

The Role of Causal Processes in the Neutral and Nearly Neutral Theories

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Abstract

In this paper, we will consider how the neutral and nearly neutral theories of molecular evolution differ from each other as a means for addressing causal processes associated with random drift and natural selection. These two theories are sometimes characterized as theories about drift alone, where drift is described solely as an outcome, rather than a process. Contra this characterization, we will argue that both selection and drift, as causal processes, are integral parts of both theories. However, the nearly neutral theory explicitly recognizes alleles and/or molecular substitutions that, while engaging in weakly selected causal processes, exhibit outcomes thought to be characteristic of random drift. A narrow focus on outcomes obscures the significant role of weakly selected causal processes in the nearly neutral theory. Clarifying the relative roles of selection and drift processes in both theories reveals that while their outcomes may be similar, the causal processes producing those outcomes are importantly distinct.

Keywords: neutral theory of molecular evolution, nearly neutral theory of molecular evolution, random drift, natural selection, Tomoko Ohta, Motoo Kimura, causal process, outcome

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