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Haeckel, Ernst (1834–1919)

Ernst Heinrich Philipp August Haeckel was Charles Darwin's foremost champion at the turn of the nineteenth century. More people prior to World War I learned of evolutionary theory through his voluminous publications than through any other source. His *Natürliche Schöpfungsgeschichte* (Natural history of creation, 1868) went through 12 increasingly augmented German editions (1868–1920) and was translated into the major European languages. Erik Nordenskiöld, in the first decades of the twentieth century, judged it “the chief source of the world's knowledge of Darwinism” (1936, 515). The crumbling detritus of this synthetic work can still be found scattered along the shelves of most used-book stores. *Die Welträthsel* (The world puzzles, 1899), which placed evolutionary ideas in a broader philosophical and social context, sold over 40,000 copies in the first year of its publication and well over 15 times that number during the next quarter century—and this only in the German editions. (By contrast, during the three decades between 1859 and 1890, Darwin's *On the Origin of Species* sold only some 39,000 copies in six English editions.) By 1912, *Die Welträthsel* had been translated, according to Haeckel's own meticulous tabulations, into 24 languages, including Armenian, Chinese, Hebrew, Sanskrit, and Esperanto. The young Mohandas Gandhi had requested permission to render it into Gujarati; he believed it the scientific antidote to the deadly religious wars plaguing India. Haeckel achieved many other popular successes, and he produced more than 20 large technical monographs on various aspects of systematic biology and evolutionary history. His studies of radiolarians, medusae, sponges, and siphonophores remain standard references today. These works not only informed the public, but they drew to Haeckel's small university in Jena the largest share of Europe's great biologists of the next generation, among whom were Richard Hertwig (1850–1937) and his brother Oscar Hertwig (1849–1922), Anton Dohrn (1840–1909), Hermann Fol (1845–1892), Eduard Strasburger (1844–1912), W. O. Kovalevsky (1842–1883), Nikolai Miklucho-Maclay (1846–1888), Arnold Lang (1855–1914), Richard Semon (1859–1918), Wilhelm Roux (1850–1924), and Hans Driesch (1867–1941). Haeckel's influence extended far into succeeding generations of biologists, many of whom recalled reading his popular works as young students.

Haeckel received his medical degree from Würzburg in 1858, after which he planned to do his habilitation with Johannes Müller (1801–1858) at

Berlin. Müller's suicide led him to turn to Carl Gegenbaur (1826–1903) at Jena, who became his adviser. During his research work in southern Italy and Sicily, he fell in with a group of German artists, among whom was the poet Hermann Allmers (1821–1902), who became a lifelong friend. Haeckel, a gifted painter (see Figure 1), thought of giving up biological research for the life of a Bohemian; only his betrothal to Anna Sethe (1835–1864), his first cousin, kept him focused on establishing a professional career. With a small tract by Müller as his inspiration, Haeckel concentrated his research on the little-known group of radiolaria, creatures about the size of a pinhead that secrete exoskeletons of unusual geometries. While completing his habilitation back in Berlin, he read Darwin's *Origin* in Georg Heinrich Bronn's (1800–1862) German translation and immediately became a convert. His research finally yielded, in 1862, *Die Radiolarien*—a magnificent two-volume folio having extraordinarily beautiful plates based on his own illustrations. The book won the admiration of Darwin, who received the volumes by way of introduction to this new disciple. Haeckel's research had the added benefit of allowing him to marry Anna and to begin his life as extraordinary professor in the medical school at Jena.

Haeckel's brilliant beginning turned dark in 1864 when his wife of eighteen months suddenly died. He suffered a nervous collapse, and during his recovery he wrote his parents that he could no longer accept their religious creed. Rather, he would put his faith in something more reliable, namely, the Darwinian promise of progressive transformation. He then developed that conviction in considerable detail in a large two-volume, theoretical application of Darwinian ideas to all areas of biology, including human evolution. His *Generelle Morphologie der Organismen* (General morphology of organisms, 1866) laid down the fundamental conceptions that he would cultivate for the rest of his career. He made central an idea that he found intimated in Darwin but more carefully worked out by Fritz Müller (1821–1897) in his book *Für Darwin* (1864), namely, the principle of recapitulation—the proposition that the embryo of a given species would pass through the same morphological stages as the phylum had in its evolutionary descent. Haeckel's *Generelle Morphologie* formulated several new perspectives, outfitting them with neologisms that gave his treatise a formidable cast: phylum, ontogeny, ecology, and a host of other terms that had a shorter life span. He also introduced tree diagrams to illustrate the descent of species and to suggest their morphological and temporal distance from one another. The book concluded by advancing a Goethean monism as the appropriate metaphysical position for the naturalist: God and nature, mind and body were to be regarded as expressions of the same underlying *Urstoff*. Darwin and Thomas Henry Huxley (1825–1895) initially sought to have an abridged version of the *Generelle Morphologie*, shorn of its polemical barbs, translated into English.

In order to seek a wider audience for his theoretical treatise, Haeckel delivered a series of popular lectures in 1868 summarizing his Darwinian morphology. The series was published the same year under the title *Natürliche Schöpfungsgeschichte*, and it achieved immediate notoriety. In an initial

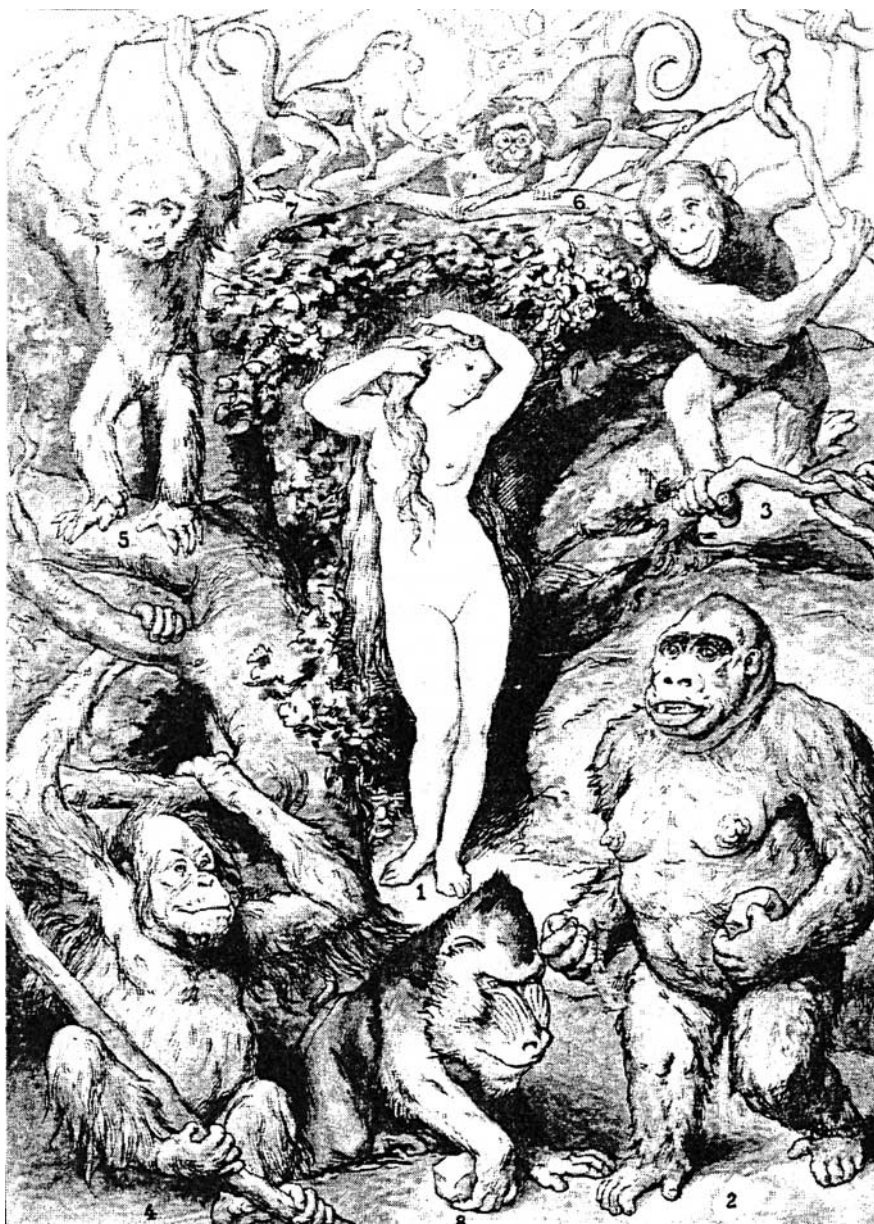


Figure 1. Ernst Haeckel was a brilliant artist and always filled his books with his own drawings. This one, revealingly labeled the “Apotheosis of Evolutionary Thought” (from the supplement to Haeckel’s *Wanderbilder*, 1905), is an interesting reflection on his own private life. He was grieving the death of a young woman, to whom he was not married but with whom he had just had a passionate (spiritual but also physical) affair, as well as the changing times. Sigmund Freud’s *Three Essays on the Theory of Sexuality* (greatly influenced by Haeckel’s thinking on recapitulation) was published in the same year this picture appeared.

review, Ludwig Rüttimeyer (1825–1895), an embryologist at Basel, charged Haeckel with fraud. He observed that in illustrating the principle of recapitulation—or the biogenetic law, as it became known—Haeckel had represented very young embryos of a dog, chicken, and turtle as morphologically identical. Rüttimeyer maintained, however, that Haeckel had made the case by using the same woodcut three times. In the next edition of the book (1870), Haeckel used only one illustration of a vertebrate embryo at a very early stage and said it might as well be the embryo of a dog, chicken, or turtle because you cannot tell the difference. The damage, however, was done, and the charge of fraud would haunt Haeckel for the rest of his days.

Despite the controversy, *Natürliche Schöpfungsgeschichte* made a powerful impact on its readers, especially on the topic of human evolution. He represented nine species of human beings along a tree of evolutionary development, with the Papuans and Hottentots at the lowest branches, closer to roots in the *Urmensch*, or ape-man, and with the Caucasian branch at the highest level, carrying at the top reaches the Mediterraneans, Germans, Jews, and Arabs. Although Haeckel shared many of the racial views common to nineteenth-century Europeans, he was decidedly not anti-Semitic, an attitude which one of his disaffected students held against him. He argued, following his friend, the linguist August Schleicher (1821–1868), that grades of human mental ability expressed grades of language complexity and that the European and Semitic languages helped create a correspondingly complex mind—a general thesis that Darwin adopted in *The Descent of Man*.

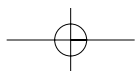
In 1867, after visiting Darwin and other British scientists in England, Haeckel traveled to the Canary Islands with ~~two research associates, Wilhelm Roux and Hans Driesch~~. He performed the kinds of experiments on developing siphonophore embryos that would garner fame for Roux and Driesch some 20 years later. He also began work on a systematic analysis of calcareous sponges that would yield a three-volume study, *Die Kalkschwämme* (The calcareous sponges, 1872). In this work, Haeckel attempted to provide what Bronn maintained was necessary to show the viability of Darwin's theory, namely, empirical proof that species descent was more than a theoretical possibility. Haeckel also argued, employing the biogenetic law, that in ancient times an organism, having the structure of a primitive sponge (and the form taken by metazoans in gastrulation), plied the ancient seas. This became his gastraea theory.

Because of his various investigations of marine invertebrates, Haeckel received the commission in the late 1870s to describe systematically several classes of organisms dredged up by HMS *Challenger*. Over a 10-year period, he composed several large volumes on medusae, calcareous sponges, siphonophores, and radiolaria—with more pages produced than by any other author in the series of *Challenger* reports. The commission indicated the high regard of the scientific community for his work in marine biology. That regard was also expressed by the many honorary degrees and awards he received during his lifetime.

Resentment by the biologically and religiously orthodox continued to build against Haeckel throughout the 1870s, and it has not abated in to this day. In 1874, the Swiss embryologist Wilhelm His (1831–1904) published *Unsere Körperform und das physiologische Problem ihrer Entstehung* (Our bodily form and the physiological problem of its origin), which repeated the earlier charges of fraud against Haeckel and instituted new ones. Among other claims, His asserted that Haeckel had represented the human embryo with an exaggeratedly long tail—a controversy that became known as the *Schwanzfrage*. In 1877, Rudolf Virchow (1821–1902) rejected his onetime student's efforts to have evolutionary theory taught in the lower schools in Germany. Virchow charged that evolutionary thought abetted socialists and communists, a claim that Huxley thought quite scurrilous because of its inflammatory character in Bismarck's Germany—although, in fact, many Marxists (e.g., August Bebel, 1840–1913) did find Darwinism congenial. At the turn of the century, religious opponents of Haeckel's *Welträthsel* and of his newly established Monist League renewed the claims of falsehood. These many charges had their foundation in Haeckel's acknowledged slip in 1868, but thereafter they gained force mostly from intellectual recalcitrance and religious dogmatism. More recently, Daniel Gasman (1971) and Stephen Jay Gould (1977) argued that Haeckel's biology supported Nazi racism, although they conveniently ignored Haeckel's philo-Semitism, an attitude quite unusual for the period. Michael Richardson reexamined Haeckel's illustrations of embryos, and he too suggested Haeckel's malfeasance. Richardson compared Haeckel's illustrations with photographs of embryos, and easily showed the deviations. However, Haeckel had adapted illustrations from then-contemporary sources. He showed that when you lined up depictions rendered by experts, the similarity of evolutionarily related types at earlier stages of embryogenesis became manifest—a phenomenon acknowledged by today's embryologists. Creationists and Intelligent Design theorists have cited the older German literature and Richardson's photographs to indict not only Haeckel but all of evolutionary theory.

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—R.J.R.