Generic and Genetic Explanations: Comparing Experimental and Historical Biology

Alan Love*[1]

[1]University of Minnesota - Twin Cities (U of M) – United States

Abstract

Session: Generic and Genetic Explanations of Evolvability and Evolutionary Novelty (Alan Love, Doug Erwin, Karl Niklas) A genetic explanatory paradigm is predominant in biology and for good reasons. The empirical successes of experimental biology and a unified framework for evolution were major achievements in the 20th century, and genetic explanations exhibit the virtue of causal specificity. Increasing attention has been paid to how physical processes can explain biological phenomena, which involves appeals to generic features that are not unique to biological entities (e.g., viscoelasticity in soft condensed materials or shear forces due to fluid flow). Finding ways to combine these two different explanatory strategies-generic and genetic-is difficult because many biologists privilege causal specificity, such as when accounting for the origin of evolutionary novelty: "novelty requires the evolution of a new gene regulatory network" (Wagner and Lynch 2010). Others argue that new structures originated early in evolution from generic properties of cells and tissues interacting with the abiotic environment: "epigenetic mechanisms, rather than genetic changes, are the major sources of morphological novelty in evolution" (Newman et al. 2006). This paper explores the conceptual challenges that attend combining generic and genetic explanations in both experimental and historical biology by comparing the situation of developmental biology with evolutionary studies of evolvability and novelty. In particular, I argue that the increasing rapprochement between genetic and generic approaches in developmental biology is due to a shared appreciation of identifying actual difference makers with experimental intervention techniques, which does not translate into the context of evolutionary theorizing where historical explanations usually have access only to potential difference makers.

*Speaker