

### Stephen Jay Gould: A View of Life 1941-2002

Stephen Jay Gould obtained an undergraduate degree in geology from Antioch College, Ohio, in 1963, and went on to obtain a PhD in palaeontology from Columbia University in 1967. He spent most of his academic career at the Museum of Comparative Zoology at Harvard University where he was Alexander Agassiz Professor of Zoology in the section of invertebrate palaeontology.

Gould is regarded as one of the most effective contemporary popularisers of the science of evolutionary biology. He was characterized by a passion for science and this passion is evident in his writing. More importantly, he did not talk down to his readership, and could quite easily be said to have made more people worldwide, scientists and lay persons alike, aware about evolutionary ideas, than any of his contemporaries.

Gould wanted to revive the genre of scientific writing that existed in Victorian times, when such great scientists as Charles Lyell and Charles Darwin were also accomplished writers with literary flair. Books by such scientists were widely read and avidly discussed even in Victorian households. This was particularly true of the sensational *Vestiges of the Natural History of Creation*, written and published anonymously by Robert Chambers in 1844, in which the idea of evolution and the origin of the universe were discussed. Many believe that *Vestiges* laid the groundwork and prepared the public mind for the acceptance of Darwin's equally shocking *Origin of Species*. Gould could be compared to Thomas Henry Huxley, who was a contemporary of Charles Darwin and a vocal, energetic champion

of Darwin's theory of evolution and its implications for human origins. Like Huxley, Gould was an impassioned campaigner against creationism and styled himself as a promoter of the secularism of scientific thought, practice and method. He was a debunker of what he perceived as racially tinged science. This attitude was illustrated in Gould's forceful book *The Mismeasure of Man* (1981), in which he exposed the dubious practices of phrenology, criminal anthropology and the concept of IQ. He liked to think of himself as "*an unfazed evolutionist fending off the slings and arrows of outrageous opposition....*". Huxley and Gould had the gift of communication. Huxley could give classic stirring talks like the one simply titled 'On a Piece of Chal' to an audience consisting purely of limestone miners. Despite its sober title, the lecture was actually a fabulous exposition of the formation of the white cliffs of Dover from the calcareous remains of marine fossil foraminifera; the very limestone that the miners dealt with each day. Gould wrote entertaining essays on similarly engaging topics of great breadth and sweep illustrating quaint evolutionary puzzles exemplified by Adam's navel. These essays appeared regularly every month from 1974 to 2001 in an unbroken run of 300 issues in the magazine *Natural History*, under a column entitled 'This View of Life'. Most of these essays have been collected and published as books with appealing and intriguing titles: *Leonardo's Clams and the Diet of Worms*, *The Flamingo's Smile*, *Bully for Bron-tosaurus*, and *Hens' Teeth and Horses' Toes*.

Stephen Jay Gould trained in the biometrics of fossil molluscs, a subject that he researched for

his doctoral dissertation. Later his own scientific endeavours were on the microgeographic variation in land snails of the genus *Cerion* in the Bahamas, work for which he was acclaimed among specialists. He also wrote *Ontogeny and Phylogeny* in 1977 in which he attempted to show that changes in the timing of developmental events could explain Haeckel's Biogenetic Law, and that developmental events could be used to infer evolutionary relationships.

It has been said that Thomas Henry Huxley made his mark more by championing Darwin and not so much from his own original work. Although steeped in Darwiniana, some critics claim that Gould attempted to make his mark by erecting straw men that he would then proceed to demolish. At the time of his PhD, it appears that palaeontology was undergoing a change from viewing fossils as static entities to viewing fossils as organisms with a dynamic history. In 1972, Niles Eldredge and Stephen Jay Gould proposed the theory of 'punctuated equilibrium' according to which evolution was supposed to occur in bursts or punctuations after long periods of stasis or equilibrium wherein the fossil record apparently recorded no changes in the fossil forms. Examination of relatively complete stratigraphic sections was believed to reveal such syncopated patterns. At these punctuations, most evolution was believed to occur by the formation of new species. Eldredge and Gould claimed that they had slain the orthodox Neo-Darwinian view of gradualistic evolution, and that they had discovered new evolutionary processes. The rest of the scientific establishment was, however, not impressed, since the evolutionary biologist George Gaylord Simpson, as early as 1944, had already described slow, medium and fast rates of evolution. Therefore, this was no real attack on Neo-

Darwinism as it was claimed to be. Moreover, the dispute appeared to merely a matter of differences in scale: what is rapid for a palaeontologist is actually the result of very slow processes for a population geneticist who measures evolution as the change in the frequency of alleles from one generation to the next. Therefore, the punctuated patterns, if they existed, could easily have been the result of small, slow, gradualistic changes. However, Gould's passionate defence of punctuated evolution forced evolutionary biologists to look more carefully at the fossil record, to use better statistical evaluations of patterns, and to confront the very real phenomenon of stasis in evolution.

Another major controversy that Gould was involved in was the debate surrounding sociobiology following the publication of E O Wilson's book *Sociobiology: The New Synthesis* in 1975. In this opus Wilson put together existing theories of kin selection and selection at the level of the gene as explanations for phenomena such as altruism in social insects such as bees or of infanticide in social taxa such as lions. Wilson alluded to the usefulness of applying this approach to the investigation of human behaviour. Gould and other colleagues believed Wilson's book to insinuate that human behaviour was determined by genes which implied that an individual's biology was his destiny. Guided possibly by a left-leaning political ideology and also haunted by the spectre of eugenics, Gould and colleagues such as Richard Lewontin railed against what they considered to be the dangers of a view that proposed biological determinism for humans. In later years, Gould was a vocal critic of the up-coming field of evolutionary psychology as he felt that there was no evidence for interpreting human behaviour today in the light

of the social and biotic environments of the hominid past.

Another cause that Gould championed with Richard Lewontin was to dethrone what they claimed was the pan-adaptationist view of the Neo-Darwinists. According to their interpretation, this view was that form and associated function in organisms were strictly the products of adaptation. In their much-cited 1979 paper presented before the Royal Society and titled *The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme*, Gould and Lewontin claimed that evolutionary biologists were prone to excessive adaptationist thinking. Students of evolution should consider the possibility that structures were often not perfectly adapted either due to genetic or developmental constraints or as a result of genetic drift or indirect selection. They declared that evolutionary biologists must also consider that structures that were derived at some earlier stage for now possibly redundant purposes, or that originated as incidental by-products of other selected characters, could have been secondarily co-opted for new functions. A classic example in this vein was the panda's 'thumb' which is not derived from the digit that primate thumbs are made from but is actually a modified wrist bone which in the panda has been co-opted to hold bamboo stems, and thus to serve as a 'functional' thumb. Gould and Elizabeth Vrba went on in 1982 to coin the word 'exaptation' for such co-opted structures. Despite the new term, this was, however, not a new concept. George C Williams in his book *Adaptation and Natural Selection* in 1966, and François Jacob in his classic paper *Evolution as Tinkering* in 1977, had already laid out these ideas. Here again, it appeared that Gould's contribution was not to be

original but to present old ideas in original packaging. In the spandrels paper, Gould used a famous satirical figure from Voltaire's *Candide*; that of Dr. Pangloss who believed that everything was for the best in the best of all possible worlds. Therefore, for example, in a Panglossian world an acceptable explanation for the protuberant human nose would be that it "arose" for the specific purpose of supporting spectacles. Incidentally, the spandrels referred to in Gould and Lewontin's paper are spaces between cathedral arches; the spandrels of San Marco in Venice are decorated with beautiful frescoes. The point Gould and Lewontin wanted to emphasise was this: the spandrels were not formed to create space for the beautiful frescoes; rather the spandrels were a by-product of the structural support system of the cathedral arches, and were later co-opted for their decorative function.

Another major issue that Gould took sides on was the problem of determining at what level was it that natural selection acted upon: the gene, the individual, the population, the group, or the species and beyond. This has been termed the problem of the unit of selection. In this controversy he pitted himself against Richard Dawkins whose popular book stressed the notion of the gene as the unit of selection using the powerful metaphor of the selfish gene. Gould objected strongly to what he called Dawkins' extreme reductionist view or hyper-Darwinism, as he felt that Darwin's theory of evolution by natural selection was about selection between individuals who should not be considered as mere vehicles for genes. Gould defended this position energetically. However in recent years, Gould appeared to have softened his stand, and even admitted that selection at the level of the gene was possible.



Gould styled himself as a pluralist in the tradition of Darwin with regard to evolutionary processes. He believed that natural selection was only one of the many forces that could shape the evolutionary history of a lineage. Gould felt that an important, hitherto neglected, factor in evolution was that of contingency or chance events. Would humans have evolved if a meteorite had not crashed into the Earth and annihilated the dinosaurs? He developed this theme of contingency in *Wonderful Life. The Burgess Shale and the Nature of History* written in 1989. This book was about the remarkable Cambrian explosion of multi-cellular life forms found in the Burgess Shale deposits of the Canadian Rockies. Gould believed that the disparity of lifeforms was greatest in the Cambrian; owing to contingent events this diversity was whittled down to the spectrum of body plans that are seen today. He firmly believed that nature would never rewind the tape, and that contingency was a major force in determining which way life would evolve. His detractors on this issue, particularly Simon Conway Morris, believed that Gould's view of an inverted cone of diversity beginning with the Cambrian was misguided, and that Gould's idea of contingency as a powerful force in determining evolutionary trajectories could not explain the persistent and quite prevalent phenomenon of convergent evolution, wherein similar evolutionary paths seems to be taken repeatedly. The history of life abounds with such examples: mammals that look like fish, marsupial 'wolves' and marsupial 'flying squirrels' in Australia that look just like their eutherian counterparts in other parts of the world. Are there then just so many ways to colonise morphospace and is the role of contingency relatively unimportant in evolution?

It is clear then that throughout his scientific career, Gould was embroiled in controversy. This controversy spilled into his popular writings, which made the eminent evolutionary biologist John Maynard Smith remark in a review of *The Panda's Thumb* in 1981, "... I hope it will be obvious that my wish to argue with Gould is a compliment, not a criticism. Popular science should reflect science as it is practised: this means that it should reflect controversy and uncertainty. ....What matters is science. I suspect that the reason why, for me at least, the best popularisers have themselves been scientists is that, however interested they may be in politics or history or philosophy, their first love is science itself. ....Often he [Gould] infuriates me, but I hope he will go right on writing essays like these".

Thomas Henry Huxley was referred to as Darwin's bulldog. Richard Dawkins has been called Darwin's greyhound. How will history remember Gould? I suspect that Gould would like to be remembered as a great modern-day natural historian in the finest tradition of the Victorians whom he emulated. I also suspect that he would also like to be remembered by the motto of the Paleontological Society of America: *Frango ut patefaciam* (I break in order to reveal.).

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