The evolutionary consequences of epigenesis and neutral change: A conceptual approach at the organismal level

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Abstract

Living beings are autopoietic systems with highly context-dependent structural dynamics and interactions, that determine whether a disturbance in the genotype or environment will lead or not to phenotypic change. The concept of epigenesis entails how a change in the phenotype may not correspond to a change in the structure of an earlier developmental stage, including the genome. Disturbances of embryonic structure may fail to change the phenotype, as in regulated development, or when different genotypes are associated to a single phenotype. Likewise, the same genotype or early embryonic structure may develop different phenotypes, as in phenotypic plasticity. Disturbances that fail to trigger phenotypic change are considered neutral, but even so, they can alter unexpressed developmental potential. Here, we present conceptual diagrams of the "epigenic field": similar to Waddington's epigenetic landscapes, but including the ontogenic niche (organism/environment interactional dynamics during ontogeny) as a factor in defining epigenic fields, rather than just selecting among possible pathways. Our diagrams illustrate transgenerational changes of genotype, ontogenic niche, and their correspondence (or lack thereof) with changes of phenotype. Epigenic fields provide a simple way to understand developmental constraints on evolution, for instance: how constraints evolve as a result of developmental system drift; how neutral changes can be involved in genetic assimilation and de-assimilation; and how constraints can evolve as a result of neutral changes in the ontogenic niche (not only the genotype). We argue that evolutionary thinking can benefit from a framework for evolution with conceptual foundations at the organismal level.

Palabras clave

Palabras clave de autor: drift; epigenesis; epigenetic landscapes; genotype; niche
KeyWords Plus: EVO-DEVO; BIOLOGY; DRIFT; FLEXIBILITY; ROBUSTNESS

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