

Ernst Haeckel and the Biogenetic Law

(An informed opinion)

A disastrous union of embryology and evolutionary biology was forged in the last half of the nineteenth century by the German embryologist and philosopher, Ernst Haeckel. Based on the assumption that the laws by which species arose on this planet (phylogeny) were identical to the laws by which the individuals of the species developed (ontogeny), he viewed adult organisms as the embryonic stages of more advanced organisms. This view was summarized by his "Biogenetic Law": Ontogeny Recapitulates Phylogeny. In other words, development of advanced species was seen to pass through stages represented by adult organisms of more primitive species. In this view, the creation of new phyla is a step towards the completion of human development. In earlier epochs, only the initial stages of this development occurred, producing protists and cnidarians. Later, more stages are added sequentially until a human being has evolved. According to Haeckel, three rules sufficed to explain how this advancing ontogeny could generate new species. First, there was the law of correspondence. The human zygote, for instance, was represented by the "adult" stage of the protists; the colonial protists represented the advancement of development to the blastula stage; the gill slit stage of human embryos was represented by adult fish. Haeckel even postulated an extinct organism, *Gastraea*, a two-layered sac corresponding to the gastrula, which he considered the ancestor of all metazoan species (Haeckel 1867, 1879; see Gould 1977a).

Second, there was the law of terminal addition. The embryo evolved new species by adding a step at the end of the previous ones. In such a view, humans evolved when the embryo of the next highest ape added a new stage. This provided a linear, not a branching, phylogeny. This is a critically important departure from what we usually consider as Darwinian evolution.

There was also the law of truncation, which held that preceding development could be foreshortened. This law was needed to prevent gestation time from being enormous. It also was needed since embryologists did not observe all these stages in all animals.

This notion of ontogeny recapitulating phylogeny was not Darwinism. In fact, Haeckel's synthesis was an attempt to fuse the works of Darwin, Lamarck, and Goethe. In Darwinism, contemporary species are seen as having a common ancestor. The result is a multibranched "bush." (A tree metaphor has also been used, but trees have a central axis, on which scientists have frequently placed the lineage leading up to *H. sapiens*.) Humans are not "higher" than chimps, but have an ancestor from which both groups diverged. In Haeckel's scheme, animals advance to new levels by adding stages to existing embryonic development. Humans were literally on the top. Interestingly, von Baer (1828) had disproven the "biogenetic law" before Haeckel ever invented it. In ridiculing the pre-evolutionary forms of this law, von Baer fantasized what would happen if birds were writing the embryology textbooks. "There is not a true feather on their body, rather only thin feather-shafts," he imagined the bird-scientists writing. "We, as fledglings in the nest, are more advanced than they will ever be."

By observing development, von Baer noted that embryos never pass through the adult stages of other animals. However, there are stages that related embryos do share. All vertebrate embryos pass through a stage in which there are embryonic gill slits. Fish elaborate them into true gills, while the slits become part of the jaw or ear apparatus in other vertebrates. But a frog or human embryo never passes through a stage in which it has the structures of an adult fish. However, even though von Baer and others had discredited the recapitulation notion, it became one of the most popular notions in biology. Gould (1977a, b) has shown that while recapitulation has a limited value in

looking at in formation of related species, it is not a general phenomenon. However, recapitulationism became one of the central paradigms of biology. When it was eventually dismissed, the notion that embryology was an important force in evolution was also dismissed. (Indeed, half of Stephen J. Gould's 1977 book *Ontogeny and Phylogeny* is spent exorcising the ghost of Haeckel so that we could discuss evolutionary developmental biology without having to deal with the biogenetic law.)

The Social Uses of Haeckel's Synthesis

Even more than in biology, Haeckel's "biogenetic law" was adapted uncritically by many of the newly forming social sciences. Early anthropologists espoused the view that other cultures were "primitive" in the embryological sense in that their development had stopped short of our own. Indeed, the word "underdeveloped" is still used to define such a culture. Since evolution was the successive adding on to the top of the tree, the different races could be ordered from top to bottom. (Indeed, they would have to be ordered linearly, since this was not a branched-chain model.) Previously, several historians of science had mentioned that Haeckel was anti-Semitic and that his biology was used by the Third Reich. These claims were repeated in this website. While his biology certainly attempted to rank human groups by racial characteristics, and it was used to justify one ethnic group's claiming supremacy over others, it was not explicitly anti-Semitic. Nor was Haeckel an anti-Semite. Bob Richards (2007) has found that there was a confusion of identities (among other things) with another (and younger) Ernst Hckel of Jena. Indeed, in his ranking of humanity, the Semites did reasonably well, coming out usually just below the Aryans. (Blacks, Finns, and the Irish, however, have grounds for complaints.)

Haeckel brought the Western notion of the Great Chain of Being into evolutionary thought. Like the Medieval, Renaissance, and Enlightenment versions of the Great Chain, it celebrated the ascent of Man. And man is the gender that was important. Both races and sexes were ranked higher and lower, and white females were essentially put on the same rung of the evolutionary ladder as Black men or European infants. (Note the consistency: The younger stages of European males are represented by the adults lower on the chain). Thus, Carl Vogt, Professor of Natural History at the University of Geneva, and a contemporary of Haeckel, claimed (1864), "By its rounded apex and less developed posterior lobe, the Negro brain resembles that of our children, and by the protruberance of the parietal lobe, that of our females." He concluded by stating that the brain characteristics together "assign to the Negro brain a place by the side of that of a white child." Women were thought to belong there, too, as Vogt also concluded that "the female European skull resembles much more the Negro skull than that of the European male." Nor was Vogt alone. He quoted numerous studies, including that of the anthropologist Hushke, who concluded that "in the Negro brain, both the cerebellum and the cerebrum, as well as the spinal cord, present the female and infantile European as well as the simious type." Blacks, women, and children thus link the apes to adult white males.

One sees this notion of linear evolution in much social thought. In religion, it became the dominant way of looking at the history of Western religious thought: Judaism recapitulated paganism and then transcended it. Then Christianity recapitulated paganism, Judaism, and then transcended it. (This became known as the Wellhausen Thesis after the person who most clearly formulated it). Thus, Judaism was seen as embryonic Christianity, a more primitive form of thought, whose role was to prepare the world for the mature form. In a more truly evolutionary sense, one can see a branched-chain model of religious thought where Christianity and modern Judaism both arose from the Judaism of 2000 years ago.

Eventually, the Biogenetic Law had become scientifically untenable. (The revolt against this "law" was started in the mid-1890s by the British embryologist, Adam Sedgwick, who noted the accumulation of exceptions to this "rule" and was able to reinterpret older results without recourse to

it. Moreover, the Biogenetic Law had become allied with the notion of the increasingly suspect notion of the inheritance of acquired characteristics. By 1922, Walter Garstang could provide a more sophisticated analysis of the relationship between evolution and development, showing that alterations in development could produce evolutionary changes.) However, it remains to this day a popular way for society to think about evolution. Dr. Spock (one of the most popular liberal thinkers in the United States) used it in 1968 to discuss the development of the human fetus, and an advertisement in *Newsweek* for Continental Bank in the 1980s shows a linear path from protist to banker (white, male, briefcase-bearing) when the bank claims to have evolved into "a no-holds-barred, full-blooded, undistracted, singleminded bank for business." We should realize that such depictions of evolution are still at large in popular culture and that they are capable of inflicting enormous harm.

Literature Cited

Garstang, W. 1922. The theory of recapitulation: a critical restatement of the biogenetic law. *J. Linn. Soc. Zool.* 35: 81-101.

Gassman, D. 1971. *The Scientific Origins of National Socialism: Social Darwinism in Ernst Haeckel and the German Monist League*. MacDonald, London.

Gould, 1977. *Ontogeny and Phylogeny*. Harvard University Press, Cambridge.

Gould, S. J. 1977. *Ever Since Darwin*. Norton, New York.

Haeckel, E. 1867. *Generelle Morphologie der Organismen*. Georg Reimer, Berlin.

Haeckel, E. 1879. *Anthropogenie*. Third edition. W. Engelmann, Leipzig.

Haeckel, E. 1902. *The Riddle of the Universe*. Harper and Brothers, New York.

Richards, R. J. 2007. Ernst Haeckel's alleged anti-Semitism and contributions to Nazi biology. *Biological Theory* 2: 97–103.

Spock, B. 1968. *Baby and Child Care*. Revised Edition. Pocket Books, New York.

Vogt, C. 1864. *Lectures on Man*. Longman, Green, Longman, and Roberts, London. p. 172-183.

von Baer, K. E. 1828. *Entwicklungsgeschichte der Thiere: Beobachtung und Reflexion*. Borntrger, Koningsberg.

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