MAX DELBRÜCK COLLOQUIUM

Physiological characterization of adaptive evolutionary dynamics

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Using a coarse-grained characterization of bacterial physiology, we identify an intermediate measure between genotype and phenotype that provides insight into the dynamics of adaptive long-term laboratory evolution. Lenski's strains, which have been adapted to growth on glucose minimal media for tens of thousands of generations, exhibit an unexpected behavior - the adapted strains are less efficient at metabolizing glucose, yet nonetheless are able to grow more quickly. A possible rationalization for the data is that the increase in doubling rate is driven by deletions and insertions occurring at a constant rate, but with an exponentially-decreasing probability of success. Both the measure of success and the decreasing probability are tied to network properties of cellular metabolism, and emphasize the importance of viewing mutations within a physiological context. A specific deletion (pyruvate kinase I, pykF) appearing between the 2000 and 5000 generations supplies an illuminating example of the benefits of this wider view.

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