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[Editor's note: A memorial service for Stephen J. Gould was held at New York University on 30 May 2002. What follows is the text of Niles Eldredge's comments made at the service.]

Homage to Steve Gould

NYU Memorial Service; May 30, 2002

Steve's death leaves a gaping hole in American scientific and intellectual life. My focus in these next few minutes will be on his scientific legacy.

Steve and I go back a long way. I was still an undergraduate when Steve—and an impressive cohort of other students—entered the graduate program in paleontology and stratigraphy at Columbia in the Fall of 1963. Steve and the others made me feel welcome in their inner circle, and Steve and I have been together ever since—inextricably bound by the work we did together in the early 1970s, but bonded as well in a lasting friendship and a mutual desire to strengthen paleontology's position at the ''High Table'' of evolutionary theory.

For that's really what Steve's work was all about: He wanted to establish as firmly as possible that paleontology is not just a mere litany of what lived before what in the history of life—but rather that the fossil record is fraught with meaning to all who would understand *how* life evolved. In his characteristic and usually highly useful penchant for naming things, Steve called the description of the often dry details of fossils the ''idiographic'' approach—while he reserved the term ''nomothetic'' for the search for meaning—generalizations, perhaps even ''laws''—that the fossil record might yield on the evolutionary process itself. If these two Greek-derived terms perhaps mercifully have not survived, the distinction he drew certainly has.

George Gaylord Simpson, our mutual predecessor at the American Museum of Natural History (where we both served our research apprenticeships as Ph.D. students in the Columbia Program) had advocated a similar approach—saying that the ''determinants'' of evolution were indeed the stuff of genetics—things like mutation rate, population size, natural selection, and so forth; BUT THAT THE FOSSIL RECORD REVEALS REPEATED PATTERNS THAT MUST BE TAKEN AS REAL PHENOMENA THAT NEED TO BE EXPLAINED; in some instances, such patterns might be unexpected if one's gaze were confined strictly to the modern biota—without, that is, the benefit of seeing what happens to species over thousands, or even millions, of years.

It is clear in retrospect that the fusion of the empirical observation of stasis—the tendency of species to remain relatively stable once they first evolve—with the notion of speciation developed especially by Ernst Mayr and Theodosius Dobzhansky (themselves from the American Museum/Columbia axis), was in reality a simple extension of what Simpson was saying—a creative fusion, if you will, of what our predecessors had been moving towards but hadn't quite reached. That is the overarching intellectual context of ''Punctuated Equilibria.''

But of course there were implications to this basic work—and we went off, severally and together, to explore them. When writing a ''where are we now'' paper published five years after our 1972 paper, we argued about very little—but differ we did: For example, everywhere that Steve had written ''tempo'' in his first draft, I wanted to add ''and mode''—not just to mirror Simpson's book of that title, but to reflect, instead, a very real, if subtle, difference between our outlooks on what punctuated equilibria is all about. I saw it as an issue of speciation versus phyletic evolution; at least back in the 70s, Steve tended to see it primarily as a matter of differential evolutionary rates.

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And that is interesting—as it reveals Steve's first, and I think deepest and longest lasting, scientific love: morphology and its transformation in both development and evolution. Steve's earliest work was in so-called ''relative growth''—where shapes of organisms change as they develop and grow larger. His early success there led to an invitation while still in graduate school to write a review paper on this so-called ''allometry'' for the prestigious British journal *Biological Reviews* (1966). I remember asking him how he dared take so much time away from his thesis research to do all the work for this paper—and I shall never forget his answer: ''The time to think and publish general, theoretical papers is now, while we are young—and not to wait until we are sixty!'' How ironic, of course. . . . but also how inspiring!

Steve's first book, *Ontogeny and Phylogeny* (1977)—a magnum opus only matched in scope, scholarly depth, and biological brilliance by his recent *The Structure of Evolutionary Theory* (2002)—integrated his love of relative growth with his love of evolution. As in his last great tome, Steve reveals his penchant and incredible talent as an historian: I never met a person so quick to grasp the essence of an idea as Steve—and this comes out in his historical work as much as it does in his pure science. One of my favorite papers of his was ''Eternal Metaphors of Palaeontology'' (1977)—where he identified themes in paleontology that actually sail right through the fundamental sea-change of pre- and post-Darwinian intellectual contexts.

Of course making such connections is the essence of critical insight and theoretical creativity. In pursuing themes of relative growth and evolution, Steve got himself in a bit of hot water when he wrote two back-to-back columns for *Natural History* exploring the life and works of the émigré geneticist Richard Goldschmidt. Goldschmidt was best known, and thoroughly maligned, for his notion of ''hopeful monsters'' that appear through the undocumented process of ''macromutations''—to the point that he was routinely dismissed as a crackpot. Steve's critics, including some distinguished evolutionary biologists who ought to have known better, accused Steve of resurrecting macromutations and hopeful monsters to explain punctuated equilibria.

But Steve was doing no such thing: rather, he was developing the thought that relatively small-scale mutations in the regulatory genetic apparatus might very well have cascading, larger-scale effects during development—in a very real way producing the sort of effects that Goldschmidt had been talking about. This idea is still very much alive in so-called ''evo-devo'' circles—and Steve was on the ground floor decades ago with it.

Of the many implications of our initial work on punctuated equilibria, one that we agreed on thoroughly is the importance of extinction. Our mutual professor, Norman D. Newell, had been virtually the only paleontologist in the mid–twentieth century who saw that mass extinctions were real events—and had had profound effects on the subsequent course of the evolution of life. Back in the day as Norman's students, we all tended to be impatient with Norman's preoccupation with extinction: extinction is negative, we thought; evolution is positive! So let's just talk about evolution.

More than anyone else, of course, it has been Steve who has established without a shadow of doubt that extinction is often the necessary precursor to bursts of evolutionary activity. Indeed, it seems to many of us that, the greater the scope and intensity of an extinction event, the greater the scope and intensity of evolutionary response. You cannot understand evolution fully *without* extinction!

And here is a graphic example of Steve's vision that the fossil record has general truths to reveal to us about the very nature of the evolutionary process. Steve used the term *contingency* to refer to the pattern where some entire groups will succumb to extinction where others may squeak through—all, as far as can be told, having nothing to do with how well adapted they were to their normal environments. The deck is shuffled when something off-scale—like an asteroid impacting the earth—temporarily rewrites the rules of existence.

What Steve's critics have failed to see is that such events are not just isolated single-event phenomena. They happen at different spatial and temporal scales and have proportionately

predictable effects—and so must, in Steve's "nomothetic" manner, be folded formally into evolutionary theory.

These are just some of the highlights of Steve's enormous impact and legacy in evolutionary science—viewed from my own perspective. He was, of course, a polymath and there is a lot more to say. I never met anyone who was so smart and who worked so hard. And though he became arguably the most famous scientist in America by the time of his death, it was his unflagging dedication to matching ideas with the empirically known world—especially, but not exclusively, of the fossil record—that kept his interest so keen despite earlier bouts with cancer and other vicissitudes of life.

Like all ambitious people, Steve could be pretty competitive. I'll never forget the time when he was trying out on me his argument that Père Teilhard de Chardin was the likely culprit behind the Piltdown hoax and subsequent scandal. He sputtered with real indignation on the phone his disgust that Teilhard commanded so many linear feet of shelf space in the Harvard library!

But the Steve I knew and worked with these past 30 years and more was kind, generous, and fun-loving. And when I spoke with him a few weeks ago, and he asked me whether I would agree to make the speech presenting him with the Paleontological Society's Gold Medal this coming October, just after I also will have the pleasure of presenting our mutual student Bruce Lieberman with the Schuchert award, Steve said: "This is actually pretty good for you . . . after all, in me you have a colleague, and in Bruce. . . ." and I said simply: "Steve, what I have here is an older brother and a son."

And that's what it is: in losing Steve, I have lost my older brother. And the world has lost an enormous intellect and a great scientist—one who consistently connected his science with broader social and intellectual themes. There is, of course, no one quite like him—and though the beat can and must go on, his passing leaves a void that no one can fill.

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