

Many animals harbor beneficial intracellular bacteria that provide nutrients or enhance resistance to natural enemies, but the molecular basis of these apparently harmonious associations is poorly understood. The aphid symbiosis with the bacterium *Buchnera* is a remarkably tractable system to investigate the interactions that underpin beneficial symbioses. I will focus primarily on the processes by which the intracellular bacteria release nutrients that support the growth and reproduction of their animal host, and the mechanisms by which the bacterial abundance is regulated such that the host and symbiont display balanced growth. These studies provide an exemplar of animal-microbial coevolution and its significance for the persistence of beneficial animal-microbial associations.