General Equations for Natural Selection Under Complete Dominance

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Abstract

In theoretical and mathematical biology, natural selection is generally considered in totality as an implicit function of time. Although this has helped achieve statistical equations for natural selection (initially by Fisher and later by Price), non-statistical equations on how evolution would proceed, at all times, under complete dominance have not been described. This talk will focus on deriving general equations for natural selection under complete dominance for all allele frequencies. We invoke a key theorem from mathematical analysis, namely, the inverse function theorem, to derive these equations. We demonstrate the validity of the equations by studying the allele frequencies of mutations in oncogenes as they exhibit dominant behavior. Consistent with population genetics model of fitness, the selection function fits a gamma distribution curve that accurately describes the trend of the mutant allele frequencies. As general and relative formulas for natural selection operating at all frequencies, these equations show that selection exhibits linear behavior favoring dominant alleles and behaves like power-law against the recessive alleles, at all times, explaining why natural selection is a strong force.

Keywords: oncogenes, allele frequencies, natural selection, gamma distribution, inverse function theorem

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