Mutational Lamarckism and the Modern Synthesis view of mutational randomness as conditional independence

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Abstract

Current evolutionary biology is based on the legacy of the modern evolutionary synthesis (Huxley 1942). Nevertheless, the Modern Synthesis enshrined natural selection as the director of adaptive evolution not by providing evidence that it did, or could, account for observed adaptations (Leigh 1999), but rather by eliminating competing explanations (Mayr 1993). One of the eliminated competitors was Lamarckism, particularly "mutational Lamarckism", a hypothesis according to which mutations may be directed towards producing phenotypes that improve the performance of the organism in a particular environment. Contrary to this hypothesis, the Modern Synthesis' view claims that mutations are "random" (Lenski and Mittler 1993, Merlin 2010). Possibly because Lamarckism had largely felt into disrepute several decades before the eventual success of the Modern Synthesis, the precise meaning of the term "random mutation" was never deeply analyzed. However, current evidence of possibly legitimate cases of Lamarckism (Jablonka and Lamb 2005, Koonin and Wolf 2009) has revitalized the interest for clarifying the meaning of the term "random" in this context (Sarkar 2007, Jablonka and Lamb 2005, Millstein 1997, Merlin 2010). In this contribution we aim to analyze previous definitions of random mutations based on the concepts of statistical independence and correlation (e.g., Millstein 1997, Sarkar 2005, Jablonka and Lamb, Merlin 2010) and to show that they are deficient. We argue that the term "random mutation" refers to a triadic rather than dyadic relationship, that neither *correlation* nor *independence* are good concepts to formalize the neo-Darwinian concept of genetic randomness, and that as a consequence neither of them is suitable to define mutational Lamarckism. Our alternative proposal is that the best probabilistic concept to define random mutations is *conditional independence*. In this contribution we will illustrate our alternative proposal, show a way to formalize the concept of mutational randomness and provide some examples of its application.

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