Microbiome ‘coral’ations

Coral reef ecosystems are home to a diverse community of microorganisms, including flagellates, bacteria and viruses, and the interactions between these organisms and with the coral colonies are important for reef function and health. Two recent studies examine the microbiome found in this unique marine habitat and report dynamic changes in community composition.

Corals are invertebrate animals that live in symbiosis with dinoflagellates and the loss of these photosynthetic endosymbionts leads to ‘bleaching’ and, potentially, death of the coral. Corals also harbour a microbiota in the mucus layer that covers the surface of the coral. In addition to its cleansing role, the mucus forms a protective layer but the contribution of the microbiome to this defence mechanism is unknown. Glasl *et al.* studied the composition of mucus-associated communities from corals in different physiological states. Some corals periodically shed their mucus layer to replace ‘aged’ mucus with fresh, clean mucus. Healthy corals with fresh mucus harboured a microbiome that was dominated by members of the Endozoicimonaceae and Oxalobacteraceae. By contrast,

aged mucus contained double the number of bacteria and was dominated by opportunistic and potentially pathogenic bacteria, such as Verrucomicrobiaceae and Vibrionaceae. Importantly, when corals were treated with antibiotics and re-introduced to the reef, they were also colonized by Verrucomicrobiaceae and Vibrionaceae and showed signs of bleaching. In fact, only two corals survived the experiment and in these corals the microbiome reverted to the Endozoicimonaceae-dominated composition of fresh mucus, which suggests that beneficial bacteria in the mucus protect the coral from harmful bacteria.

To assess the interactions between viral and microbial community members, Rohwer and colleagues analysed 223 samples from Pacific and Atlantic coral reefs. Microbial viruses are important for ecosystem function, for example, through the virus-mediated release of organic matter or by providing host cells with virus-encoded activities, such as virulence factors. Lysogeny, that is the integration of temperate viruses into host genomes, has been reported to dominate when host cells are low in abundance, whereas lysis was

thought to dominate when host cells are high in abundance according to the ‘Kill-the-Winner’ ecological model. However, in the coral reef samples, the number of virus-like particles decreased with increasing microbial density, which is an indicator of a shift towards lysogeny. In addition, the relative abundance of integrase, excisionase and prophage sequences correlated with microbial density. These results, supported by further data from other ecosystems, led the authors to propose a new model, which they called ‘Piggyback-the-Winner’. A predominance of temperate viruses might facilitate microbial overgrowth and, therefore, might contribute to coral reef decline.

Both studies highlight the importance of microbial interactions for the function and health of the coral reef ecosystem.

Ursula Hofer

“
beneficial
bacteria in the
mucus protect
the coral
from harmful
bacteria
”

ORIGINAL ARTICLES Glasl, B., Herndl, G. J. & Frade, P. R. The microbiome of coral surface mucus has a key role in mediating holobiont health and survival upon disturbance. *ISME J.* <http://dx.doi.org/10.1038/ismej.2016.9> (2016) | Knowles, B., Silveira, C. B. *et al.* Lytic to temperate switching of viral communities. *Nature* <http://dx.doi.org/10.1038/nature17193> (2016)
FURTHER READING Brum, J. R. & Sullivan, M. B. Rising to the challenge: accelerated pace of discovery transforms marine virology. *Nat. Rev. Microbiol.* **13**, 147–159 (2015)