

Symbiosis and holobiont physiology: A New Understanding of the Roles and Functions of Chemosynthetic Symbionts in Bivalves

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Bivalve hosts and their chemosynthetic symbionts form the basis of chemosynthesis-based ecosystems such as deep-sea hydrothermal vents and cold seeps, and can also contribute substantially to productivity in shallow-water habitats such as seagrass meadows. Chemosynthetic symbioses were found in bivalves in 1983, heralding the beginning of three decades of discoveries on the biodiversity, function and evolution of these symbioses. The 'omics revolution' is now transforming our view on the biology of chemosynthetic symbionts in bivalves, revealing novel energy sources such as hydrogen, new metabolic capabilities such as nitrogen fixation, unexpected functions in host defense, and mechanisms of interaction between symbionts and hosts. The greatest challenge for future research will be to develop experimental approaches to test this plethora of new ideas in the field and in the laboratory.