Gene conversion facilitates adaptive evolution on rugged fitness landscapes

Abstract:
Gene conversion is a ubiquitous phenomenon that leads to the exchange of genetic information between homologous DNA regions and maintains co-evolving multi-gene families in most pro- and eukaryotic organisms. In this talk, I will consider its implications for the evolution of a single functional gene with a silenced duplicate, using two different mathematical models of evolution on rugged fitness landscapes. Our analytical and numerical results show that, by helping to circumvent valleys of low fitness, gene conversion with an inactive duplicate gene can cause a significant speedup of adaptation which depends non-trivially on the frequency of gene conversion and the structure of the landscape. Stochastic effects due to finite population sizes further increase the likeliness of exploiting this evolutionary pathway. Our results reveal the potential for duplicate genes to act as a “scratch paper” that frees evolution from being limited to strictly beneficial mutations in strongly selective environments.

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