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EDITED AND REVIEWED BY
Katrin Linse,
British Antarctic Survey (BAS), United Kingdom

*CORRESPONDENCE
Xiao Liang
x-liang@shou.edu.cn
Linlin Zhang
linlinzhang@qdio.ac.cn

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Editorial: The response, adaptation, and evolution of marine molluscs

Xiao Liang[1]*, Linlin Zhang[2]* and Yingxiang Li[3]

[1]International Research Center for Marine Biosciences, Ministry of Science and Technology, Shanghai Ocean University, Shanghai, China, [2]Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China, [3]Department of Molecular, Cellular and Developmental Biology, University of Michigan, Ann Arbor, MI, United States

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Editorial on the Research Topic
The response, adaptation, and evolution of marine molluscs

The phylum Mollusca holds a prominent position as the second-largest group within the animal kingdom, exhibiting a remarkable diversity of life cycles and body plans. This adaptability enables them to thrive in a wide array of habits, including both terrestrial and aquatic environment. They possess substantial economic roles as vital food sources, providers of jewelry and adornments, and even as source of medicinal compounds. Particularly, in the context of global climate change, the study of marine mollusks becomes paramount importance as they serve as bioindicators, helping us understand the impacts of environmental changes on organisms. The five articles featured in this Research Topic focus on the responses, adaptations, and evolution of marine mollusks. Employing the methodologies of transcriptomics, metabolomics, and behavioral studies, these articles showcase the responses and adaptability of marine mollusks under various environmental conditions. By shedding light on these intricate mechanisms, they contribute significantly to our comprehension of the adaptation and evolution of marine mollusks.

With global warming, marine heatwaves have become more prolonged and intense, leading to severe impacts on marine ecosystems. For instance, in the mini review article of Masanja et al., the current state of knowledge regarding the effects of marine heatwaves on bivalves and their microbial communities is reviewed. Heatwaves can alter the microbial communities associated with bivalves, affecting their immunological responses and other physiological reactions to varying degrees, potentially posing further threats to human health. Suggestions are made to mitigate the impacts of climate change by reducing pollution, protecting critical bivalve habitats, and implementing other measures to safeguard ecosystems and human health. In the research of Jing et al., experiments on the Manila clam *Ruditapes philippinarum* under heat stress are conducted, revealing further insights into the molecular and metabolic adaptations of Manila clams to heat stress through comparative transcriptomics and metabolomics analyses. Processes such as protein processing, substance metabolism, inoxidizability and immunology/anti-apoptosis play significant roles in the physiological adaptation of clams to heat stress.

This study deepens our understanding of strategies for mollusk responses to global warming.

However, in addition to facing climate change, marine mollusks also encounter the issue of environmental pollution. Charifi et al. conducted an interesting study exploring the potential effects of noise and light pollution on the behavior and biological traits of the pearl oyster *Pinctada radiata*. By comparing the behavior and biological traits of pearl oysters in a quiet room and a standard laboratory environment, the study found that in the standard aquarium of the laboratory, pearl oysters dispersed rather than regrouping as observed in their natural environment. They stayed closed longer, the opening amplitude of their valves was systematically lower, and in the closed position, they squeezed their valves more tightly when subjected to noise and light pollution. Additionally, the switching of electric lights significantly influenced the daily opening rhythm of pearl oysters and led to reduced egg-laying behavior in female individuals. This study suggests that seemingly innocuous human activities may significantly impact the behavior of pearl oysters, potentially exerting important effects on populations and ecosystems.

The above researches have demonstrated that anthropogenic stress can lead to significant changes in the behavior of marine molluscs. However, for responses to other environmental pressures, such as changes in salinity, further understanding is needed. In another study, "Transcriptomic response to salinity variation in native and introduced mud-tidal gastropod *Batillaria attramentaria*" from Patra et al., the transcriptomes of four populations of gastropod were examined, including three from native habitats and one from an introduced habitat, to investigate their response to salinity variation. The study found that *B. attramentaria* exhibited good adaptability to different salinity conditions and gradually evolved after being introduced to Elkhorn Slough approximately 100 years ago. This study provides valuable transcriptomic data on genes involved in the response to salinity stress in tidal gastropods and contributes to research on the adaptive evolution of coastal gastropods. Together, these studies underscore the sensitivity and adaptability of marine molluscs to environmental changes.

Biomineralization is a widespread phenomenon in molluscs and is the primary process behind the production of shells and pearls. Shen et al. delves into the immune response of the mantle and visceral mass in pearl *Hyriopsis cumingii* culturing. Using high-throughput sequencing technology, a mantle transcriptome database was established, and the differential gene expression between the mantle and visceral mass at different insertion periods was analyzed. The result revealed a significant number of differentially expressed genes in the mantle and visceral mass at various time points post-insertion, with a notable downregulation trend observed in immune-related genes in the visceral mass. This has significant implications for understanding the immune response of molluscs in artificial environments and provides valuable insights for mollusk aquaculture.

Overall, this Research Topic offers a comprehensive exploration of the intricate interplay between marine molluscs and their environment, highlighting their remarkable resilience and adaptability. The findings presented within these articles pave the way for further investigations and provide a solid foundation for future research endeavors in the field of marine mollusc biology and ecology.

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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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