Stephen Jay Gould (1941-2002) [1]

By: Barnes, M. Elizabeth Keywords: developmental constraints [2]

Stephen Jay Gould [3] studied snail fossils and worked at Harvard University [4] in Cambridge, Massachusetts during the latter half of the twentieth century. He contributed to philosophical, historical, and scientific ideas in paleontology, evolutionary theory, and developmental biology. Gould, with Niles Eldredge, proposed the theory of punctuated equilibrium, a view of evolution [5] by which species undergo long periods of stasis followed by rapid changes over relatively short periods instead of continually accumulating slow changes over millions of years. In his 1977 book, *Ontogeny and Phylogeny* [6], Gould reconstructed a history of developmental biology and stressed the importance of development to evolutionary biology. In a 1979 paper coauthored with Richard Lewontin, Gould and Lewonitn criticized many evolutionary biologists for relying solely on adaptive evolution [5] as an explanation for morphological change, and for failing to consider other explanations, such as developmental constraints.

Gould was born on 10 September 1941 in New York City, New York to artist and entrepreneur Eleanor Rosenberg and court stenographer Leonard Gould. When Gould was five years old, his father took him to the American Museum of Natural History in New York City, New York. Gould later said that the skeletal display of *Tyrannosaurus rex* [7] at the Museum sparked his interest in paleontology and made him want to become a paleontologist.

In 1958 Gould graduated from Jamaica High School in New York City, New York. He then attended Antioch College in Yellowsprings, Ohio and received a BA in geology and philosophy in 1963. During his time at Antioch, he studied abroad at the University of Leeds in West Yorkshire, England. He met his first wife, Deborah Lee, at Antioch. They married in October 1963 and later had two children, Jesse and Ethan.

After graduating from Antioch, Gould attended the University of Columbia in New York City and received his doctorate in paleontology in 1967. He immediately joined the faculty at Harvard University [4] as assistant professor of geology. He was tenured in 1971 and received full professorship in 1973. In 1982, he became the Alexander Agassiz [8] Professor of Zoology.

In the 1970s, Gould and his colleague Niles Eldredge developed the theory of punctuated equilibrium. At the time, most biologists held that new species evolved from other species by the small gradual changes continuously accumulated by natural selection [9] over millions of years. However, Gould and Eldredge saw problems for this view based on the fossil record. They noticed many gaps in the transitions from one species to the next. The sequence of fossils that were available did not exhibit the smooth gradual change that one would find if species evolved continuously and gradually. Other biologists interpreted the gap in the fossil record as an indication of missing data. They theorized that because the fossils that had been found so far were so old, fragile, and eroded by geological processes, the vast majority of animals who once lived would never be fossilized or discovered.

For Gould and Eldredge however, the gaps in the fossil record suggested that the evolution [5] of a lineage could proceed at variable rates of change. They hypothesized that species actually do not change much most of the time. They believed that isolated events, such as major geological catastrophes, or the formation of new geological barriers, could contribute to the evolution [5] of species. According to their theory, speciation happens relatively quickly over thousands, rather than millions, of years. The theory stirred controversy, much of which continued for decades.

In 1977 Gould published *Ontogeny and Phylogeny* [6] in which he reconstructed the history of developmental biology and showed how development relates to evolution [5]. A main topic of the book was recapitulation, the idea that the stages in the development of animals replay the stages of their evolutionary ancestors. Gould focused on the two opposing theories of developmental biology presented by Karl Ernst von Baer [10] and Ernst Haeckel [11] in Europe during the nineteenth century.

In this book, Gould described von Baer's laws [12] of embryology [13], which claimed that embryos from different taxa look similar to each other early in development, but diverge from each other as development progresses. Von Baer argued that there was no relationship between developmental stages [14] and evolutionary ancestry. Gould then described Haeckel's biogenetic law [15]. The biogenetic law [15] entails that as an embryo from a species develops, it repeats the adult stages of organisms from the species out of which the embryo's species evolved. Haeckel argued that there was a close relationship between development and ancestry, and thus opposed von Baer's theory.

Gould proposed that both theorists were right in different ways, and that their theories remained important for evolutionary theory in the twentieth century. Gould described how biologists eventually adopted von Baer's theories and not Haeckel's, but claimed that some of Haeckel's theories remained relevant to developmental biology. According to Gould, Haeckel's concepts of heterochrony—the change in timing of a developmental event, and of neotany—the retardation [16] of development, help researchers study patterns in macroevolution, a term used to describe large-scale changes in the morphology [17] of species over millions of years.

In 1979, Gould again challenged some assumptions in evolutionary theory when he co-wrote "The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme" with Richard Lewontin, an evolutionary biologist then working at Harvard University [4]. In this paper, Gould and Lewontin claimed that the current adaptationist program in evolutionary biology, in which biologists sought to explain every trait of organisms as adaptations to environments, was naïve and failed to consider other possible factors in evolution [5], such as developmental constraints. They used the example of spandrels, the decorated spaces between arches in the church of San Marco in Venice, Italy as a metaphor for how a complex character may lead us to conclude that it was designed for a specific purpose, rather than simply the result of some other related process. They argued, in contrast, that the spandrels in the church of San Marco can be better explained as the byproduct of the construction of the arches. The spandrels are thus only afterthoughts in the design of the archways. Gould and Lewontin argued that spandrels in buildings are analogous to some morphological features of organisms. According to Gould and Lewontin, biologists often tried to explain every feature of organisms as adaptations. However, they argued, some morphological features are better explained as the result of developmental processes that constrain the evolution [5] of the structure of an organism's morphology [17], rather than as the result of adaptiveevolution [5].

Gould also opposed ideas in sociobiology. In 1975 Edward Osborne Wilson, a biologist atHarvard University [4], published *Sociobiology: The New Synthesis*, in which he argued thatevolution [5] could be used to explain human behaviors, such as altruism and aggression. Gould, Lewontin, and others wrote a letter to the *New York Review of Books*entitled "Against Sociobiology," expressing opposition to Wilson's project. Gould warned that ideas in sociobiology promoted biological determinism, implying that an individual's choices play no significant role in the development of one's character. Gould, as a self-proclaimed Marxist who wrote about social justice, thought that sociobiology could encourage racism and sexism. He feared a reemergence of problematic ideas, such as Social Darwinism [18] and eugenics [19], which had exhibited a similar kind of biological determinism and had been used in the past to justify repressive acts against minorities. In response, Wilson defended his research program against claims that it promoted biological determinism by arguing that he merely sought to describe human behavior, and he refrained from prescribing how humans [20] ought to behave.

Gould wrote popular science texts about evolutionary theory. Some of his colleagues lauded his ability to explain scientific concepts in a way that captured the public's interest while not oversimplifying the important complexities and nuances within evolutionary theory. He wrote several books intended for a general audience, including *The Pandas Thumb*, *The Mismeasure of Man*, *Ever Since Darwin* , and *Wonderful Life: The Burgess Shale and the Nature of History*. He wrote regularly in newspapers and popular science magazines such as *Scientific American*, *The Scientist*, *Discover*, and *The New York Times*. In 1981 *Discover Magazine* named Gould scientist of the year. He was also the subject of many interviews and stories in popular magazines, such as *Newsweek*, *People*, and *Time*, and he appeared in an episode of the cartoon television series*The Simpsons*.

Gould engaged in the discussions between creationists and biologists about whether or notevolution [5] should be taught in schools in the US. Gould was opposed to creationism, and in 1982 he testified in an Arkansas trial against the use of biblical teachings in the science curriculum. During that same year, Gould was diagnosed with mesothelioma, a rare form of cancer found in the lining of internal organs and which is linked to asbestos exposure. Gould eventually recovered and later said that he saw his recovery as an opportunity to pursue his work. Over the next decade, Gould received many awards including the Medal of Excellence from Columbia University [21] in 1983, the silver medal from the Zoological Society of London in 1984, and the Gold Medal for Service to Zoology from the Linnean Society of London in 1992. He received greater than 40 honorary degrees from several institutions worldwide.

In 1995, Gould divorced Deborah Lee and married Rhonda Shearer. In 1999, he became the president of the American Association of the Advancement of Science. On 20 May 2002 Gould died after a second bout with cancer; this time a metastatic cancer of the lung.

Sources

1. Allen, Elizabeth et al. "Against Sociobiology." Review of *Sociobiology: the new synthesis*, by Edward Osborne Wilson. *The New York Review of Books*, November 13, 1975. http://www.nybooks.com/articles/archives/1975/nov/13/against-sociobiology/?pagination=false [22](Accessed March 28 2013)
2. Allen, Warren. "The Structure of Gould." In*Stephen Jay Gould [3]: Reflections on His View of Life*. Oxford: Oxford University Press, 2008.
3. Bonner, John Tyler. "Stephen Jay Gould [3]." *Journal of Biosciences* 27 (2002): 450.
4. Bowler, Peter J. *Evolution: The History of an Idea*. Berkeley and Los Angeles: University of California Press, 1984.
5. Briggs, Derek E. G. "Obituary: Stephen Jay Gould [3] (1941-2002)." *Nature* 417 (2002): 706.
6. David, Jean R. "Stephen Jay Gould [3] (1941-2002)." *Journal of Biosciences* 27 (2002): 453–454.
7. Encyclopedia Britannica Online. "Stephen Jay Gould [3]." http://www.britannica.com/EBchecked/topic/240011/Stephen-Jay-Gould [23] (Accessed March 28, 2013).
8. Gould, Stephen Jay. *Ontogeny and Phylogeny [6]*. Cambridge: Harvard University Press [24], 1977.

9. Gould, Stephen Jay. *Wonderful Life: The Burgess Shale and the Nature of History*. New York: W.W. Norton & Company, 1989.
10. Gould, Stephen Jay. *Ever Since Darwin: Reflections on Natural History*. W.W. Norton & Company, 1992.
11. Gould, Stephen Jay. *The Panda's Thumb: More Reflections on Natural History*. New York: W.W. Norton & Company, 1992.
12. Gould, Stephen Jay. *The Mismeasure of Man*. New York: W.W. Norton & Company, 1996.
13. Gould, Stephen Jay. *The Structure of Evolutionary Theory* [25]. Cambridge: Harvard University Press [24], 2002.
14. Gould, Stephen Jay, and Niles Eldredge. "Punctuated equilibria: an alternative to phyletic gradualism." In *Models in Paleobiology* ed. Thomas J.M. Schopf. San Francisco: Freeman, Cooper, and Co., 1972, 82–115.
15. Gould, Stephen Jay, and Niles Eldredge. "Punctuated Equilibria: The Tempo and Mode of Evolution Reconsidered." *Paleobiology* 3 (1977): 115–151.
16. Gould, Stephen Jay, and Richard Lewontin. "The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme." *Proceedings of the Royal Society of London Series B, Biological Sciences* 205 (1979): 581–598. http://rspb.royalsocietypublishing.org/content/205/1161/581.abstract [26] (Accessed February 17, 2014).
17. Hull, David L. "Gould, Stephen Jay." *Dictionary of Scientific Biography* 21: 159–165.
18. McNamara, Ken J., and Michael L. McKinney. "Heterochrony, disparity and macroevolution." In *Macroevolution: Diversity, Disparity, Contingency. Essays in Honor of Stephen Jay Gould* [3] . Lawrence, Kansas: The Paleontological Society, 2005, 17–26.
19. Nielsen, Rasmus. "Adaptationism-30 years after Gould and Lewontin." *Evolution* 63 (2009): 2487–2490.
20. "Paleontologist, author Gould dies at 60." *Harvard University* [4] *Gazette*, May 20, 2002. http://www.news.harvard.edu/gazette/2002/05.16/99-gould.html [27] (Accessed March 28, 2013).
21. Segerstrale, Ullica. "The Scientist of the Underdog." *Journal of Biosciences* 27 (2002): 460–463.
22. Segerstrale, Ullica. *Defenders of the Truth: The Battle for Science in the Sociobiology Debate and Beyond* Oxford: Oxford University Press, 2000.
23. Wilson, Edward Osborne. *Sociobiology: The New Synthesis*. Cambridge: Belknap, 1975.
24. Yoon, Carol. "Stephen Jay Gould [3], 60, Is Dead; Enlivened Evolutionary Theory." *New York Times*, May 21, 2002. http://www.nytimes.com/2002/05/21/us/stephen-jay-gould-60-is-dead-enlivened-evolutionary-theory.html [28] (Accessed February 17, 2014).

Stephen Jay Gould studied snail fossils and worked at Harvard University in Cambridge, Massachusetts during the latter half of the twentieth century. He contributed to philosophical, historical, and scientific ideas in paleontology, evolutionary theory, and developmental biology. Gould, with Niles Eldredge, proposed the theory of punctuated equilibrium, a view of evolution by which species undergo long periods of stasis followed by rapid changes over relatively short periods instead of continually accumulating slow changes over millions of years. In his 1977 book, Ontogeny and Phylogeny, Gould reconstructed a history of developmental biology and stressed the importance of development to evolutionary biology. In a 1979 paper coauthored with Richard Lewontin, Gould and Lewonitn criticized many evolutionary bioligists for relying solely on adaptive evolution as an explanation for morphological change, and for failing to consider other explanations, such as developmental constraints.

Subject

Gould, Stephen Jay [29] Punctuated equilibrium (Evolution) [30] Spandrel beams [31] Ontogeny [32] Phylogeny [33] Fossils [34] Paleontology [35] Evolution [36] Developmental biology [37] Embryology [38] Lewontin, Richard C., 1929- [39] adaptation [40] Developmental Biology [41]

Topic

People [42]

Publisher

Arizona State University. School of Life Sciences. Center for Biology and Society. Embryo Project Encyclopedia.

Rights

Format

Articles [43]

Last Modified

Tuesday, September 17, 2019 - 19:15

DC Date Accessioned

Tuesday, February 18, 2014 - 22:12

DC Date Available

Tuesday, February 18, 2014 - 22:12

DC Date Created
2014-02-18

- Contact Us

- The Embryo Project at Arizona State University, 1711 South Rural Road, Tempe Arizona 85287, United States

---

Source URL: https://embryo.asu.edu/pages/stephen-jay-gould-1941-2002

Links
[1] https://embryo.asu.edu/pages/stephen-jay-gould-1941-2002
[2] https://embryo.asu.edu/keywords/developmental-constraints
[3] https://embryo.asu.edu/search?text=Stephen%20Jay%20Gould
[4] https://embryo.asu.edu/search?text=Harvard%20University
[5] https://embryo.asu.edu/search?text=evolution
[6] https://embryo.asu.edu/search?text=Ontogeny%20and%20Phylogeny
[7] http://eol.org/pages/4433638
[8] https://embryo.asu.edu/search?text=Alexander%20Agassiz
[9] https://embryo.asu.edu/search?text=natural%20selection
[10] https://embryo.asu.edu/search?text=Karl%20Ernst%20von%20Baer
[11] https://embryo.asu.edu/search?text=Ernst%20Haeckel
[12] https://embryo.asu.edu/search?text=von%20Baer%27s%20laws
[13] https://embryo.asu.edu/search?text=embryology
[14] https://embryo.asu.edu/search?text=developmental%20stages
[15] https://embryo.asu.edu/search?text=biogenetic%20law
[16] https://embryo.asu.edu/search?text=retardation
[17] https://embryo.asu.edu/search?text=morphology
[18] https://embryo.asu.edu/search?text=Darwinism
[19] https://embryo.asu.edu/search?text=eugenics
[20] https://embryo.asu.edu/search?text=humans
[21] https://embryo.asu.edu/search?text=Columbia%20University
[22] http://www.nybooks.com/articles/archives/1975/nov/13/against-sociobiology/?pagination=false
[23] http://www.britannica.com/EBchecked/topic/240011/Stephen-Jay-Gould
[24] https://embryo.asu.edu/search?text=Harvard%20University%20Press
[25] https://embryo.asu.edu/search?text=Structure%20of%20Evolutionary%20Theory
[26] http://rspb.royalsocietypublishing.org/content/205/1161/581.abstract
[27] http://www.news.harvard.edu/gazette/2002/05.16/99-gould.html
[28] http://www.nytimes.com/2002/05/21/us/stephen-jay-gould-60-is-dead-enlivened-evolutionary-theory.html
[29] https://embryo.asu.edu/library-congress-subject-headings/gould-stephen-jay
[30] https://embryo.asu.edu/library-congress-subject-headings/punctuated-equilibrium-evolution
[31] https://embryo.asu.edu/library-congress-subject-headings/spandrel-beams
[32] https://embryo.asu.edu/library-congress-subject-headings/ontogeny
[33] https://embryo.asu.edu/library-congress-subject-headings/phylogeny
[34] https://embryo.asu.edu/library-congress-subject-headings/fossils
[35] https://embryo.asu.edu/library-congress-subject-headings/paleontology
[36] https://embryo.asu.edu/library-congress-subject-headings/evolution
[37] https://embryo.asu.edu/library-congress-subject-headings/developmental-biology
[38] https://embryo.asu.edu/library-congress-subject-headings/embryology
[39] https://embryo.asu.edu/library-congress-subject-headings/lewontin-richard-c-1929
[40] https://embryo.asu.edu/library-congress-subject-headings/adaptation
[41] https://embryo.asu.edu/medical-subject-headings/developmental-biology
[42] https://embryo.asu.edu/topics/people
[43] https://embryo.asu.edu/formats/articles