



PHYSICS COLLOQUIUM 293

Glimpses of Gut Microbes in their Physical World

Raghuveer Parthasarathy
Department of Physics
University of Oregon

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For more information contact:
Ajay Gopinathan;
agopinathan@ucmerced.edu

ABSTRACT

In each of our digestive tracts, trillions of microbes representing hundreds of different species colonize local environments, reproduce, and compete with one another. Little is known about the physical structure and temporal dynamics of gut microbial communities: how they grow, fluctuate, and respond to perturbations. To address this and investigate microbial colonization of the vertebrate gut, my lab applies 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. I will describe this approach and focus especially on 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. We find that responses of bacteria to the mechanical contractions of the gut, and to contact-mediated inter-bacterial killing, can dictate apparent competition between microbes, suggesting a major role for physical mechanisms in guiding the composition of the gut microbiota.

BIO:

Raghuveer Parthasarathy has been a professor at the University of Oregon since 2006. He received his Ph.D in Physics from the University of Chicago and was a Miller Postdoctoral Fellow at UC Berkeley before he joined the University of Oregon. He and his research group construct experiments to examine a variety of biophysical topics, exploring systems in which the complex interactions between individual components (biomolecules, cells, ...) can give rise to, or be described by, simple and robust physical patterns. His projects fall under two main umbrellas: developmental biophysics and membrane biophysics. To explore these themes, the group devotes lots of effort to developing new optical and computational tools. Professor Parthasarathy's teaching interests mostly involve courses for non-science majors, including for example a recently developed "biophysics for non-scientists" class (The Physics of Life). Honors include the Alfred P. Sloan Fellowship and the NSF Career Award.

