



Seminar/Talk

How Phages Find, Invade, and Coexist with Their Hosts: Multiscale Models of Phage-Bacteria Interactions

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Bacteriophages interact with their bacterial hosts across a remarkable range of scales. Successful infection requires a virus to encounter a host, remain associated with it long enough to locate an appropriate receptor, transfer its genome into the cell, and ultimately propagate in an environment where host populations are themselves structured and dynamic. Each of these stages is shaped by stochasticity, spatial organization, and physical constraints, making phage-bacteria systems a rich setting for studying how microscopic processes influence ecological outcomes. In this talk, I will discuss theoretical and computational approaches to several aspects of this problem. At the population level, bacterial growth into microcolonies can qualitatively alter classical predator-prey dynamics, generating heterogeneous colony-size distributions and stabilizing phage-host coexistence. At the scale of an individual infection event, receptor finding can be viewed as a stochastic search problem in which multivalent tail-fiber attachment must balance stable association with the ability to explore the cell surface. Moving further into the infection process, coarse-grained polymer simulations provide a framework for examining how genome translocation may couple to the activity of molecular motors such as host and phage RNA polymerases. Together, these examples illustrate how phage-host dynamics emerge from interactions between processes operating at very different scales, and how relatively simple physical and stochastic models can help connect molecular mechanisms with population-level behavior.

Tuesday, October 13, 2026 10:00am - 11:00am

Sunstone Bldg / Ground floor / Big Seminar Room A / 27 seats (I23.EG.102)



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