Subcellular view of host–microbiome nutrient exchange in sponges

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Abstract

Sponges are key ecosystem engineers in many aquatic habitats. Their unrivalled ability as filter feeders allows them to capture and transform organic and inorganic nutrients, and their rich microbial communities have a metabolic repertoire that helps them transform habitats. To better understand how sponge hosts and their microbial symbionts work together to eat and drink particulate and dissolved food, researchers used specialized imaging techniques to visualize the uptake and translocation of isotope-labeled dissolved and particulate organic matter. Using two different sponge species with high vs. low microbial abundance, they found that both sponges showed enrichment of the labeled food over time. Sponge-associated microbes were actively involved in processing dissolved organic matter, but host filtering cells were the primary site of nutrient uptake – dissolved matter via pinocytosis and particulate matter via phagocytosis. Carbon and nitrogen were transferred from sponges to their microbial symbionts, suggesting their ability to recycle nutrients from their hosts. These results reveal a complex relationship between sponges and their microbes, where sponge-associated microbes obtain nutritional benefits from their host-associated lifestyle, allowing them to recycle and retain limiting nutrients in their environment.