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In Memoriam

BEYOND DARWINISM

In Memoriam of Stephen J. Gould

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Although Gould never said that "punctuated equilibrium" was something different from Darwinism and in fact stubbornly maintained that his theory and Niles Eldredge's was just another aspect of Darwinism, there is something that the great man forgot. We all know that if evolution does not take place incrementally, but rather in spurts that are separated by long periods of time during which natural selection simply does not take place, then "punk-eq" departs significantly from Darwinian competition among organisms. Gould and Eldredge were not the only ones to defy Darwin's reductionistic theory; Kimura did it (Kimura and Ohta, 1974) with the triumph of the neutral theory, and its broad predictions have been confirmed by extensive molecular sequence data, Lamarck did too and so did the catastrophic change produced by a 11-km wide asteroid that descended on the Yucatan Peninsula in the Cretaceous Period, destroying 70% of living species, including almost all the dinosaurs. Natural selection theory cannot recover from the implications of this catastrophe, although it appears that it still applies to the micrological details of genes and individuals, and certainly serves well to theoretically treat individuality at the different levels of biological hierarchy - genes, chromosomes, cells and species (Hoenigsberg, 2001a,b). I suppose that natural selection cannot be helpful in prebiotic models, such as spontaneous aggregations and in the first moments, such as dissipative structures "a la Prigogine" in polypeptide synthesis, by condensation over catalytic surfaces (Prigogine, 1967; Nicolis and Prigogine, 1977; Prigogine and Stengers, 1984).

Not only does the 11-km wide rock that hit earth and destroyed 2/3 of the living species in the Cretaceous Period constitute a challenge to natural selection as the only guiding force of organic evolution, but Eigen (1971) and Eigen and Schuster's (1979) brilliant theory of the evolution of hypercycles as a means to cancel competition so that cooperating gene networks could emerge, also does not depend on the action of natural selection. Notwithstanding himself, Gould was in good company as a challenger of natural selection: Goldschmidt (1940) did so too, notwithstanding Wilson Stone in Texas. Axelrod and Hamilton (1981) did it by showing that the theory of reciprocity through game theory, utilizing the Prisoner's Dilemma of Rapoport

and Chammah (1965), and reciprocal altruism through repeated opportunities for interaction, with individual recognition and learning, by Trivers, cancel the Darwinian need for step-by-step single gene survival as the only strategy to account for the single selective level functioning among individuals. Indeed, one way to improve an organism's biological machinery, where higher order selection can operate, is by curtailing Darwinian demands for competition in order to improve coherent within-organism variation, competition, conflict and selfishness! (for recent reviews, see Hoenigsberg, 2001a,b and 2002). Gallardo's saltational model (Gallardo,1997) is another non-Darwinian karyotypic evolution in the Octodontoidea.

There is still more about the forces that have shaped evolution: Jennings (1940, p. 48, cited by Hoenigsberg, 1992) clearly stated that: "the doctrine of the inheritance of acquired characteristics finds its last refuge in the genetics of Protozoa". The Somatic Selection Hypothesis first proposed by Steele (1979) is the modern molecular counterpart of the Pangenesis idea. Steele's theory is neo-Lamarckism aided by modern molecular biology. This hypothesis proposes a mechanism to explain the evolution of variable antibody genes (V genes) via soma-to-germline gene feedback turn (for recent results, see Spadafora, 1998; Giordano et al., 2000) through the action of reverse transcription (Temin and Baltimore,1975, cited by Steele et al., 1998, p.11). For implications for cell biology, molecular embryology, and general evolvability, see Hoenigsberg (2002).

PALEY, SMITH AND DARWIN

The distinguishing theoretical characteristic of both Darwin and Smith is reductionism. Both reduce all knowledge to the level of the individual. But of course, reductionism was already present as a different line of approach towards knowledge (different from Pithagorian mysticism) stemming from the Ionian philosophers, which culminated in Democritus, a contemporary of Socrates, who first dealt in materialistic terms (see Polanyi, 1958). It is interesting to find that Darwin was obsessed with Paley's image of the "great watchmaker" to account for the perfect adaptation of creatures to harmonious ecosystems. Thus, his contribution is immense in his claim that natural selection is the only cause of evolution. We owe a great deal to Darwin because he rescued the history of life from the superstitious fantasies of religion. Darwin offered solid empirical and materialistic evidence. Pre-Darwinian evolutionists, faced with the evidence for natural selection and still under the spell of Paley's Natural Theology sought the final cause of evolution, and they found it in the proposal of an intelligent designer. Modern science is not interested in final causes because they are unknowable. We don't look for why things happen but how they happen. This methodological stand, although old in Europe, was new in nineteenth century England, Darwin and Wallace, as well as Weismann and Lamarck adopted it to explain the changes observed in species. Whereas Darwin's predecessors had seen adaptation of organisms as the effects of design, Darwin and others saw the physical and material development of organisms as the sole cause of evolution. There was no need for the great watchmaker.

Gould frequently addressed Darwin's breakthrough as a methodological nineteenth century stand. In fact, during the whole century methodological reductionism permeated all intellectual and scientific endeavors; the focus was then, as today, on the details of individual behavior, including reproduction and death.

ADAM SMITH AND POLITICAL ECONOMY

The "political economy" of Adam Smith was the first work to confront William Paley's Natural Theology and his image of the "great watchmaker". Adam Smith's reductionistic stand was that the material actions of individuals in pursuit of their own selfish ends is the real driver of the economy as a whole. For Smith, a wholesome economy results from combining all the self-interested actions of individuals. It is conceivable that Darwin, in order to prove William Paley's Natural Theology (1802) wrong, consciously and deliberately imported Smith's economic methodology into biology to refute natural theology's argument of the "great watchmaker". Gould said that "the theory of natural selection is, in essence, Adam Smith's economics transferred to nature". Richard Lewontin, his friend and collaborator, in the New York Review of Books (The Politics of Science, 2002) criticized Gould for failing to draw out the implications of the "overwhelming influence of ideology on science". For Lewontin, "Darwin's Theory of Evolution by natural selection is obviously nineteenth-century capitalism writ large".

In Gould's The Structure of Evolutionary Theory, the author appears fascinated by the fact that Darwin did not see that the species around us do not appear as a continuum of infinitesimally graduated stages of evolution. What we find is clearly distinct species, although there are also siblings. When we look at the fossil record, evolutionary stasis is frequent, and paleontology testifies that changes take place abruptly, as though suddenly spurred by some external causes.

I can assure the reader that the death of Steven J. Gould represents a great loss for Biology.

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