Editorial

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# Innate Immunity in Initial Deviation of Metazoanst

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## Editorial Note

The desire to learn more about innate immunity and general immunological responses in early diverging metazoans including cnidarians, placozoans, sponges, and ctenophores prompted this article on innate immunity. The area of comparative invertebrate immunology was founded on previous immunological research in vertebrates and invertebrates, such as *Drosophila*, *C. elegans*, and shellfish. However, as the field grew in popularity, there was a disproportionate reliance on bilateral models, which limited our knowledge of the development and variety of metazoan innate immunological systems. There are definitely common basic mechanisms of immunity across the Metazoan, as well as lineage-specific mechanisms that have yet to be found and hence remain concealed from our perspective.

The process of phagocytosis is an important part of cellular innate immunity. Despite the discovery of phagocytosis in the late 1800s and the study of *Drosophila* hemocytes (blood cells analogous to phagocytes) since 1957, the finding of specialized phagocytic immune cells in early diverging lineages, including coral, remains elusive. For the first time, scientists have demonstrated functioning processes related with phagocytic cells in stony corals in this issue. They functionally identified and characterized phagocytes from the *scleractinian* coral *Pocillopora damicornis* and the actiniarian sea anemone *Nematostella vectensis* using Fluorescence-Activated Cell Sorting (FACS) and fluorescence microscopy. Their research showed that phagocytes from several *anthozoan* species detect and engulf targets with a variety of Microbe-Associated Molecular Patterns (MAMPs) and Danger-Associated Molecular Patterns (DAMPs), such as bacterial and fungal antigens, heat stressed self-cells, and microplastic beads.

More refined characterizations of immune responses in coral ecosystems responsive to environmental disturbance will be possible thanks to this core information. Using amoebocyte concentrations to monitor cellular immunity in the Caribbean Sea fan octocoral, *Gorgonia ventalina*, vulnerable to infection and parasitism from fungus and copepods, researchers illustrated the importance of knowing cellular immunity in cnidarians. The immune effects of environmental parameters, population demography, and host-parasite interactions were studied using amoebocyte density. In the face of fungal and copepod co-infection, researchers discovered that environmental conditions and sea fan demography are important predictors of sea fan immunity and illness. These two findings demonstrate the value of fundamental research that identifies and characterizes early metazoan immune components in answering important and relevant ecological concerns.

Within our Research Topic, immunological complexity was a prevalent topic. Pathogen recognition receptors (PRRs), for example, have been discovered. In both investigations, the evolutionarily conserved immune signaling systems displayed unanticipated redundancy and expansions. These receptor families are anticipated to play a crucial role in identifying DAMPs and activating host defenses since these species rely primarily on innate immunity to guard against pathogens. Researchers discovered that distinct Cnidaria subphyla had varied immunological PRR repertoires. They discovered that these distinct repertoires were linked to life-history characteristics. In compared to mobile, solitary, and non-symbiotic peers, enlarged PRR repertoires were found in sessile, colony species that maintained algal symbiosis. They also discovered that in response to an immunological challenge, specific sponge genotypes exhibited distinct immune gene expression patterns. They were able to link immunity to features like holobiont fitness and sensitivity to stress, as well as characterize sponge immune response including signaling and recognition, including GTPases and post-translational regulatory processes like ubiquitination and phosphorylation. These investigations clearly demonstrate the link between immunological complexity and organismal characteristics that may influence survival in rapidly changing settings. Other publications in the series look at immunity from an ecological viewpoint in octocoral co-infection, all the way down to discrete cellular activity levels in scleractinian corals and anemones.

Other early diverging metazoans, such as ctenophores and placozoans, have mostly unknown immune repertoires. How does the different array of PRRs interact with distinct DAMPS in Anthozoa? Similarly, how customized is the Anthozoa immune response to a perceived pathogen? Is it possible that we're approaching functional limits in the face of rapidly changing environments? These and related questions are intriguing new study fields that have emerged as a result of this Research Topic. We expect that the ideas presented in this issue will lead to a change in our knowledge of early diverging metazoan immunity and its consequences in highly unpredictable and changing settings.