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Symposium: Multidisciplinary Perspectives on Evolutionary Reasoning

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Evolution is widely perceived to be a cornerstone of modern biology. In recent years, evolutionary theory has penetrated an ever-widening circle of scientific domains including the various disciplines of cognitive science such as linguistics, anthropology, artificial intelligence, and neuroscience. Evolution plays a dual role in cognitive science: as an explanatory theory, it may provide us with insights into the genesis of mind and brain; as a complex and controversial scientific framework, it is the object of philosophical, psychological, and educational inquiry.

This symposium presents multidisciplinary perspectives on reasoning about evolution. Evolutionary reasoning continues to provide formidable challenges for children, lay adults, students of biology, as well as scientists engaged in the enterprise. Although several studies have documented student misconceptions and significant gaps in individuals' knowledge, we contend that many of the most serious difficulties in addressing evolutionary problems concern the processes of reasoning, argumentation, and explanation. This is the focal theme of this symposium.

The nature and structure of evolutionary argumentation have been the subject of intensive debate within both biology and philosophy. The Chair, David Kaufman provides a framework for considering the philosophical, psychological, and educational issues in evolutionary reasoning and argumentation. One of the central and most contentious issues has to do with function and adaptation. For example, certain evolutionary theories endeavor to account for an organism's traits and characteristics as adaptations optimized for current function. The first speaker in this symposium, Lawrence Shapiro, considers a dispute in the philosophy of biology concerning the explanation of function. Most philosophers of biology accept either an etiological or a dispositional analysis of function (Shapiro & Epstein, in press). Using evolutionary psychology as a case study, Shapiro argues that both analyses can play an instrumental role in explaining evolutionary processes.

The development of coherent and accurate evolutionary explanations presents considerable difficulties for students studying biology. It has been demonstrated that novices are prone to teleological and reasoning biases that interfere with their ability to construct effective Darwinian explanations. Understanding evolution is predicated on acquiring an appropriate explanatory schema that integrates related facets such as variation, inheritance, and cumulative change (Ohlsson, 1998). The second speaker in this symposium, Stellan Ohlsson, addresses novice explanations of evolutionary phenomena. He presents the results of two studies. The first is concerned with a characterization of novices' explanatory schemata of biological adaptation and the second focuses on an instructional intervention designed to foster the acquisition of a Darwinian explanation schema.

It is increasingly recognized that the development of skills of reasoning and argumentation is central to the effective application of science concepts across a range of domains (Ranney & Schank, in press). Computer-mediated learning environments have proven to be a useful tool for promoting the development of these metacognitive competencies. The third speaker in the symposium, Brian Reiser, will discuss the teaching of skills of evolutionary reasoning and argumentation using a computer-mediated instructional system. BGuILE (Biology Guided Inquiry Learning Environments) is a collection of learning environments designed to facilitate students' development of more sophisticated conceptions of scientific phenomena by focusing on the reasoning strategies that allow the construction of convincing scientific arguments (Tabak, Smith, Sandoval, & Reiser, 1996). His presentation discusses the philosophy and design of this environment as well as the results from several classroom trials. In addition to discussing the presentations, Michael Ranney addresses aspects and findings of how evolution is defined and what the theory means to people and their world-views