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The limits of understanding in biological systematics

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Abstract

Ernst Mayr's (1961, *Science* 131: 1501–1506) distinction between proximate and ultimate causation in biology is examined with regard to the acquisition of understanding in biological systematics. Rather than a two-part distinction, understanding in systematics is characterized by relations between three explanatory components: descriptive (observation statements)—proximate (ontogenetic hypotheses)—ultimate (e.g. specific and phylogenetic hypotheses). Initial inferential actions in each component involve reasoning to explanatory hypotheses via abductive inference, providing preliminary understanding. Testing hypotheses, to critically assess understanding, is varied. Descriptive- and proximate-level hypotheses are routinely tested, but ultimate hypotheses present inherent difficulties that impose severe limits, contrary to what is usually claimed in the systematics literature. The problem is compounded by imprecise considerations of 'evidence' and 'support.' For instance, in most cases, the 'evidence' offering 'support' for phylogenetic hypotheses, as cladograms, is nothing more than the abductive evidence (premises) used to infer those hypotheses, i.e. character data and associated phylogenetic-based theories. By definition, such evidence only offers initial, trivial understanding, whereas the pertinent evidence sought in the sciences is test evidence, which cannot be supplanted by character data. The pursuit of ultimate understanding by way of spurious procedures such as contrived testing, Bremer support, and resampling methods are discussed with regard to phylogenetic hypotheses.

Key words: biological systematics, causal explanation, cladistics, falsification, inference, testing

> *Every hypothesis should be put to the test by forcing it to make verifiable predictions. A hypothesis on which no verifiable predictions can be based should never be accepted, except with some mark attached to it to show that it is regarded as a mere convenient vehicle of thought—a mere matter of form.*
> Peirce (1935: 5.599)

> *Systematics is on a dangerous path towards irrelevancy to the remainder of biology because meaningful dialogue or assessment is no longer attempted, and is essentially impossible.*
> Mooi and Gill (2010: 27)

Introduction

The subject of causation is probably the most fundamental consideration in all the sciences, as it is the continual desire of scientists to acquire understanding of the phenomena we encounter (Hempel 1965; Rescher 1970; Popper 1983, 1992; Salmon 1984a; Van Fraassen 1990; Strahler 1992; Mahner & Bunge 1997; Hausman 1998; de Regt *et al*. 2009). Such understanding entails the interplay between our activities of explanation and prediction in conjunction with available hypotheses and theories. For instance, de Regt and Dieks (2005: 150, emphasis original) define the 'criterion for understanding phenomena' as, "*A phenomenon P can be understood if a theory T of P exists that is intelligible (and meets the usual logical, methodological and empirical requirements).*" Regarding biology specifically, Leonelli (2009: 197, emphasis original) characterizes understanding as "*the cognitive achievement realizable by scientists through their ability to coordinate theoretical and embodied knowledge that apply to a specific phenomenon.*" A notable exegesis on causation and understanding in biology was provided by

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