EVOLUTION

Speciation meets microbiomes

It is well-established that gut microbiomes have beneficial effects on many aspects of host biology. A new study shows that these microorganisms can also have crucial evolutionary roles — in providing barriers that keep related species separate. Complex interactions that have evolved between host genes and the microbiome may be responsible for mediating this effect.

Brucker and Bordenstein had previously established differences between the gut microbiomes of closely related species of parasitoid wasps from the genus *Nasonia*. They hypothesized that these differences might be responsible for the lethality that is seen in second-generation (F2) offspring arising from hybridization between *Nasonia* species.

In support of this idea, the authors showed that the microbiomes of F2 hybrids just before lethality are distinct from those of either parental species. Crucially, when parents and hybrids were reared in a way that eliminated gut microorganisms, hybrid lethality was rescued. Furthermore, lethality was restored when 'germ-free' hybrids were

A scanning electron micrograph of a female *Nasonia* sp. wasp. Image courtesy of R. M. Brucker, Vanderbilt University, USA.

inoculated with bacteria that recapitulated the parental microbiomes.

The authors suggest that these effects may be due to interactions between the gut microbiota and the genes of the host, which have evolved together in the parental species. In the hybrids, they postulate, this co-adapted state breaks down and there are harmful interactions — or negative epistasis — between host genes and the microbiome.

Brucker and Bordenstein argue that these findings support the importance of the 'hologenome' — the totality of the genomes of the host and its microbiota — which should be treated as a single unit in evolutionary studies.

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ORIGINAL RESEARCH PAPER Brucker, R. M. & Bordenstein, S. R. The hologenomic basis of speciation: gut bacteria cause hybrid lethality in the genus *Nasonia*. *Science* <http://dx.doi.org/10.1126/science.1240659> (2013)