Relationship breakdown

Even with the best communication in the world, not all relationships work out. There’s ample evidence that symbiosis can be lost despite the presence of a symbiotic organ—although it’s rare to find examples in the wild. In the last 25 years, Currie says he’s only once come across a fungus-growing ant colony that lacked the bacterial symbionts usually associated with the species. That colony wasn’t doing so well, he adds. “The garden was dead and all the ants were motionless on the side,” he says. “It looked like either they’d lost the bacteria and the garden had overgrown, or the garden overgrew and then they stopped supporting the bacteria and died.”

Looking at an evolutionary scale, though, researchers have identified various examples of symbioses that have permanently broken down. In ants, this kind of loss has occurred in species “where the ants appear to have evolved other mechanisms for dealing with infections, or the infection pressure is lower,” Currie says. In certain scenarios, some creatures may even coopt symbiotic organs for alternative or additional purposes. One bacteria-hosting species that Currie’s group studies also grows a biomineral armor on its exoskeleton that protects it in battle against other ant colonies. Preliminary data suggest that the growth of this armor is somehow aided by the ants’ crypts, Currie says. “We speculate that the structure might be maintained for the biomineral.”

It can be just as useful to study collapse in symbiosis as it is to study how it arises, notes Sachs, adding that while many plant species produce nodules, others seem to have lost the trait. Studying symbiotic loss can help researchers understand not only the costs and benefits of symbiotic relationships, but also the long-term effects of the relationship on a species’ physiology and genetics. It’s a reminder, too, that even when you evolve an entire organ to host your microbes of choice, “symbiosis is this knife-edge,” Sachs says. “It’s beneficial for the host under a certain set of scenarios. But you alter the ecology, and suddenly it becomes neutral or even harmful.”

References

1. L.J. Baker et al., “Diverse deep-sea anglerfishes share a genetically reduced luminous symbiont that is acquired from the environment,” *Life*, 8:e47606, 2019.