Interviewed by Daniel Edelstein

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INTERVIEW

Dr. Douglas H. Erwin

Background

Born: March 27, 1958, Los Angeles, California

Position: Research Paleontologist and Curator,
Department of Paleobiology,
Smithsonian,
United States National Museum of Natural History,
Washington, D.C.

Biography

Received his A.B. in 1980 from Colgate University, Hamilton, New York with a major in Geology and an emphasis in Evolutionary Biology. Earned his Ph.D. in Geological Sciences 1985 from the University of California, Santa Barbara.

After focusing on Permian gastropods and the end-Permian mass extinction in his dissertation, he continued similar research while on the faculty of the Department of Geological Sciences at Michigan State University.

In 1990, he joined the Smithsonian Institution's National Museum of Natural History as a Research Paleobiologist and Curator. Here, his work on the evolutionary history of Paleozoic gastropods and the end-Permian mass extinction has further progressed, resulting in a book titled The Great Paleozoic Crisis.

His current and most recent investigations have included biotic recoveries following mass extinctions, in addition to ecological and developmental aspects of the metazoan radiation during the late Neoproterozoic and Early Cambrian.

In 1996 he received the Charles Schuchert Award of the Paleontological Society in honor of his outstanding promise as a "younger than 40" paleontologist. Two years ago, he was invited to become a member of the NASA Astrobiology Institute as part of a group centered at Harvard and MIT. He is also currently an External Faculty Member at the Santa Fe Institute, acclaimed worldwide for its interdisciplinarian collaboration in complex systems.

He has helped co-organize conferences and been an invited speaker at several international professional meetings, including those sponsored by the National Academy of Sciences and the National Research Council.

In addition to his own book (mentioned above), he has co-authored and co-edited texts such as The Fossils of The Burgess Shale (Smithsonian Institution Press, 1994), New Approaches to Speciation in the Fossil Record (Columbia University Press, 1995), and Evolutionary Paleobiology: Essays in Honor of James W. Valentine (University of Chicago Press, 1996)

What first inspired you to go into your field?

Although I was fascinated by both history and science while growing up, I had never considered a science discipline as a career. Then a freshman seminar course in geology at Colgate University exposed me to earth history in general, and, perhaps more importantly, to the interactions between geological processes and the evolution of life on the earth.

In my field of paleontology, besides concentrating on fossils, there's a focus on the history of life on earth—and that requires a diverse understanding of geological aspects, including how fossils form and are preserved, as well as the role of plate movement (plate tectonics) and climate change in evolution. My field also concerns the age of fossil deposits and the importance of geochemical cycles, such as changes in the carbon cycle over time. But there's also biological aspects, and they are equally important—including an understanding of ecology, developmental biology, phylogenetics and evolution.

What was a key event that pushed you into research?

Getting into graduate school. Well, that action certainly helped. I was doing field archeology in New Mexico as a teenager, and spent my last year in high school doing a project on latitudinal variation in clutch size (number of eggs) of southern California birds.

So I think I always wanted to do research, but it wasn't until well into college that I realized you could actually get a job doing it. However, I was not a particularly good student, except in the courses that interested me, and, for this reason, none of my advisors suggested graduate school as an option until my senior year in college.

Who was your most influential teacher?

Bob Linsley at Colgate University. Bob is generally considered one of the best teachers of paleontology in the country, and if it weren't for his inspiring and quirky lectures, I never would have become interested in paleobiology. In addition, if not for his belief in me, I never would have gotten to graduate school.

Which research paper has had the most effect on your work?

This is an almost impossible question to answer, of course. But if I had to choose one that spurred my interest in paleobiology, it would be a paper in American Scientist in 1976 by Jim Valentine and Cathy Campbell. Using the Britten-Davidson models of gene regulation, Valentine (later my Ph.D. advisor) and Campbell described how changes in gene regulation could underlie the evolutionary patterns seen in the fossil record. I was entranced by this possibility, which is really just now coming to fruition in comparative evolutionary developmental biology.

Who awarded you your first grant and what was it for?

A student grant from the Geological Society of America to visit collections at the National Museum of Natural History and work on my doctoral dissertation. It turned out that my project wasn't "do-able," so I switched to another one. Curiously enough, I now oversee those collections at the natural history museum.

What was your best experiment?

As a paleontologist, we usually don't do experiments, at least not in the classic sense. (The National Science Foundation budget for paleobiology is too small for time machines, I suppose). We can, however, make predictions based on available data, or modeling about what we expect, and then go test those in the fossil record.

Which scientific idea or concept perplexes you the most and why (i.e., confuses you and is difficult for you to understand)?

Almost anything mathematical. I have about zero mathematical ability and chose geology in part because I thought there was less math than other fields. Boy was I wrong!

What qualities do you need to be a successful researcher?

I'm not a particularly good (research) scientist in the classic sense. What skills I have lie in critical analysis and synthesis of evolutionary patterns in deep time. This requires very broad interests (and reading) because it's never clear which information will turn out to be useful. It also requires the ability to find connections between different areas. And, then, of course, the ability to figure out ways to test the ideas.

If you could work with any scientist (historical or current), who would it be and why?

Darwin, of course, is the easy answer for anyone interested in evolution. At least I'd like to have a long dinner with him.

What will be the great discoveries of this century?

Such predictions are almost invariably wrong, of course. The discovery I am most looking forward to is whether or not life exists elsewhere in the universe. I can't think of any area where the results, whatever they are, would more profoundly affect us, in areas from religion to having more than one example of how life occurs.

What is your greatest unanswered scientific question?

I'd like to know the nature of the protostome/deuterostome ancestor (PDA), the last common ancestor between vertebrates and flies. For some researchers, the wealth of comparative developmental data suggests that the PDA was a relatively complex animal, with Pax-6 indicating the presence of eyes, and other genes the presence of segmentation and even limbs.

There are alternative (and more likely, in my view) ways of interpreting this data. These views suggest important implications for understanding the Metazoan radiation of animals between about 575 and 530 million years ago (often known as the Cambrian explosion). Understanding the PDA also has important implications for understanding the evolution of development, particularly whether extensive sequence conservation of developmental control genes necessarily implies conservation of function.

What is your proudest achievement?

Probably writing my first book, The Great Paleozoic Crisis, (Columbia, 1993) on the end-Permian mass extinction. Trying to critically synthesize so much information was a real challenge for me, and I never thought I would finish it. I am even more proud, oddly enough, that the book is now horribly out of date in many areas, based on the research that has been done on extinction in the past eight years. Fortunately, I suppose my colleagues and I have contributed to some of that new research.

What scientific plans do you have for the next five years?

I have spent most much of the past 10 years working on the nature of the end-Permian mass extinction, the most extensive mass extinction in the past 600 million years. But my interests have always been more in studying biotic recoveries after mass extinctions. These are far more interesting from an evolutionary perspective than are the mass extinctions. So I am turning my research more to recoveries. This shift is part of a long-term aim to focus more on evolutionary innovations, and to explore the relative significance of changes in the physical environment, in ecological interactions and in development for evolutionary innovations.