membrane better adapted to the marine environment. This review provides a reference basis for active marine ingredients, especially AMPs, in developing new drugs or pesticides.

Superfluous reactive oxygen species (ROS) in the body can cause oxidative stress and accordingly lead to biological injury and the emergence of different diseases (Sheng et al., 2023). The Keap1/Nrf2 signaling pathway plays a key role in the antioxidant defense system by increasing the levels of phase II detoxifying/antioxidant enzymes to inhibit ROS production. Xu et al. isolated and identified three oligopeptides including MDYYFEER, MHLWAAK, and MAQAAEYYR from pancreatin hydrolysate of C-phycocyanin, and these oligopeptides showed significant 2,2-Diphenyl-1-picrylhydrazy (DPPH) and 2,2′-Azino-bis (3-ethylbenzthiazoline-6-sulfonic acid) (ABTS) radical scavenging activity. Moreover, MDYYFEER, MHLWAAK, and MAQAAEYYR could effectively ameliorate H_2O_2-induced oxidative injury of the zebrafish embryos by regulating the Nrf2 pathway to increase the activity of superoxide dismutase (SOD) and catalase (CAT), which further decreased the levels of ROS and malondialdehyde (MDA). This study indicated that the peptides MHLWAAK, MAQAAEYYR, and MDYYFEER from C-phycocyanin could serve as effective antioxidants against oxidative injury.

Previous literature has reported that liver diseases are closely related to oxidative stress (Wu et al., 2023). Moreover, inhibiting ROS-induced damage may be a feasible method to cure liver disease. Li et al. found that polysaccharides from *Sargassum fusiforme* (SFPS) consisted of Rha, Glc, Xyl, Fuc, Man, Ara, and Gal. Furthermore, SFPS could alleviate the H_2O_2-induced injury of human fetal hepatocyte line (LO2) by increasing SOD and CAT activities to decrease levels of ROS, MDA, and lactate dehydrogenase. These findings demonstrated that polysaccharides from *S. fusiforme* could protect the hepatocytes from H_2O_2-induced liver injury.

The heavy-chain-only antibody (HCAb) and immunoglobulin new antigen receptor (IgNAR) were separately discovered from sharks and camelidae, and they are regarded as the products of convergent evolution. However, there has been relatively little research on skate immunoglobulins compared to sharks. As a result, few discoveries have been made to confirm the previous conclusion that IgNAR emerged before the skate and shark divergence, occurring about 2.2×10^8 million years ago. Wen et al. identified and characterized the IgNAR and variable new antigen receptor (VNAR) repertoire from *Okamejei kenojei*, which provided clear evidence that IgNAR existed in the serum and transcriptome of the mononuclear cells of *O. kenojei*. In addition, the study suggested that IgNAR came from a common ancestor of sharks and skates. Moreover, the authors showed that about 99% of VNARs in the ocellate spot skate belong to type IV, which indicated that the VNAR repertoire has an unusually high proportion of type IV. The unique nature of VNAR adds a variety of key structures to the naive elasmobranchs VNAR library.

Algal toxins can accumulate in the digestive glands of shellfish when shellfish feed on toxic algae (Kumar et al., 2021). Most studies on these algal toxins have focused on acute toxicity. However, Maeda et al. found that mice could lose their appetite, until to death, if they were fed a diet with mantle tissue (1%, w/w). As a result, they purified and characterized toxic ingredients from the mantle tissue of scallops. These components are protein complexes and made of two constituents with molecular weights of 18 and 29 kDa, respectively. In addition, the purified protein complexes were regarded as an actin fragment and an N-terminal fragment of a gel-like protein. Toxicity tests indicated that the two components (18 and 29 kDa) were necessary for the toxicity of scallop tissue. The research first found new toxins in scallop tissue.

Biological macromolecules are the crucial ingredients of a marine organism and have various physiological functions. However, due to the complexity of the composition and structure of most marine macromolecules, their chemical structure, pharmacological mechanism, rational dose, and administration method are not fully understood. Therefore, further studies are needed on marine macromolecules, especially on their structural and functional diversity.

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BW: Writing – original draft, Writing – review & editing. Z-SC: Writing – review & editing. ZJ: Writing – review & editing. ZZ: Writing – original draft, 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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