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SYMBIOSIS

Sweet talking your partner

> catabolism of COS by *V. fischeri* is required for persistence of the symbiosis

Long-term stability of symbiotic relationships between animal hosts and their bacterial partners requires the fostering of a mutually beneficial dialogue, but the factors involved are poorly understood. Schwartzman *et al.* now show that the strategic provision of a single glycan by the Hawaiian bobtail squid *Euprymna scolopes* to its bioluminescent symbiont *Vibrio fischeri* contributes to the persistence of their lifelong symbiosis.

The functional basis of the *V. fischeri*–squid symbiosis involves cyclic bacterial bioluminescence in the light organ of *E. scolopes*, which peaks at night, thereby providing camouflage for the squid when it is foraging for food. In addition, *V. fischeri* colonization induces maturation of the light organ in juvenile squid. Previous work has indicated that host-derived chitin oligosaccharides (COS) are an important nutrient source for *V. fischeri*, and transcriptional assays have shown that genes associated with COS fermentation are upregulated in *V. fischeri* during nocturnal bioluminescence. Together, these findings suggest that both the provision of COS by the squid, and its metabolism by the bacterial population, contribute to the diel bioluminescent rhythm that maintains the symbiosis.

To investigate this hypothesis, the authors began by assessing the source of chitin in the light-organ crypts and found that migratory haemocytes were the main source, and that their lysis releases particulate chitin. Compared to aposymbiotic organs, haemocyte numbers increased approximately fourfold in symbiotic organs, and this increase occurred at dusk and declined before dawn, suggesting that haemocyte trafficking to the light organ is symbiosis dependent and occurs only during the nocturnal phase of the diel cycle. Furthermore, haemocytes were found to be the main producers of the *E. scolopes* chitotriosidase enzyme *Es*Chit1, which also follows a diel pattern of expression that peaks at night in mature light organs and degrades chitin into COS. Consistent with the data on haemocyte migration, an increase in the transcript levels of *eschit1* was also symbiosis dependent.

Further experiments revealed that delivery of COS to the symbionts seems to occur only in the mature light organ, and that catabolism of COS by *V. fischeri* is required for persistence of the symbiosis. But how does the catabolism of COS contribute to the stability of the symbiosis? The authors showed that degradation of this glycan by *V. fischeri* results in acidification of the light-organ crypts, which increases the availability of oxygen, thereby enhancing bacterial bioluminescence in the mature light organ.

These data highlight the power of this model system for investigating complex interactions between symbiotic partners, and the authors propose that the strategic provision of host nutrients may be a common principle that coordinates symbioses between more complex microbial consortia, including the human microbiota, and their hosts.

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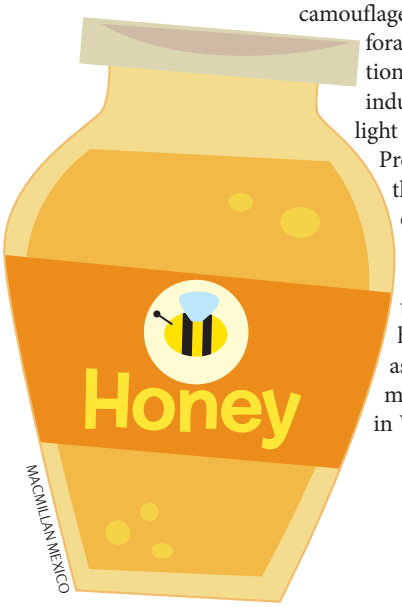

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ORIGINAL RESEARCH PAPER Schwartzman, J. A. *et al.* The chemistry of negotiation: rhythmic, glycan-driven acidification in a symbiotic conversation. *Proc. Natl Acad. Sci. USA* http://dx.doi.org/10.1073/pnas.1418580112 (2014)