DOUGLAS H. ERWIN

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Douglas H. Erwin is a paleobiologist and evolutionary biologist who studies large-scale patterns in the history of life, including mass extinctions and the origin of animals. Past research projects have involved the causes of the end-Permian mass extinction (251 million years ago) and the evolution of gene regulatory networks in the early evolution of animals. His current project focuses on novelty and innovation across biological, cultural and technological systems, particularly the question of whether a common conceptual framework can encompass these three domains.

He has pursued field work in Australia, Canada, southern China, Namibia, South Africa and through the southwestern United States. His research has been funded by the NASA Astrobiology Institute for almost two decades. A Senior Scientist and Curator in the Department of Paleobiology at the National Museum of Natural History, Smithsonian Institution, his most recent book is The Cambrian Explosion: The Construction of Animal Biodiversity (2013).

The tempos of evolution and the complexities of deep time

Understanding rates of evolutionary change is confounded by several factors:

1) Evolution runs at different rates, or on different timescales, even within the same species or lineage. Paleontologists first observed that the rate of change in morphology is proportional to the duration over which it is measured: the longer the duration, the slower the rate. Recent studies confirm that short-term rates of molecular change are more rapid than long-term rates.

2) Organisms are influenced by both fast and slow variables, with slow variables providing a sort of insurance bounding the limits of more rapid evolutionary responses. For example, reefs, as both an architectural and an ecological framework, respond more slowly to environmental perturbations than do individual populations residing on reefs.

3) There is an unresolved dispute over whether rates and processes of evolutionary change observed over short timescales (micro-evolution) can be summed over longer time spans to generate macroevolutionary patterns. In Tempo and Mode in Evolution (1944) G. G. Simpson argued that fossils provided unique information on the tempos of evolutionary change. Yet Simpson's view of macroevolution was largely an extrapolation from the evidence provided by studies of modern organisms.