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Visualizing the population dynamics of microbial communities in the larval zebrafish gut[1]

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In each of our digestive tracts, trillions of microbes representing hundreds of different species colonize local environments, reproduce, and compete with one another. The resulting ecosystems influence many aspects their hosts development and health. Little is known about how gut microbial communities vary in space and time: how they grow, fluctuate, and respond to various perturbations. To address this and investigate microbial colonization of the vertebrate gut, we apply light sheet fluorescence microscopy to a model system that combines a realistic *in vivo* environment with a high degree of experimental control: larval zebrafish with defined subsets of commensal bacterial species. Light sheet microscopy enables three-dimensional imaging with high resolution over the entire intestine, providing visualizations that would be difficult or impossible to achieve with other techniques. Quantitative analysis of image data enables measurement of bacterial abundances and distributions. I will describe this approach and focus especially on recent experiments in which a colonizing bacterial species is challenged by the invasion of a second species, which leads to the decline of the first group. Imaging reveals dramatic population collapses that differentially affect the two species due to their different biogeographies and morphologies. The collapses are driven by the peristaltic motion of the zebrafish intestine, indicating that the physical activity of the host environment can play a major role in mediating inter-species competition. role in mediating inter-species competition.

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