Examining the power of host social interactions in bacterial evolution

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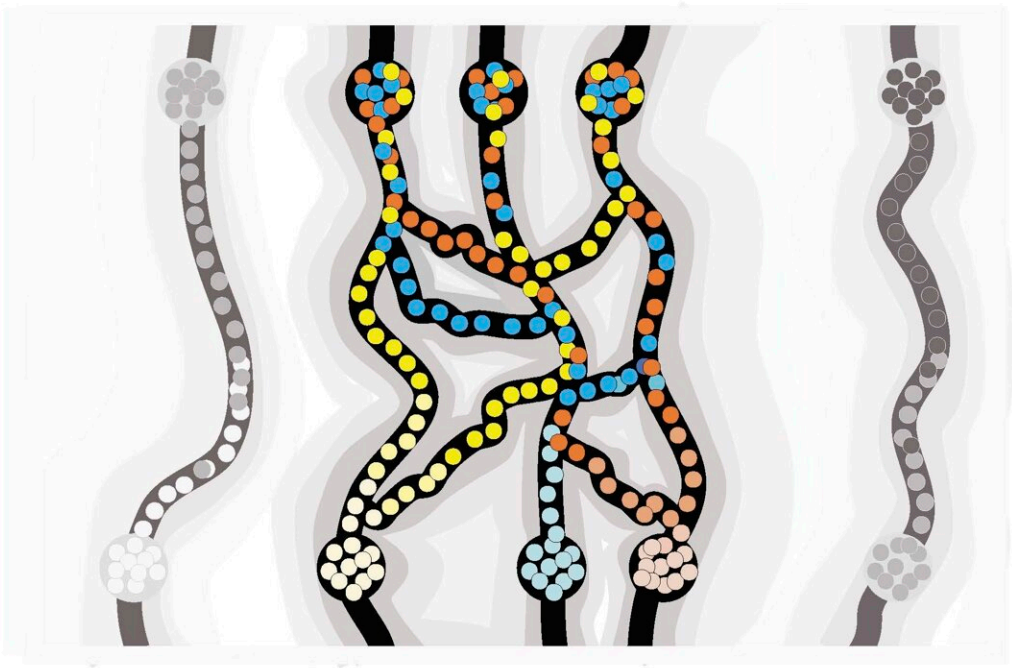

In a social context, host microbiomes can be shared among individuals. Paths represent the evolution of gut bacteria over time. Along the central paths, three distinct microbiomes are being transmitted among hosts, leading to similar bacterial evolution among them. Artwork by Nelson Frazão.

In a social context, host microbiomes can be shared among individuals. Paths represent the evolution of gut bacteria over time. Along the central paths, three distinct microbiomes are being transmitted among hosts, leading to similar bacterial evolution among them. Credit: Nelson Frazão, IGC 2023

Previous studies in humans and animals have shown that hosts in a social condition (sharing the same space) harbor a more similar microbiota composition. Microbial transmission between hosts, which is increased when living in the same household, leads to similar species inhabiting the gut. However, whether bacterial evolution in the gut is affected by microbiota transmission has remained unknown.

To fill this knowledge gap, researchers of a new study published in *Molecular Biology and Evolution* used an innovative in vivo experimental evolution approach, which revealed an average transmission rate of 7% of E. coli cells per day between hosts inhabiting the same household. This led to a high level of shared evolutionary events in co-housed mice, as a theoretical population genetics model predicted. Interestingly, the rate of mutation accumulation in E. coli was the same irrespective of the social context of the hosts.

This is the first study to show that hosts sharing the same diet and habits are expected to harbor similar microbiome species composition, and notably, similar bacterial evolutionary dynamics. These data uncover a significant role for bacterial transmission across hosts in shaping the adaptive evolution of new strains that colonize gut microbiomes.

Nelson Frazão, the study's lead author, emphasizes the importance of these findings, stating, "Our research provides compelling evidence that social interactions and shared environments play a crucial role in the evolution of gut bacteria. Understanding these dynamics sheds new light on the interplay between human or animal health and social interactions."

The discoveries by the research team led by Isabel Gordo, principal investigator at the Instituto Gulbenkian de Ciência, pave the way for new studies on the complex relationship between social interactions, intestinal bacteria, and human health.

More information: Nelson Frazão et al, Shared Evolutionary Path in Social Microbiomes, *Molecular Biology and Evolution* (2023). DOI: 10.1093/molbev/msad153

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