Success comes at a cost, even for phages

June 13 2006

As many a mother may tell you, expending the energy necessary to raise a clutch of kids can shave years off one's life. Trade-offs between reproductive success and survival have been demonstrated for a wide variety of organisms, in keeping with life history theory. In a new study published in the open-access journal *PLoS Biology*, Marianne De Paepe and Franɜois Taddei asked whether these trade-offs extend to viruses, which are not--by some definitions--even alive.

Though not universally considered alive because they can't replicate without the help of their host's molecular machinery, viruses pass through distinct life cycle stages, mutate, and evolve in response to selection pressures from their host. Viruses also have life history traits, such as multiplication rate in a host, survival outside the host, and mode of transmission.

Working with viruses that infect bacteria, called bacteriophages (or in this case, coliphages, which infect Escherichia coli), De Paepe and Taddei predicted that the phage, just like a full-fledged cellular organism, would display trade-offs between survival and reproduction. They discovered that, although coliphages don't wither and die like "real" organisms, they do experience life history trade-offs, with rapid reproducers suffering higher casualties outside the host. And, by investigating several physical properties of the coliphages, they found that two physical parameters account for most of the observed variation in survival.

Thus, even though they don't have their own metabolism, viruses

experience the same sorts of trade-offs between survival and reproduction seen in a wide range of species. This finding suggests that models of virulence evolution, which assume that transmission rates increase along with virulence, may not be valid, since transmission depends not just on parasite multiplication rate but also on survival--which, they show, are negatively correlated. "The fact that this trade-off is present in this very simple biological situation," the researchers write, "suggests that it might be a fundamental property of evolving entities produced under constraints." If this is true, the "nonliving" phages that opened the door to some of the most important discoveries in molecular biology may well provide a similar service for a wide range of evolutionary phenomena.

Source: Public Library of Science