Genetic and Generic Explanations: A Pluralistic Perspective

Karl Niklas*[1]

[1]Cornell University – 91709 – Cornell University – Ithaca, New York 14853 US, United States

Abstract

Session: Generic and Genetic Explanations of Evolvability and Evolutionary Novelty (Alan Love, Doug Erwin, Karl Niklas) How much of an organism's development is directly encoded by its genome and how much is a direct consequence of how living matter generically responds to the effects of physical laws and processes? No biologist would deny the importance of the information stored in an organism's genes. However, no biologist can deny the importance of passive diffusion, temperature, gravity, and viscoelasticity during development. Thus, it is reasonable to suppose that under some circumstances natural selection favors an organism with developmental sub-routines that are actuated and subsequently driven by universally reliable physical laws, processes, and "cues" over an organism whose genome encodes these sub-routines. It is also reasonable to suppose that these kinds of sub-routines were prevalent and perhaps more important during the early evolution of some lineages. Consequently, debates about genetic and generic explanations should not be framed around "either or" questions but rather in terms of the relative importance of each. In this respect, developmental and evolutionary biology resemble alternative model-rich conceptual frameworks, similar in some respects to engineering or information theory. This "generic and genetic" perspective is illustrated in the context of gravity- and light-sensing, mechanoperception, cell wall formation, and other biophysical phenomena contributing to plant development and growth. In each case, evidence is presented for the participation of generic biophysical processes operating in an equally important genomic background. Consequently, theories about developmental biology will advance only if development is conceptualized as a hybrid of parsimonious and stable generic processes operating in dynamically evolving genomic backdrops.

*Speaker