

**The Struggle over Evolution and Religion in the Nineteenth Century,
with Ernst Haeckel as the Anti-Pope**

Robert J. Richards¹

If religion means a commitment to a set of theological propositions regarding the nature of God, the soul, and an afterlife, Ernst Haeckel (1834-1919) was never a religious enthusiast. The influence of the great religious thinker Friedrich Daniel Schleiermacher (1768-1834) on his family kept religious observance decorous and commitment vague.² The theologian had maintained that true religion lay deep in the heart, where the inner person experienced a feeling of absolute dependence. Dogmatic tenets, he argued, served merely as inadequate symbols of this fundamental experience. Religious feeling, according to Schleiermacher's *Über die Religion* (On religion, 1799), might best be cultivated by seeking after truth, experiencing beauty, and contemplating nature.³ Haeckel practiced this kind of Schleiermachian religion all of his life.

Haeckel's association with the Evangelical Church, even as a youth, had been conventional. The death of his first wife severed the loose threads still holding him to formal observance. The power of that death, his obsession with a life that might have been, and the dark feeling of love forever lost drove him to find a more enduring and

¹This article is based on my forthcoming book, *The Tragic Sense of Life: Ernst Haeckel and the Struggle over Evolutionary Thought in Germany*.

²Wilhelm Bölsche, who interviewed Haeckel's aunt Bertha Seth (sister of his mother), describes the impact of the Schleiermachian view on the family in his *Ernst Haeckel: Ein Lebensbild* (Berlin: Georg Bondi, 1909), pp. 10-11.

³I have discussed Schleiermacher's religious ideas in *The Romantic Conception of Life: Science and Philosophy in the Age of Goethe* (Chicago: University of Chicago Press, 2002), pp. 94-105.

rational substitute for orthodox religion in Goethean nature and Darwinian evolution. The passions that had bound him to one individual and her lingering shadow became transformed into acid recriminations against any individual or institution promoting what he saw, through Darwinian eyes, as cynical superstition.⁴ The antagonism between conservative religion and evolutionary theory, brought to incandescence at the turn of the century, and burning still brightly in our own time, can be attributed, in large part, to Haeckel's fierce broadsides launched against orthodoxy in his popular books and lectures. These attacks and reactions to them were brought to a new level of intensity during the period from 1880 to his death in 1919.

“Science Has Nothing to Do with Christ”—Darwin

On April 21, 1882, Haeckel finally reached his home in Jena after a six-month research trip to India and Ceylon, where his sensitivity to religious superstition had been brought to a higher pitch. Upon his return, he immediately learned that his friend and mentor, Charles Darwin (1809-1882), had died three days before, on April 19. Later, that October, Haeckel traveled to Eisenach, a morning's train ride away, to attend the fifty-fifth annual meeting of the Society of German Natural Scientists and Physicians, during which he would celebrate his friend's great contributions to science. The plenary lecture that Haeckel gave sang a hymn to Darwin's genius and to the extraordinary impact of his theory on all realms of human thought, emancipating that thought for a

⁴I have discussed the impact of the death of Haeckel's first wife on his science and on his rejection of orthodox religion in “The Aesthetic and Morphological Foundations of Ernst Haeckel's Evolutionary Project,” in Mary Kemperink and Patrick Dassen (eds.), *The Many Faces of Evolution in Europe, 1860-1914* (Amsterdam: Peeters, 2005).



Figure 1: Haeckel in Ceylon, 1881-1882

rational approach to life.⁵ Haeckel argued that the Englishman followed upon the path first hacked through the jungle of religiously overgrown biology by the likes of Lessing, Herder, Goethe, and Kant. Indeed, Darwin had solved the great problem posed by Kant, namely “how a purposively directed form of organization can arise without the aid of a purposively effective cause.”⁶ In his encomium, Haeckel, like the devil, could appeal even to scripture—or at least to one who

translated scripture in the very city of Eisenach: just as Martin Luther, who “with a mighty hand tore

asunder the web of lies by the world-dominating Papacy, so in our day, Charles Darwin, with comparable over-powering might, has destroyed the ruling, error-doctrines of the mystical creation dogma and through his reform of developmental theory has elevated the whole sensibility, thought, and will of mankind onto a higher plane.”⁷

Haeckel certainly advanced no new ideas in his lecture—something his close friend Hermann Allmers (1821-1902) observed after reading the text⁸—but he did

⁵Ernst Haeckel, “Ueber die Naturanschauung von Darwin, Göthe und Lamarck,” *Tageblatt der 55. Versammlung Deutscher Naturforscher und Aerzte in Eisenach, von 18. bis 22. September 1882* (Eisenach: Hofbuchdruckerei von H. Kahle, 1882), pp. 81-91.

⁶*Ibid.*, p. 82.

⁷*Ibid.*, p. 81.

⁸Hermann Allmers to Ernst Haeckel (January, 1883), in *Haeckel und Allmers: Die Geschichte einer Freundschaft in Briefen der Freunde*, pp. 149-50.

eloquently reinforce four points: that Darwin fulfilled the promise of higher German thought—especially that of Goethe; that the evolutionary theories of Goethe, Lamarck, and Darwin were as vital to modern culture and as substantial as the locomotive and the steamship, the telegraph and the photograph—and the thousand indispensable discoveries of physics and chemistry; that Darwinism yielded an ethics and social philosophy which balanced altruism against egoism; and, in summary, that Darwinian theory and its spread represented the triumph of reason over the benighted minions of the anti-progressive and the superstitious, particularly as shrouded in the black robes of the Catholic Church. In Haeckel’s analysis, then, Darwinism was thoroughly modern, liberal, and decidedly opposed to religious dogmatism. To drive his message home, Haeckel read to the audience a letter Darwin had sent to a student of Haeckel, a young Russian nobleman who had confessed to the renowned scientist his bothersome doubts about evolutionary theory in relation to revelation. The letter read:

Dear Sir:

I am much engaged, an old man, and out of health, and I cannot spare time to answer your questions fully,—nor indeed can they be answered. Science has nothing to do with Christ, except in so far as the habit of scientific research makes a man cautious in admitting evidence. For myself, I do not believe that there ever has been any revelation. As for a future life, every man must judge for himself between conflicting vague probabilities.

Wishing you happiness, I remain, dear Sir, Yours Faithfully,

Charles Darwin⁹

⁹Haeckel, “Ueber die Naturanschauung von Darwin, Göthe und Lamarck,” p. 89. Haeckel translated

What Darwinism offered instead of traditional orthodoxy, Haeckel contended, was Goethe's religion: a "monistic religion of humanity grounded in pantheism."¹⁰ This declaration of rationalistic faith would hardly be the recipe to satisfy those who yet hungered after the old-time convictions.

For the assembled at Eisenach—and for those many others that read the published text of Haeckel's lecture—the recitation of Darwin's letter functioned as a kind of anti-Bridgewater treatise; it drove a wedge into the soft wood of compatibility between science and traditional religion, utterly splitting the two. The lecture revealed that an aggressive, preacher-baiting German was not the only evolutionary enemy of faith but that the very founder of the theory had also utterly rejected the ancient beliefs. Several English authorities complained that Haeckel had committed a great indiscretion in communicating Darwin's private letter even before the earth had settled around his grave.¹¹ But indiscrete or not, the message could hardly be planner: Darwinian theory was decidedly opposed to that old-time religion. And as Haeckel discovered during the next three decades (and as we are still quite aware), that old-time religious was decidedly opposed to modern Darwinian theory.

the letter into German. A copy of the original, which I have used here, is held in the Manuscript Room of Cambridge University Library. The letter was from Nicolai Alexandrovitch Mengden.

¹⁰Haeckel, "Ueber die Naturanschauung von Darwin, Göthe und Lamarck," p. 89.

¹¹Haeckel mentioned to Allmers the unfavorable response coming from England at the publication of Darwin's letter. See Ernst Haeckel to Hermann Allmers (26 December 1882), in *Ernst Haeckel: Sein Leben, Denken und Wirken*, ed. Victor Franz, 2 vols. (Jena: Wilhelm Gronau, 1943-1944), 2: 81. Edward Aveling, consort of Karl Marx's daughter and translator of *Das Kapital* into English, wrote Haeckel to describe the cowardly reaction of the British press to Haeckel's exposition of the letter. See Edward B. Aveling to Ernst Haeckel (6 October 1882), in Ernst Haeckel, *Die Naturanschauung von Darwin, Goethe und Lamarck* (Jena: Gustav Fischer), pp. 62-64.

Monistic Religion

Haeckel had, over the course of a quarter of a century, expressed his own religious views both negatively and positively. The negative critique attacked orthodox religion, dismissing its belief in an anthropomorphic Deity and deriding its view of an immaterial human soul. Haeckel was an equal opportunity basher of all orthodox doctrines—that of Christianity, Judaism, Muslimism, and the faiths of the East. Yet he still thought of himself as a religious person; though his was the religion of Spinoza and Goethe. He took opportunity to synthesize his negative and positive critiques when invited to Altenburg (thirty miles south of Leipzig) to help celebrate the seventy-fifth anniversary of the *Naturforschende Gesellschaft des Osterlandes* (The Natural Research Society of the Eastern Region). At the meeting on October 9, 1892, Haeckel was preceded by a speaker who said something rather irritating about the relationship of science and religion. Haeckel tossed aside his prepared text and gave a lecture extemporaneously, which he wrote down the next day from memory, augmenting where necessary. The lecture was published in the popular press and as a small monograph, *Der Monismus als Band zwischen Religion und Wissenschaft* (Monism as the bond between religion and science)—a book that would reach a seventeenth edition just after Haeckel's death. It became the foundation for the even more successful *Die Welträthsel* (The world puzzle), which would be published in 1899.

In his small tract, Haeckel argued for a unity of the world, in which homogeneous atoms of matter expressed various properties through the fundamental powers of attraction and repulsion. These atoms propagated their effects through vibrations set up in an ocean of ether. From the inorganic, through the simplest organisms, right up to

man, no unbridgeable barriers arose; rather a continuous, law-governed unity ran through the whole. Even what might be called man's soul—his central nervous system—appeared over the course of ages by slow increments out of antecedents in the lower animals. Though Haeckel's enemies thought this cosmology to be the sheerest materialism, he yet maintained his was a strict monism: all matter had its mental side, just as all examples of mind displayed a material face. This meant that the elements of perception and thought could be traced right down to the simplest organisms—every one-celled protist could thus boast of a "soul"—after a manner of speaking. This sort of conception gave the comparative psychologist, according to Haeckel, permission to discover the antecedents of human cognitive ability in animal life. The great unity pervading the universe, a universe governed by ineluctable law, could be understood materially as nature in her organized diversity and spiritually as God; or as Spinoza expressed it: *deus sive natura*.

While Haeckel wished to whisk away all anthropomorphisms from religion, he thought something was yet worth preserving from the old dispensation. This was the ethical core of traditional orthodoxy, especially of Christianity:

Doubtless, human culture today owes the greater part of its perfection to the spread and ennobling [effect] of Christian ethics, despite its higher worth often in a regrettable way being injured by its connection with untenable myths and so-called "revelation."¹²

¹²Ernst Haeckel, *Der Monismus als Band zwischen Religion und Wissenschaft, Glaubensbekenntnis eines Naturforschers* (Bonn: Emil Strauss, 1892), p. 29.

Haeckel's tract had an immediate and, for the author, a surprising outcome: he was sued. This occurred because of a note that he appended to his discussion of anti-Darwinian scientists. He mentioned, as he had often before, Louis Agassiz (1807-1873) and Rudolf Virchow (1821-1902) as objectors to descent theory. He added that more recently, his former student and assistant Otto Hamann (1857-1928) had taken a reactionary turn in his book *Entwicklungslehre und Darwinismus* (Evolutionary theory and Darwinism, 1892). Hamann went from being an enthusiastic supporter of Darwinian evolutionary theory during his years with Haeckel to rejecting it for a more distinctively teleological and ultimately religious conception in his new publication.

In his book, Hamann variously argued: that the paleontological evidence indicated gaps in the fossil record;¹³ that von Baer had shown long ago that embryos were of consistent type, not passing from one type to another;¹⁴ and that the gap between the mental abilities of men and animals was absolute.¹⁵ He maintained, in opposition to "Darwinian dogmatism," that one had to explain the goal-striving character [*Zielstrebigkeit*] of life as based on "inner causes" that produced macro-mutations responsive to altered environments. The great harmony in the natural system of coordinated adaptations discovered by the naturalist was "the same as that unity and harmony which men prior to all scientific research feel and have sensed—a unity and limitlessness that goes by the name of God."¹⁶

¹³Otto Hamann, *Entwicklungslehre und Darwinismus. Eine kritische Darstellung der modernen Entwicklungslehre* (Jena: Hermann Constenoble, 1892), pp. 7-20.

¹⁴Ibid., pp. 21-26.

¹⁵Ibid. p. 120.

¹⁶Ibid., p. 288.

Haeckel felt the sting of this apostasy. The argument of Hamann's volume, he remonstrated, was the very opposite of science; rather it was "from the beginning to the end a great lie."¹⁷ Haeckel attributed the reversal in his one-time student's attitude not to the discovery of new truths about the failure of Darwinism but to his own failure to receive an academic appointment. Hamann had implored his former teacher to recommend him for a vacant chair in zoology at Jena. Haeckel did put him on a list of candidates submitted to the faculty senate, but did not place his former student among the top contenders. Hence, as Haeckel charged in his *Monismus*, Hamann took his revenge by going over to the dark side. Yet, all that would be needed to bring him running back, Haeckel supposed, would be "the jingle of coins."¹⁸

Hamann sued Haeckel because of this characterization, contending loss of income and slander. He requested the court grant him a total of 7500 marks, 6000 for reduced income and 1500 as punishment for the libel. Haeckel countersued, and the case was heard in the Schöffengericht (a lower court) in Jena. During the process, it came out that Hamann had misrepresented himself as a professor at Göttingen, whereas he was only a Privatdozent there, though professor in the Royal Library in Berlin. Haeckel put in evidence a series of obsequious letters from Hamann, in which the supplicant referred to his former teacher as a god whom he revered. The court concluded that Haeckel did slightly slander Hamann and fined him 200 marks; the judge also levied a fine of 30 marks against Hamann. Both were enjoined not to speak of the conflict again, and Haeckel complied by expunging his remarks from subsequent

¹⁷Haeckel, *Der Monismus als Band zwischen Religion und Wissenschaft*, pp. 42-43.

¹⁸*Ibid.*, p. 43.

editions of his *Monismus*. Most on-lookers thought that Haeckel had won the moral victory, or so an anonymous account of the case reported.¹⁹ This trial is probably the source of the rumor, one still bubbling around in the heads of many creationists, that Haeckel had been brought before a “university court” by five of his colleagues where he was judged guilty of having committed scientific fraud. Though Jena had a student *Kerker*, a jail, a university court is an unknown entity and any talk of one could come only from brains on the boil.²⁰

Erich Wasmann, a Jesuit Evolutionist

The Challenge of the Catholic Church

Ever since his medical school days in Bavaria, Haeckel had been both attracted and repelled by the Catholic Church, especially by its black-robed combat troops, the Jesuits. While in Rome, unlike Goethe who rather enjoyed the pomp of Papal celebrations, Haeckel felt his north-German sensibilities continually assaulted. Protestant liberals like Haeckel, on due reflection, came to perceived the wars against Austria and France not only as political-social conflicts but also as struggles against an alien religious force. Intellectual and cultural threats from the Church were codified for liberals in the series of condemnations listed in Pope Pius IX’s *Syllabus Errorum* (1864), his brief of particulars brought against the modern world. Condemned were such heretical tenets as pantheistic naturalism, the autonomy and sufficiency of reason to

¹⁹Anonymous, *Der Ausgang des Prozesses Haeckel-Hamann* (Magdeburg: Listner & Drews, 1893).

²⁰This mythical story can be found on a large number of creationist websites. The words “Haeckel” and “university court” in any search engine will dump the sites on to a waiting computer.

discover the truth, freedom of individuals to embrace any religion, civil control of education, and unbridled speech. The declaration by the Vatican Council (1870) of papal infallibility only heightened the cultural clash between the Vatican and liberal movements all over Europe—including those within the Catholic Church itself. Otto von Bismarck (1815-1898), the Chancellor of the German Empire, recognized that the negative reaction of liberals made it opportune to curb the growing power of the Catholic Center Party. He promoted what Virchow called a *Kulturkampf*—a cultural battle—but one fought with the force not of persuasion but of legislation. At Bismarck's instigation, the Reichstag passed a series of laws, the so-called May Laws of 1872-1875, that restricted the civil activities of the Catholic clergy, especially in performing state-recognized marriages and in education. In 1872, the Jesuits, the perceived sinister agents of Pius IX, were expelled from Germany; and the next year all religious orders, except those directly concerned with care of the sick, had to disband. The suppression of the Catholic Church in Germany by the liberal-dominated Reichstag ran against the principles of those same liberals, who often acted out of religious intolerance and prejudice, and, as Gordon Craig has suggested, not a little out of the economic advantages accruing to those of a more materialistic taste.²¹ Even among individuals differing on many other issues—Haeckel and Virchow, for instance—the exclusion of the Jesuits and the restrictions on the Catholic clergy found favor. By the end of the 1870s, however, the political situation began to flex as Bismarck's worries turned from Catholics to the growing socialist movements. In 1878, a new Pope, Leo XIII, ascended to the chair of Peter. Leo sought accommodation with the German government; and with a

²¹Gordon Graig, *Germany, 1866-1945* (Oxford: Oxford University Press, 1980), 78-79.

lessening of tensions, the legal and extra-legal opposition to the Catholic Church began to ease. The old *Kulturkampf* abated, but a new one, more personal, was turned against its original author as the young emperor William II (1888-1918) strove to take a greater hand in the social and foreign affairs of his government. Quickly relations with his aged Chancellor deteriorated, until the exit became clearly marked and the door opened. Bismarck departed in 1890. Thereafter the Social Democrats and the Center Party continued to gain seats in the Reichstag, as a more accommodating head of state took command.²²

The new political dispensation drove Haeckel further into a conservative and anti-religious mode. In a move that angered many of his colleagues at Jena, he and several other professors, students, and town's people met Bismarck and invited him to visit Jena to be honored for his creation of and service to the Empire. With this as something of a *fait accompli*, Haeckel then informed Archduke Carl Alexander of Saxe-Weimar-Eisenach (1818-1901), officially rector of the university, of the personal invitation. The archduke made the invitation official and Bismarck accepted it. At the end of July, 1892, the old Chancellor addressed a cheering throng of students and townspeople gathered in the market place. Since he had already received honors from various law and medical faculties throughout the Empire, his benefactor devised a new degree to be conferred on the Chancellor—the degree of doctor of phylogeny, *honoris causa*! The degree, of course, suggested more about the turn of the new government—with rumors spreading that the king might convert to Catholicism—than about any contributions

²²See James Scheehan, *German Liberalism in the Nineteenth Century* (Chicago: University of Chicago Press, 1978), p. 223.

Bismarck might have made to this special branch of biology.²³ Through the next decade, the political and social situation, from the old liberal point of view, continued to deteriorate. In 1903, the newly elected pope, taking the ominous name of Pius X, cast a lengthening shadow up from the south. The threat of Catholic revanchism brought an invitation from friends in Berlin for Haeckel to sally forth out of retirement and to take up arms against the newly resurgent Church. The invitation,

especially mentioned that the continually growing reaction in the leading circles, the over weaning confidence of an intolerant orthodoxy, the shift in balance toward ultramontane Papism, and the consequent threat to German spiritual freedom in our universities and schools—that all of this made an energetic defense a pressing necessity.²⁴

Haeckel accepted the invitation and, in 1905, gave three lectures in the great hall of the Sing Akademie in Berlin to over two thousand enthusiastic auditors on each of the succeeding days. He rehearsed, in a minor key, the indictment against old enemies, especially those who either rejected or hesitated to endorse evolutionary theory, but orchestrated a thundering denunciation of a new and quite unexpected foe. This was a group most conspicuously represented by an entomologist, a man who was chiefly responsible for bringing the old bear out of his cave.²⁵ This individual argued strongly

²³See the brief account of Haeckel's involvement in the invitation to Bismarck by Else von Volkmann, granddaughter of Haeckel, in her "Ernst Haeckel veranlasste die Einladung Bismarck's," in *Ernst Haeckel, Sein Leben, Denken und Wirken*, 1: 82-86; see also Haeckel's account of the invitation, in *ibid.*, 2: 119-22.

²⁴Ernst Haeckel, *Der Kampf um den Entwicklungs-Gedanken: Drei Vorträge, gehalten am 14, 16, und 19 April 1905 im Salle der Sing-Akademie an Berlin* (Berlin: Georg Reimer, 1905), p. 7.

²⁵Haeckel mentioned to his biographer, Wilhelm Bölsche, that it was Wasmann who provoked what he thought would be his last public lectures. See Ernst Haeckel to Wilhelm Bölsche (3 April 1905), in *Ernst Haeckel-Wilhelm Bölsche, Briefwechsel 1887-1919* (Ernst-Haeckel-Haus-Studien, vol. 6/1), ed. Rosemarie

for evolutionary theory, grounding his defense in extremely compelling empirical evidence; and he had just written a scientifically exemplary study, *Die moderne Biologie und die Entwicklungstheorie* (Modern biology and evolutionary theory, 1904). But the scientist was also a Jesuit priest, Father Erich Wasmann (1859-1931). For the Jesuits to endorse evolution meant that subtle chicanery had to be afoot. Haeckel declared Wasmann's book "a masterpiece of Jesuitical confusion and sophistry."²⁶ Wasmann bears some extended consideration not only because of the vehemence of Haeckel's reaction but also because of this Jesuit's scientific acumen, which has preserved his name in the reference lists of modern entomological studies, and especially because he provides a telling case of an individual whose scientific observations trumped his initial dogmatic convictions.²⁷

The Guests of Ants—Evidence for Evolution

Since his days in the Jesuit seminary in the Netherlands, Wasmann had been an enthusiastic collector of bugs (not unlike the Cambridge student Charles Darwin). Because of a recurring lung infection, the young seminarian could not go to the missions

Nöthlich (Berlin: Verlag für Wissenschaft und Bildung, 2002), p. 173.

²⁶Haeckel, *Kampf um den Entwicklungs-Gedanken*, p. 32.

²⁷Of the hundreds of authors cited by Edward O. Wilson in his *Insect Societies* (Cambridge: Harvard University Press, 1971), Wasmann has about the eighth largest number of citations, some fourteen (p. 521). Abigail Lustig has written an illuminating essay on Wasmann and colleagues. See her "Ants and the Nature of Nature in Auguste Forel, Erich Wasmann, and William Morton Wheeler," in *The Moral Authority of Nature*, eds. Lorraine Daston and Fernando Vidal (Chicago: University of Chicago Press, 2004): 282-307. Lustig also has published a comparison of the intellectual styles of Haeckel and Wasmann. See her "Erich Wasmann, Ernst Haeckel and the Limits of Science," *Theory in Biosciences* 121 (2002): 252-59.

or teach in a Jesuit school after finishing the philosophy curriculum. Instead he was allowed to engage in private theological study and to continue exercising an obvious talent for entomological research. His interest in this latter quickly turned to ants and a class of beetles that lives symbiotically in ant nests, the so-called “myrmecophile” or “guest of ants.” In the short period from 1884 to 1890, Wasmann had over sixty publications on ants, termites, and their guests. His meticulous study of slave-making behavior in ants of the new and old worlds culminated in a work that secured his reputation as a leading authority in entomology: *Die zusammengesetzten Nester und gemischten Kolonien der Ameisen* (The commonly established nests and mixed colonies of ants, 1891). He concluded that work with a consideration of its bearing on evolutionary theory. He argued that slave-making ants in the Americas and Europe, which displayed common instincts, had either to have been created originally with these behavioral traits or to have evolved in the two, widely separated locations in a strictly parallel fashion, which on Darwinian grounds seemed quite improbable. One had to acknowledge, therefore, that a higher intelligence had established internal laws of development and instilled their causal processes in the hereditary structure of these organisms.²⁸ Wasmann’s anti-evolutionary convictions, however, became muted after deeper study of those odd beetles that came to live in ant nests. Indeed, through empirical evidence supplied by the guests of ants, he dramatically altered his original attitude toward evolution.

²⁸Erich Wasmann, *Die zusammengesetzten Nester und gemischten Kolonien der Ameisen* (Münster i.W.: Aschendorff’schen Buchdruckerei, 1891), pp. 252-53.

In a series of articles first appearing in *Biologisches Zentralblatt* and in *Stimmen aus Maria-Laach*,²⁹ and then summarized in *Moderne Biologie und die Entwicklungstheorie*, Wasmann presented extensive and quite detailed empirical evidence for evolutionary transitions in the myrmecophile.³⁰ He distinguished three kinds of inquiline, or ant-guests, according to their morphology and behavior: the aggressive type (*Trutztypus*), the symphilic type, and the mimetic type. Aggressive, tank-like beetles could be found in the genus *Dinarda*. These species displayed heavily armored, compact individuals that were impervious to ant attacks. Wasmann examined four species that were distributed over north central Europe and showed that they varied in color and size depending on the color and size of the species of ants with which they lived. The similarity of color made the beetles less conspicuous in the nests; and appropriate size made them less vulnerable to attacks on their appendages. Wasmann asserted that “we have here, therefore, a case in which we can explain effortlessly and completely satisfactorily, by the simplest natural causes, the differentiation of similar species of the same genus from a common progenitor.”³¹ He further argued that the genus *Chitosa*, which inhabited southern Europe, had to be related to *Dinarda* through a common ancestor. Thus, he concluded, evolutionary adaptations had been acquired in

²⁹See Erich Wasmann, “Gibt es tatsächlich Arten, die heute noch in der Stammesentwicklung begriffen sind?” *Biologisches Zentralblatt*, 21 (1901): 685-711, 737-52; “Konstanztheorie oder Deszendenztheorie?” *Stimmen aus Maria-Laach* 56 (1903): 29-44, 149-63, 544-63.

³⁰Erich Wasmann, *Die moderne Biologie und die Entwicklungstheorie*, 2nd ed. (Freiburg im Breisgau: Herdersche Verlagshandlung, 1904), pp. 210-45. The third edition (1906) was also published in English translation: Erich Wasmann, *Modern Biology and the Theory of Evolution*, trans. A. M. Buchanan (St. Louis, Mo.: B. Herder, 1914).

³¹Erich Wasmann, “Gibt es tatsächlich Arten, die heute noch in der Stammesentwicklung begriffen sind?” *Biologisches Zentralblatt*, 21 (1901): 685-711, 737-52; citation on pp. 694-95.

the descent of species. Moreover, inquilines found in termite nests in India suggested that beetle species in the genus *Doryloxenus*, typical of the myrmecophile dwelling with African wandering ants (*Dorylus*), had come to live with termites, quite different insects; moreover, one could trace alterations in the species of this genus as they evolved more effective adaptations for protecting themselves against termite attacks.

Wasmann drew further evidence of evolutionary transformation in the symphilic group of myrmecophile, those that secreted a sweet exudate and were fed by the ants in return. He showed that species of the *Lomechusini* varied in features dependent on the species of ant with which they lived. The most startling evidence he produced, however, was within the mimetic group. These were beetles that had evolved to look like ants. Wasmann showed that myrmecophile of quite different genera that yet inhabited nests of the same species of ant had converged in their morphologies (see fig. 2). On the basis of such evidence, Wasmann affirmed that “we ought calmly accept the evolutionary doctrine insofar as it is scientifically founded on a definite class of structures with a sufficient degree of probability.”³²

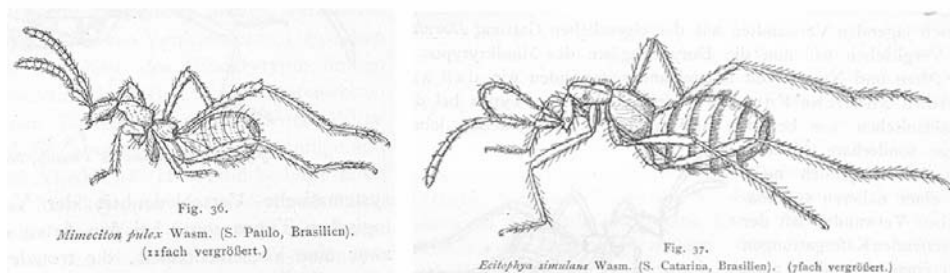


Figure 2: Two species of mimetic myrmecophile, beetles that have evolved to look like ants; from Wasmann’s *Moderne Biologie und die Entwicklungstheorie*.

While Wasmann thought his inquilines—and also various ant species—offered compelling

empirical evidence for descent with modification, he would still not yield to Darwinian

³²Wasmann, *Moderne Biologie und die Entwicklungstheorie*, p. 219.

theory. He argued that several considerations precluded natural selection as the primary agent of change. First, selection could only eliminate possibilities once they arose, not create them initially—a common enough objection (and a common enough misunderstanding of Darwin’s device). Second, he argued that most variations were neutral, so that selection would have no purchase on them. Third, though species of the *Lomechusini* evolve because the ants, as it were, selected those with the sweetest liquor—what Wasmann called “amical selection”—the beetles yet ate ant pupa and thus were positively harmful to the ant community, something natural selection should have prevented.³³ Finally, a gradual change, as Darwin would have it, in these inquiline species ought to take hundreds of thousands of years, exhausting, as Wasmann estimated, the geological time available.³⁴ Instead of Darwinian evolution, Wasmann proposed a theory of evolution that seems to have been a hybrid of ideas drawn from Hugo De Vries (1848-1935) and Hans Driesch (1867-1941). Like De Vries, he argued that alterations in species would come as macro mutations; and like Driesch, he held that *Anlagen*—dispositions—in the hereditary structure of organisms would respond to external causal relationships in a teleologically directed way.

Wasmann maintained that the marshaled evidence suggested that certain natural *Urspecies*, coming from the hand of the Creator, formed the base of the stem-trees

³³While E. O. Wilson cites Wasmann’s work throughout his *Insect Societies*, he obviously did not penetrate Wasmann’s German very deeply. Wilson believes that Wasmann did not recognize that symphilic beetles often preyed on ant pupa (p. 390), something that Wasmann, in fact, emphasized as part of his argument against natural selection.

³⁴We now know that beetles were diversely proliferating during the Permian, 300 million years ago; and fossil ants of more than 90 million years old have recently been discovered. It is reasonable to suppose the symbiosis between the two has existed for many millions of years. See Grimaldi, D.A., Agosti, D., and Carpenter, J.M., “New and Rediscovered Primitive Ants (Hymenoptera: Formicidae) in Cretaceous Amber from New Jersey, and their Phylogenetic Relationships.” *American Museum Novitates*, no. 3208 (1997): 1-43.

whose branches held the derived species of plants and animals. Since we had no evidence of spontaneous generation, we had to assume a divine act as the source of the several types of life. Wasmann regarded it an open question as to the number of original types—perhaps only a few, perhaps more. But one type, he vigorously insisted, was unique, namely the human.



Figure 3: Erich Wasmann, S.J., about 1900.

allowed that man's body might have been prepared by an evolutionary process prior to the reception of the soul, the leading contenders for this kind of pre-adaptation—Neanderthal man and Dubois's Java man—were, he thought, both unlikely candidates as proto-humans. Neanderthals, as Virchow suggested, were quite within the range of human variation—so they were real human beings; and Dubois's discovery appeared to be only that of a giant ape unrelated to the human stock.

Wasmann rejected the possibility that human beings might have arisen out of the stock of lower animals.³⁵ Human intellect simply bore no relationship to what passed as animal intellect—an argument that Wasmann retained from his earliest considerations of the question. He continued to reject Haeckel's monistic metaphysics as the proper foundation for understanding human beings or animals. While he

³⁵Wasmann, *Moderne Biologie und die Entwicklungstheorie*, pp. 273-304.

The Confrontation between Wasmann and the Monists

In his Berlin lectures, Haeckel took delight in referring to Wasmann as the “Darwinian Jesuit,” an ironically intended designation that yet begrudgingly suggested some respect for this Jesuit’s accomplishments in entomology.³⁶ But he simply derided Wasmann’s rejection of a thorough-going evolutionism in the case of human beings: “If Wasmann assumes this introduction of the soul for the development of the type, then he must postulate in the phylogeny of the anthropoid apes an historical moment in which God descends and injects his spirit into this hitherto spiritually bereft ape soul.”³⁷ Haeckel thought the whole assumption absurd, but not innocent of political consequence. He suspected that the conservative Prussian government would seek a union of “crown and altar” not for reasons of religious conviction but for reasons of practical advantage. He was convinced that this would be no even match; under the banner of reconciliation, the crown would become “the footstool of the altar,” as the Church bent the state to its own purposes.³⁸

When Wasmann read of Haeckel’s attack in the several newspapers that described the lectures, he penned a long open letter to his nemesis, which appeared on page one of the morning edition of the *Kölnische Volkszeitung* (2 May 1905).³⁹ He complained that Haeckel too easily identified evolutionary theory with monism, and thus misleadingly suggested that the Jesuits and the Church had come over to the Darwinian

³⁶Haeckel, *Der Kampf um den Entwicklungs-Gedanken*, p. 75.

³⁷*Ibid.*, p. 83.

³⁸*Ibid.*, p. 84.

³⁹Erich Wasmann, “Offener Brief an Hrn. Professor Haeckel (Jena),” *Kölnische Volkszeitung* 46, no. 358 (2 May 1905): 1-2.

side. Wasmann rejected Haeckel's assumption of only one meaning for evolution, and he protested that his own theistic version had no official sanction from the Church or the Jesuits. About this second point, Wasmann would eventually be proved mistaken: his view of evolution came to be widely accepted by the Catholic Church as a way of accommodating this latest scientific, though dangerous, advance. Under Wasmann's orchestration, the Vatican could at last admit the world actually moved.

The drama of the evolution-religion conflict and a sense of its high-culture entertainment value brought Wasmann, amidst a flurry of newspaper interpretations of the debate, an invitation in 1906 to reply to Haeckel at the Sing Akademie. He declined the offer, but a short time later did accept a comparable invitation issued by a group of prominent scientists in Berlin. Initially he was to have addressed a meeting of the entomological society, but Ludwig Plate (1862-1937), a member of the inviting committee and an associate of Haeckel, insisted that the meeting be open to the public.⁴⁰ Wasmann agreed and he further allowed that after his three public lectures, his opponents could present their objections and he would respond. Initially some twenty-five critics requested time, but Wasmann left it up to the committee to pare down the list to something manageable.

On February 13, 14, and 17, 1907, Wasmann lectured in the Sing Akademie each day to over one thousand people, who paid one mark for each occasion (two for reserved seating). He took as his subjects: the general theory of evolution and its support drawn from entomology; varieties of evolutionary theory—theistic and monistic

⁴⁰Wasmann had already crossed pens with Plate in the pages of the *Biologisches Zentralblatt* (1901), where he defended evolutionary descent in the guests of ants but not on the monist's terms. See Wasmann, "Gibt es tatsächlich Arten, die heute noch in der Stammesentwicklung begriffen sind?"

(atheistic); and the problem of human evolution.⁴¹ At 8:30 on the evening of February 18, with the audience swelling to some two thousand men and women, eleven opponents confronted Wasmann in the auditorium of the Zoological Gardens. His objectors were allotted varying amounts of time, with Plate, the principal organizer, receiving the longest period at half of an hour. Wasmann was granted thirty minutes to answer his eleven critics. He mounted the podium at 11:30 p.m., with the full complement of the audience still in their seats. He focused his response on Plate's objections, and brought in others as time permitted. He asserted that he would surrender to the idea of spontaneous generation if the scientific evidence demonstrated the likelihood, but he could not allow the creation of matter and its laws to be proper scientific subjects. These latter problems lay in the province of metaphysics, about which he would nonetheless be happy to argue. His own position on the purely scientific issues, he said, was close to that of Hans Driesch: one had to postulate, internal vital laws to devise adequate explanations of species descent. Though Plate and others continued to attribute an interventionist theology to Wasmann, he claimed that his science did not require that—though he was philosophically committed to the belief that God had created matter and its laws, which laws might, he allowed, eventually include those governing spontaneous generation. And while the evolution of man's body from lower creatures had yet to be shown, he also allowed that as a possibility. But, he

⁴¹Several accounts of Wasmann's lectures and the ensuing debate are extant. I have relied on the book-length descriptions given by Wasmann himself and his principal opponent, Ludwig Plate. See Erich Wasmann, *Der Kampf um das Entwicklungsproblem in Berlin* (Freiburg im Breisgau: Herdersche Verlagshandlung, 1907); and Ludwig Plate, *Ultramontane Weltanschauung und moderne Lebenskunde, Orthodoxie und Monisms* (Jena: Gustav Fischer, 1907). Wasmann's book was also published in English as *The Berlin Discussion of the Problem of Evolution*, authorized translation (St. Louis, Mo.: Herder Book Co., 1909).

maintained, it was the natural science of psychology that absolutely distinguished human mentality from animal cognition, and therefore a gradual transition in mind from animals to man was precluded by science itself.

Wasmann's opponents shelled him not only with intellectual objections but also lobbed the occasional invective designed to dismember less substantial egos—Plate concluded that “Father Wasmann is not a genuine research scientist (*Naturforscher*), not a true scholar”; the anthropologist Hans Friedenthal (1870-1943) referred to Wasmann as a “dilettante” in the area of human evolution.”⁴² Yet Wasmann met the over-wrought responses with a calm professionalism made piquant with a “dry sense of humor” (as the *Berliner Morgenpost* characterized his lectures).⁴³ The *Deutsche Tageszeitung* judged that with the exception of Plate, Wasmann's opponents “seemed almost like pygmies.”⁴⁴ After midnight, at the conclusion of the reply to his critics, Wasmann, according to the *Kölnische Volkszeitung*, received from the audience a “thunderous ovation.”⁴⁵ It seems clear that if he did not always convince his auditors—some five hundred articles in the various German papers reported a variety of judgments—he at least charmed them. But from our historical perspective, he did more than that. He showed that evolutionary theory at the turn of the century still had not achieved consensus, though was rapidly approaching fundamental agreement among professionals of every philosophical

⁴²Plate, “Ultramontane Weltanschauung,” p. 77, 93.

⁴³[Anonymous], “Pater Wasmanns Berliner Vorträge,” *Berliner Morgenpost* (14 February 1907).

⁴⁴*Deutsche Tageszeitung* (19 February 1907), as quoted by Wasmann in *Kampf um das Entwicklungsproblem in Berlin*, p. 148.

⁴⁵[Anonymous], “Pater Wasmann,” *Kölnische Volkszeitung* (morning edition) no. 149 (20 February 1907), p. 2.

conviction. And his subtle arguments demonstrated that no necessary antagonism had to exist between evolutionary theory and a liberal, philosophically acute brand of theology. Not all objectors from the side of religion showed themselves as high-minded as Wasmann. Certainly Arnold Brass of the Protestant Keplerbund did not.

The Keplerbund vs. the Monistenbund

Haeckel's book *Die Welträthsel* set off a swarming and stinging reaction from the many quarters that had already been aroused by Haeckel's frequent attacks on religion. While the book seemed, especially to the young, like a flaming torch lighting the way to liberation from the crushing hands of orthodox science and religion, others thought it an incendiary faggot set at the base of Christian civilization. Many of those for whom it illuminated the path to freedom joined the Monistenbund, originally a union of scientists and dedicated citizens who subscribed to Haeckel's program of monistic philosophy. Haeckel had harbored the idea of such an organization for several years. While attending the International Free-Thinkers Conference in Rome in 1904, where he was celebrated as the anti-pope, he thought it might then spontaneously form. When that failed, he took practical steps to bring it into existence.⁴⁶ The planning began in the wake of his Berlin lectures against Wasmann, and the initial meeting took place on January 11, 1906, in Jena. The first president selected was the radical Protestant pastor, Albert Kalthoff (1850-1906), though Haeckel quickly importuned the noted

⁴⁶Ernst Haeckel to Wilhelm Bölsche (15 October 1905), in *Ernst Haeckel-Wilhelm Bölsche: Briefwechsel*, pp. 180-81.

naturalist August Forel (1848-1931) to assume leadership.⁴⁷ Eventually the Nobel Prize winner Wilhelm Ostwald (1853-1932) would occupy the chair (1911), presiding over an organization that would grow to some six thousand members before disbanding in 1933 rather than be taken over by the Nazis. While the league was initially guided by Haeckel's declarations of monistic philosophy—especially its anti-dualism, anti-clericalism, and notions of scientific management of the state—it became a more heterogeneous alliance, embodying, as one of its early presidents maintained, the principles of the Enlightenment further elevated through modern science. It continued to stress scientific epistemology, world peace, international co-operation, and eugenic principles of forming a healthy society. While some of its members—Wilhelm Schallmayer (1857-1919), for instance—would preach race hygiene, others, like Magnus Hirschfeld (1868-1935), would preach tolerance for homosexuals. After the Great War, the Monistenbund became decidedly more pacifistic and socialistic. The society spread to most of the European countries, as well as America, where the journal *The Monist*, edited by Paul Carus (1852-1919), published Haeckel and many other like-minded philosophers and scientists.⁴⁸

⁴⁷Heiko Weber, "Der Monismus als Theorie einer einheitlichen Weltanschauung am Beispiel der Positionen von Ernst Haeckel und August Forel," in *Monismus um 1900: Wissenschaftskultur und Weltanschauung*, ed. Paul Ziche (Berlin: Verlag für Wissenschaft und Bildung, 2000), 81-127.

⁴⁸See Niles Holt, "Monists & Nazis: A Question of Scientific Responsibility," *Hastings Center Report* 5 (1975): 37-43. See also Richard Weikart, "Evolutionäre Aufklärung? Zur Geschichte des Monistenbundes," in *Wissenschaft, Politik und Öffentlichkeit*, eds. Mitchell Ash and Christian Stifter (Vienna: Universitätsverlag, 2002), pp. 131-48. For a contrasting picture of the Monist League, see Daniel Gasman, *The Scientific Origins of National Socialism* (New York: Science History Publications, 1971), especially pp. 31-54.



Figure 4: Eberhard Dennert, founder of the Keplerbund.

In 1907, the year after the founding of the Monistenbund, Eberhard Dennert (1862-1942), a botanist and teacher in the Evangelical Pädagogium in Bad Godesberg, called into existence “the Keplerbund for the Advance of Natural Knowledge.” This was an organization of Protestant scientists and laymen dedicated, as their initial call declared, to the conviction that: “Truth encompasses the harmony of natural scientific facts with philosophical knowledge and religious

experience. Accordingly, the Keplerbund is expressly distinguished from the materialistic dogma of biased Monism and struggles against the thoroughly atheistic propaganda of this latter, which falsely claims to be grounded on natural science.”⁴⁹

The founder of the bund, Dennert, had trained in the Realeschule at Lippstadt under the Darwinian enthusiast Hermann Müller (1829-1883), who was the brother of the more famous Fritz Müller (1822-1897). The school master sent his best pupils to Jena. Dennert went to Marburg, where under the strongly anti-Darwinian Albert Wigand (1821-1886), he cultivated a distaste for evolutionary doctrine.

Dennert reacted like a tightly wound spring to Haeckel’s *Welträthsel*, immediately firing off a broadside: *Die Wahrheit über Ernst Haeckel und seine “Welträtsel”* (The truth about Ernst Haeckel and his “Riddle of the Universe,” 1901), one of the over ninety

⁴⁹Eberhard Dennert, *Die Naturwissenschaft und der Kampf um die Weltanschauung*, Schriften des Keplerbundes, Heft 1 (Godesberg b. Bonn: Naturwissenschaftlicher Verlag, 1910): 29.

books and pamphlets venting his religious enthusiasms.⁵⁰ Under the flapping spread of his many tracts he sought the reconciliation of religion and science by draining the blood from one and emasculating the other. Religion, he asserted, was not a matter of understanding, of intellectual demonstration, but a matter of feeling. He thought it manifest from his own surveys of the faith of past scientists that “natural scientific research [*Naturforschung*] does not exclude simple Biblical faith, and that religious belief and religious life do not draw their proof from the intellect, but entirely from other factors. These factors [feelings of the heart] are available to every person.”⁵¹ In contrast to religious faith, science did require the most rigid intellectual demonstration: only unequivocal fact and theory strictly derived from fact could be admitted into its domain. But Darwinism, with its atheistic implications, froze the heart and supplied no set of demonstrated facts from which to launch its speculations. Thus, as a second requirement for reconciliation, Darwinian evolution had to be rejected. Typical of Dennert’s effort was the often reprinted tract *Vom Sterbelager des Darwinismus* (On the deathbed of Darwinism, 1902), which cursorily and loosely examined the work of several biologists (e.g., Albert von Kölliker [1817-1905], Oskar Hertwig [1849-1922], Gustav Theodor Eimer [1843-1898]) who had alternative evolutionary proposals. The argument seems to be that all of these different variations on evolutionary theory somehow prove Darwin and Haeckel’s version to be moribund. The heterogeneity of proposals

⁵⁰Eberhard Dennert, *Die Wahrheit über Ernst Haeckel und seine “Welträtsel, nach dem Urteil seiner Fachgenossen*, 2nd ed. (Halle: C. Ed. Müller’s Verlagsbuchhandlung, 1905). The book is mostly a compilation of the positions of the various objectors to Haeckel, beginning with Ludwig Rüttimeyer’s charge of fraud.

⁵¹Eberhard Dennert, *Bibel und Naturwissenschaft* (Halle: Richard Mühlmann’s Verlag, 1911), pp. 312-20.

concerning evolution and the ultimately inadequate efforts to substantiate it suggested to Dennert that the very doctrine of descent itself must also be quite doubtful. At least we could have no “clear and exact demonstration of evolutionary theory [Entwicklungslehre],” and thus the mode of its occurrence would of necessity remain forever hidden.⁵²

Dennert found a particularly aggressive and paranoid ally in another hapless naturalist, Arnold Brass (b. 1854). Brass had failed to start his academic career in a way that would lead to a professorship: he wanted to work at the Naples Zoological Station, but was not chosen; at Marburg, his application for recognition of his habilitation was rejected. He had to fall back on itinerate work in zoology, usually producing drawings for various books and articles in anatomy. After the turn of the century, as he reflected on the derailment of his academic career two decades before, Brass began to suspect the conspiratorial hand of Ernst Haeckel.⁵³ Haeckel would later deny any such connivance, since he barely knew the man. In 1906, Brass published a tract that came to the defense of Dennert, who had been dismissed by Plate and Haeckel as an inept Christian apologist. In the booklet, *Ernst Haeckel als Biologe und die Wahrheit* (Ernst Haeckel as

⁵²Eberhard Dennert, *Vom Sterbelager des Darwinismus*, neue Folge (Halle: Richard Mühlmann's Verlag, 1905), p. 6. Dennert rather liked Kropotkin's emphasis on cooperation in nature but thought it militated against the Russian's retention of Darwinian selection theory (pp. 123-34). But in sum, he thought transformation might occur, but we would never have any proof of it nor could we ever discover its mode. If we yet postulated it, we would have to assume internal driving forces (*Triebkräften*) as responsible (p. 6).

⁵³Naively Brass let slip out his various failures to obtain desired academic positions, and increasingly detected Haeckel as the culprit. See Arnold Brass, *Ernst Haeckel als Biologe und die Wahrheit* (Halle: Richard Mühlmann's Verlag, 1906), pp. 10-11. See also the second edition of Brass's *Affen-Problem* (1909) as quoted by Reinhard Gursch, *Die Illustrationen Ernst Haeckels zur Abstammungs- und Entwicklungsgeschichte* (Frankfurt a. M.: Verlag Peter Lang, 1981), p. 89: “In 1886, I had submitted a habilitation work on the systematics of the mammals, etc. at Marburg for the first and only time. This audacity had angered Haeckel and others at the time. To exclude the possibility of my again attempting a habilitation in Marburg, Plate, a student of Haeckel, was admitted to the position of docent.”

biologist and the truth, 1906), Brass remained fairly polite, actually rather sycophantic.

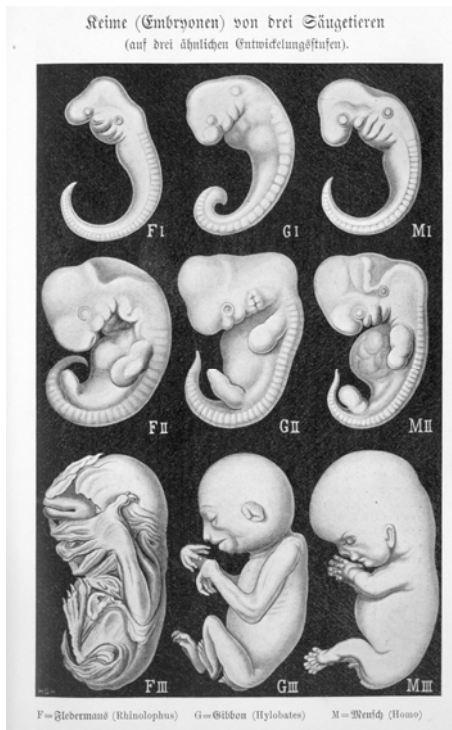


Figure 5: Vertebrates (bat, gibbon, human) at three stages of development; from Haeckel's *Das Menschen-Problem*.

He acknowledged Haeckel's "genius" and command of vast areas of zoology—far superior to Darwin's in this respect. But he thought himself able to meet the Jena lion on common ground. He expended most of his effort in the book describing the presumed deficiencies of Darwinian theory and arguing for the compatibility of reliable science with evangelical theology. After this publication, he began to lecture on Haeckel's monism, for which he received some financial support from the

Keplerbund.⁵⁴ In these lectures, his opposition to monism in general and Haeckel in particular grew in

stridency.

On April 10, 1908, Brass delivered a lecture in Berlin to a meeting of the Christian-Social Party at which he claimed that Haeckel had illustrated a recent talk in an "erroneous" fashion.⁵⁵ As reported in the Berlin *Staatsbürgerzeitung*, Brass asserted

⁵⁴Brass later denied he received any money from the Keplerbund—and maybe he did not. But the business director of the Keplerbund, Wilhelm Teudt, reported that Brass did receive financial guarantees from the society for his lectures in winter of 1807-1808. Haeckel would use this as an indictment. See Wilhelm Teudt, "Im Interesse der Wissenschaft! Haeckel's 'Fälschungen' und die 46 Zoologen," Schriften des Keplerbundes, Heft 3 (Godesberg bei Bonn: Naturwissenschaftlicher Verlag, 1909), p. 7.

⁵⁵I have reconstructed the course of these debates from two opposing sources, from the account of the Keplerbund's general business manager, Wilhelm Teudt, and from that of the secretary of the Monistenbund, Heinrich Schmidt. Both quote verbatim from newspaper articles and other sources, and both, of course, offer their particular interpretations of the events. See Teudt, *Im Interesse der Wissenschaft*; and Heinrich Schmidt, *Haeckel's Embryonenbilder: Dokumente zum Kampf um die Weltanschauung in der Gegenwart* (Frankfurt a.M.: Neuer Frankfurter Verlag, 1909). In 1900, Schmidt had become Haeckel's assistant and protégé. See Uwe Hossfeld, "Haeckel's 'Eckermann': Heinrich

that in arguing for the biogenetic law, Haeckel had made a “mistake” (*Missgeschick*) by depicting an ape embryo sporting the head of a human embryo and a human embryo with an ape head. The newspaper reported that “the lecturer could speak here from the most exact personal knowledge, since he himself had presented to Haeckel the correct illustrations.”⁵⁶ The supposedly “mistaken” illustration was from Haeckel’s Jena lecture on the occasion of the two-hundredth anniversary of Linnaeus’s birth. The lecture was published as *Das Menschen-Problem und die Herrentiere von Linné* (The problem of man and the anthropoid animals of Linnaeus, 1907), and it had several illustrations appended to it. In the illustration that compared the embryos of a bat, gibbon, and human being, Brass claimed that Haeckel had switched the heads of the gibbon and human being depicted in the second row (fig. 5).⁵⁷

When Haeckel learned of Brass lecture, he explosively responded in an open letter to a colleague that the charge was a “barefaced lie” (*freche Lüge*); he did not make the alleged “mistake” and Brass certainly never prepared any illustrations for him. In a fury, he had his lawyer contact several newspapers threatening suit if they perpetuated this “brazen invention.”⁵⁸ Brass immediately modified his charge in two newspaper articles (*Statsbürgerzeitung* and *Volk*, Berlin, April 25, 1908), now saying that the head

Schmidt (1874-1935),” in Matthias Steinbach and Stefan Gerber (eds.), *Klassische Universität und akademische Provinz: Die Universität Jena von der Mitte des 19. bis in die 30er Jahre des 20. Jahrhunderts* (Jena: Bussert & Stadeler, 2005), pp. 270-288.

⁵⁶Schmidt, *Haeckels Embryonenbilder*, p. 8.

⁵⁷Ernst Haeckel, *Das Menschen-Problem und die Herrentiere von Linné: Vortrag, gehalten am 17. Juni 1907 in Volkshause zu Jena* (Frankfurt a. M.: Neuer Frankfurter Verlag, 1907), table 3. This is the same illustration Haeckel had used in his *Der Kampf um den Entwicklungs-Gedanke* two years earlier.

⁵⁸Schmidt, *Haeckels Embryonenbilder*, p. 8; Teudt, *Im Interesse der Wissenschaft*, p. 13.

of the gibbon in the illustration bore “more than the usual similarity to the human embryo at a similar developmental stage, which I have repeatedly sketched and illustrated from a preparation.”⁵⁹ Haeckel quickly wrote to the same newspapers saying that he himself had not drawn the illustrations but had a designer do so relying on figures taken from well-known authors: the ape embryo, which he called a “hylobates” (a genus of gibbon), he said he took from Emil Selenka (1842-1902) and the human embryo was based on the work of a couple of authors, including Wilhelm His.⁶⁰ A comparison of Selenka’s and His’s images with those of Haeckel’s lecture shows, indeed, a close similarity (see figs. 6 and 7).⁶¹ It is quite clear that Haeckel did not switch heads of the embryos as Brass had initially charged.

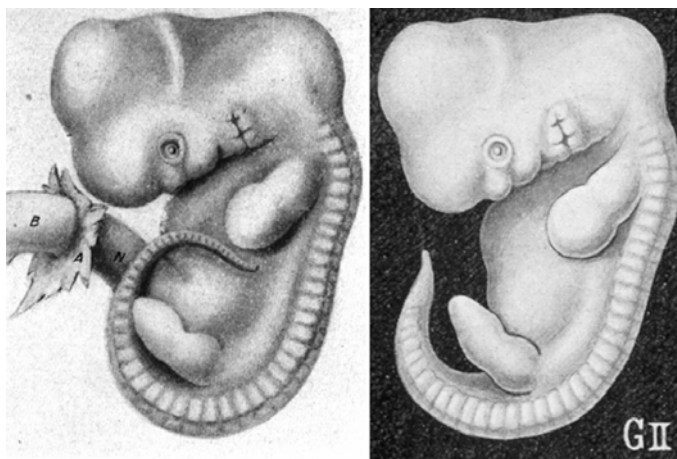


Figure 6: Macaque embryo, from Selenka's *Menschenaffen* (left); and Haeckel's depiction of a gibbon embryo, from his *Menschen-Problem*.

Brass, nonetheless, quickly escalated in another lecture: “Haeckel has not only falsely represented the developmental condition of the human, ape, and other mammals, in order to be able to sustain his hypothesis, he took

⁵⁹Ibid., p. 14.

⁶⁰Ibid., pp. 14-15; Schmidt, *Haeckels Embryonenbilder*, p. 9.

⁶¹For their respective depiction of a macaque embryo and a human embryo, see Emil Selenka, *Menschenaffen (Anthropomorphae): Studien über Entwicklung und Schädelbau*, vol. 5 of *Zur Vergleichenden Keimesgeschichte der Primaten* (Wiesbaden: C. W. Kreidel's Verlag, 1903), p. 357; and Wilhelm His, *Anatomie menschlicher Embryonen*, 3 vols. with 3 atlases (Leipzig: Verlag von F. C. W. Vogel, 1880-1885), III atlas, table 10.

from the scientific store of a researcher the figure of a macaque, cut off its tail, and made a gibbon out of it.”⁶² Haeckel in fact did use a macaque embryo with a shortened tail instead of a gibbon embryo. In the Selenka volume, the illustrations of gibbon embryos immediately follow those of macaques, without, however, any gibbon embryo at the stage which Haeckel needed.⁶³ The similarity of macaque and human embryos would seem to make Haeckel’s case even stronger. But there is no doubt that Haeckel’s use of the macaque embryo instead of a gibbon embryo rendered him vulnerable. Brass promised that Haeckel’s malfeasance would be extensively demonstrated in a little book he was preparing. Haeckel perceived the forthcoming tract as another repetition of the old charge, a creature he had slain over and over, which was now returning to seek

vengeance against an old man.

Brass’s book appeared as *Das Affen-Problem* in late 1908.⁶⁴

In the tract, he expanded his indictment by enumerating several trivial particulars and at the same time deflated what had been his

initial, quite serious charge. The

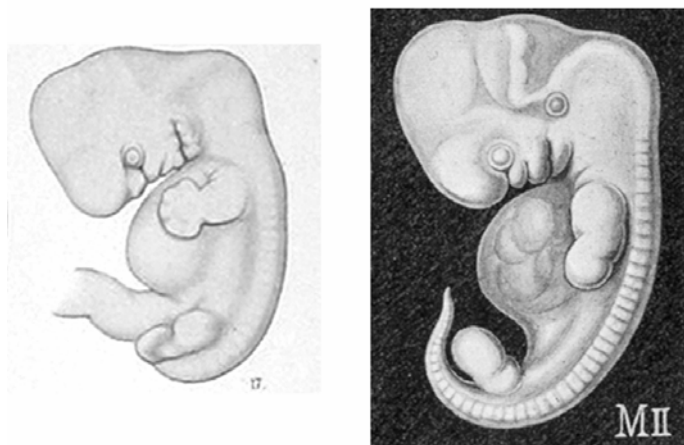


Figure 7: Human embryo from His's *Atlas 3: Anatomie menschlicher Embryonen* (left); and Haeckel's depiction of the human embryo, from his *Menschen-Problem*.

⁶²Schmidt, *Haeckels Embryonenbilder*, pp. 9-10; Teudt, *Im Interesse der Wissenschaft*, p. 15.

⁶³Selenka, *Menschenaffen*, pp. 353-63.

⁶⁴Arnold Brass, *Das Affen-Problem: Prof. E. Haeckel's Darstellungs- u. Kampfweise sachlich dargelegt nebst Bemerkungen über Atmungsorgane u. Körperform d. Wirbeltier-Embryonen* (Leipzig: Biologischer Verlag, 1908).

first plate of Haeckel's *Das Menschen-Problem* depicted a representation of four ape skeletons and a human skeleton, assuming poses similar to those in a famous illustration by Thomas Henry Huxley (1825-1895). Brass contended that Haeckel had made the human too stooped, the gorilla too erect, the apes with their feet flat on the ground, and the gorilla displaying his teeth in an all too human grin.⁶⁵ Concerning the second plate, which showed embryos of a pig, rabbit, and human being at three very early "sandal" stages, Brass mostly suggested they lacked other surrounding features (e.g., yolk) and that they were too symmetrical.⁶⁶ Finally, concerning the third plate of the embryonic stages of the bat, gibbon, and human being, Brass simply dropped his original charge that Haeckel had swapped the heads of the gibbon and human embryos. He found other falsifications, however: the bat was the common bat (*Vespertilio murinus*) instead of the horseshoe nosed bat (*Rhinolophus*) that Haeckel claimed; the human embryo in MII was represented with forty-six vertebrae instead of the thirty-three to thirty-five normally present; and the so-called gibbon at GIII was really a macaque that had its tail removed.⁶⁷

Haeckel responded to Brass's new charges in the December 29, 1908 number of the *Berliner Volkszeitung* in a long article that recounted the activities of the Keplerbund and its opposition to Darwinian theory and monism. Haeckel acknowledge that like virtually every illustrator he had "schematized" his depictions, removing features

⁶⁵Ibid., p. 8.

⁶⁶Ibid., pp. 8-10.

⁶⁷Ibid., pp. 15-21.

inessential to the point of the discussion.⁶⁸ I think an impartial judge would recognize that Haeckel's schematizations did not materially alter his essential message, namely, that the embryonic structures of vertebrates at comparable stages were strikingly similar and that the best explanation of the similarity was common descent.

The Response of the 46

The contretemps between Haeckel and the Keplerbund generated a massive reaction from scientists and laymen alike. Hundreds of articles and pamphlets, some calm and reflective, most vituperative and dismissive streamed from the presses. The Keplerbund sought a thorough condemnation of Haeckel and to that end they sent around a letter to many distinguished anatomists and embryologists seeking their support. They did get a response, but not precisely the one they had hoped for. In mid February, the following letter, signed by some of the most distinguished researchers in biology, appeared in a number of German newspapers:

The undersigned professors of anatomy and zoology, directors of anatomical and zoological institutes and natural history museums, and so on, herewith declare that they certainly [*zwar*] do not approve [*nicht gutheissen*] of the few instances in which Haeckel practiced a kind of schematization but that in the interest of science and the freedom to teach they condemn in the sharpest way the battle that Brass and the Keplerbund have waged against him. They further declare that

⁶⁸ Teudt, *Im Interesse der Wissenschaft*, p.28; Schmidt, *Haeckels Embryonenbilder*, pp. 16-17.

the developmental concept, as it is expressed in descent theory, can suffer no injury from a few inappropriately repeated embryo illustrations.⁶⁹

The letter was signed by forty-six biologists, including Theodor Boveri, Karl Escherich, Max Fürbringer, Alexander Goette, Richard Hertwig, Karl Kraepelin, Arnold Lang, Ludwig Plate, Karl Rabl, Gustav Schwalbe, and August Weismann. Lest their meaning be unclear about their mild reproof of Haeckel, Karl Rabl (1853-1917), the great Leipzig cytologist, published in the *Frankfurter Zeitung* a clarification of what they meant by “schematization”:

concerning the schematizations that went a bit too far, this is not a question of falsification or betrayal. The mild form in which the objection was clothed has been dictated by the great regard the zoologists and anatomist feel for Haeckel. They know very well how to appreciate how much they owe Haeckel and they know also that the few schemata of lesser value are hardly of consequence, as opposed to the numerous first-rate ones that Haeckel has produced and that have become the common property of science.⁷⁰

Rabl securely situated Haeckel in the minds and sentiments of the significant scientists at the beginning of the twentieth century; and he and the other members of the forty-six provided, I think, a just evaluation of the old warrior’s protracted dispute with the Keplerbund.

Conclusion

⁶⁹Ibid., p. 50; Teudt, *Im Interesse der Wissenschaft*, p. 49.

⁷⁰Schmidt, Schmidt, *Haeckels Embryonenbilder*, p. 63.

“Darwin’s *Origin of Species* had come into the theological world like a plough into an ant-hill,” wrote Andrew Dixon White in 1894. “Everywhere,” he remarked, “those thus rudely awakened from their old comfort and repose had swarmed forth angry and confused.”⁷¹ None more angry and confused than the theologians and theologians manqué who saw in Haeckel the embodiment of the anti-Christ. From sophisticated German theologians who found his scientific world view an appropriate challenge to Christianity to English preachers who feared “the depth of degradation and despair into which the teachings of Haeckel will plunge mankind,” the German Darwinian came to symbolize Evolution Militant.⁷² Moreover, the complex relations of religion with political parties and revolutionary social movements, especially the Marxists, made even more hyperbolic the reactions of the lower minded orthodox to a doctrine that seemed to deny the hand of the creator in shaping the living world. To what shoals did that doctrine lead? “Primitive barbarism, Sun worship, Mohammedanism, self-love: these are the awful rapids to which Haeckel would steer the ship of humanity,” so warned the preacher of the Hampstead Congregationalist Church.⁷³

⁷¹Andrew Dixon White, *A History of the Warfare of Theology with Science in Christendom*, 2 vols. (New York: George Braziller, [1894] 1955), 1: 70. Michael Ruse delivers a pungent account of the reaction of contemporary religious sects to evolutionary theory in his *The Evolution-Creation Struggle* (Cambridge: Harvard University, 2005). Ronald Numbers provides a scholarly treatment of the American Fundamentalist response to evolution in the early part of the twentieth century in his *The Creationists* (New York: Knopf, 1992).

⁷²For examples of calm and sophisticated responses to Haeckel’s attacks on religion, see, for example, Friedrich Loofs, “Offener Brief an Herrn Professor Dr. Ernst Haeckel in Jena,” *Die Christliche Welt* 13 (1899): 1067-72; and Georg Wobbermin, *Ernst Haeckel im Kampf gegen die christliche Weltanschauung* (Leipzig: J. C. Hinrichs’sche Buchhandlung, 1906). The analytic and reflective consideration was not the strong suite of the English preacher R. F. Horton; see his “Ernst Haeckel’s ‘Riddle of the Universe,’” *The Christian World Pulpit* 63 (1903): 353-56 (quotation from p. 353).

⁷³*Ibid.*, p. 355.

But was evolutionary theory in necessary conflict with sophisticated theology? I do not think so, and Erich Wasmann's own way of dealing with evolution would suggest this. Today, not many philosophers—or even theologians of cultivated taste—would be ready to endorse his Thomistic dualism. Yet his readiness to reflect on articulate scientific theory and accept striking empirical evidence indicate the kind of flexible mind that is not saturated with dank ideology—a mind that in a later day might be ready to conceive sensory cognition (which he though the provenance of animals) and human reason as more dynamically related, one that might interpret the “soul” not as an entity but as an achievement. Wasmann stands as a case of an individual for whom empirical truth triumphed over dogmatism. By contrast, the crude opposition of individuals like Brass would not have stirred Haeckel to wrath, except for that failed academic's mendacity. Wasmann's scientific intelligence and sophisticated acumen created for Haeckel a much more dangerous situation: that Jesuit showed how one could be both an intelligent evolutionist and a sophisticated religious thinker. This was the deeper problem for the Monist position. Of course, it did not take much to discharge Haeckel's long-term suspicion and disdain for the Church of Rome. Even when the more vitriolic and personally damaging dispute with the Keplerbund broke out, he still thought of that group as somehow allied with Wasmann's Jesuits, so intellectually pernicious did he regard the latter. In 1910, Haeckel brought out a small tract entitled *Sandalion: Eine offene Antwort auf die Fälschungs-Anklagen der Jesuiten* (Sandalion: an open answer to the charges of falsification of the Jesuits).⁷⁴ “Sandalion” referred to the sandal-shaped

⁷⁴Ernst Haeckel, *Sandalion: Eine offene Antwort auf die Fälschungs-Anklagen der Jesuiten* (Frankfurt a.M.: Neuer Frankfurter Verlag, 1910).

embryos of vertebrates. But by “Jesuits” he meant not only the Catholic religious order but also Protestant religious thinkers of a low, Jesuitical type. Protestant Jesuits! He saw those dark shapes looming everywhere. That part of the World-Soul where Haeckel now dwells must be even more chagrined and suspicious of Jesuit intrigue after eavesdropping on the meeting of the Pontifical Academy of Sciences in 1996, where Pope John Paul II declared that “fresh knowledge leads to recognition of the theory of evolution as more than just a hypothesis.”⁷⁵ The Pope, in stating the Church’s position, however, hardly broke new theological ground. He essentially reiterated the resolution that Wassman had worked out a century before.

Haeckel had lost his taste for any orthodox religion after his habilitation work in Italy and Sicily. The wonderful excesses of southern Catholicism should, perhaps, have amused him; instead he took them as a personal affront. The death of his first wife, Anna, not only caused him to abandon formal observance, the soul-searing event turned him against the kind of superstition that would worship such a malevolent being. Yet because of his second wife, his children, and their social life in Jena, Haeckel retained nominal membership in the Evangelical Church. The attacks of the Keplerbund, however, finally drove him out. In December, 1910, he formally declared, in a published account of his religious trajectory, that he had left the Evangelical Church.⁷⁶ What

⁷⁵John Tagliabue, “Pope Bolsters Church’s Support for Scientific View of Evolution,” *New York Times* (25 October 1996): A1. This is a report of Pope John Paul II’s address to the Pontifical Academy of Sciences. The current Pope, Benedict XVI, may be having second thoughts. His friend, the Cardinal Archbishop of Vienna, Christoph Schönborn, has asserted: “Evolution in the sense of common ancestry might be true, but evolution in the neo-Darwinian sense—an unguided, unplanned process of random variation and natural selection—is not. Any system of thought that denies or seeks to explain away the overwhelming evidence for design in biology is ideology, not science.” His essay appeared as an op. ed. in the *New York Times*: Christoph Schönborn, “Finding Design in Nature,” *New York Times* (7 July 2005): A27.

⁷⁶Ernst Haeckel, “Mein Kirchenaustritt,” *Das freie Wort* 10 (1910): 714-17.

undoubtedly surprised those who read the article was that he had still been a member of the Church.

Coda: "The Rape of the Ants"

After his encounter with Haeckel and the Monists, Wasmann continued his research on inquilines and their hosts. His correspondence network of important ant-men—August Forel, William Morton Wheeler (1865-1937), and Hugo von Buttel-Reepen (1860-1933)—continued apace, with the exchange of many ant species among them. Wasmann built up the largest entomological collection of ants in the world, some 3500 different species. He also strove unremittingly against Haeckelian evolutionary theory and its cultural spread, which he believed to be rife during the first decades of the new century. He lectured and wrote on the dangers to German culture of Monistic thought, especially that connection about which Virchow had warned, namely, its alliance with the Social Democratic Party and the Communists. Wasmann thought this danger particularly acute after the Great War, with German institutions and society in shambles and with their need of reconstruction. In a lecture delivered to the Catholic Union in Aachen on January 28, 1921, Wasmann asked, rhetorically, about the direction to take in the wake of the destruction of German cultural and social life.

Our answer can only be shouted: back to Christianity and away with Haeckelian Monism! For the impregnation of anti-Christian ideas of this neopaganism into our social networks bears the chief responsibility for not only the material collapse

of our Fatherland but also its ethical and religious orientation. For that reason we say: Haeckel's Monism is a cultural danger [*Kulturgefähr*].⁷⁷

During Wasmann's last years, he saw the beginning of a transformation in German society, but in a way that confirmed his dark forebodings. Wasmann died in 1931. His ants, however, were fated to have a curious connection with the Nazi regime.⁷⁸

After his death, Wasmann's large collection of books and reprints, along with his ants and beetles, were donated to the Natural History Museum of Maastricht to be used for all researchers. In October of 1942, Dr. Has Bischoff, curator of the Berlin Zoological Museum, received an order from Heinrich Himmler, head of the *Schutzstaffel* (SS) and himself an amateur entomologist. Bischoff was to go to Holland and get Wasmann's ants. He first traveled to the Jesuit house in Limburg looking for the collection. He was told it was transferred to the Natural History Museum in Maastricht. The museum personnel and other citizens learned of Bischoff's mission; and, with the connivance of even the Quisling mayor, they hid the ants in the basement of the city hall. Only temporarily foiled, Bischoff returned to Maastricht the next spring with a contingent of SS troops. Quite formally he stated the ants were being repatriated. They were German ants! The burgomaster retorted that Wasmann was born in the Tyrol. They were Italian ants. The Dutch, needless to say, did not win the argument. The ants and Wasmann's book collection were carted off to Berlin. A *Time Magazine* article of 1944, entitled "The

⁷⁷ The lecture is in the Nachlass of Erich Wasmann held in the Natural Museum of Maastricht.

⁷⁸The outline of the following story was told to me by Dr. Fokeline Dingemans of the Natural History Museum of Maastricht. For other details, I have relied on a story, "Ants Rescued by Richmonder," in the *Richmond Times-Dispatch* (10 February 1946). I am grateful to David Leary (University of Richmond) for providing information on John Wendell Bailey.

Rape of the Ants,” stood aghast at the perfidy of the SS, who even stooped so low as to steal ants.⁷⁹

After the Normandy Invasion, Colonel John Wendell Bailey (1895-1986), head of typhus control in Europe, made his way to Maastricht in fall of 1945 to examine Wasmann’s collection. Bailey was a professor of entomology at the University of Richmond and a former student of Harvard Professor William Morton Wheeler, Wasmann’s old friend. When he got to the museum he learned about the fate of the ants. He decided to chance it and traveled the 600 miles to Berlin and the Zoologisches Museum, which lay in rubble. He did manage to locate Bischoff and with some tactful threats discovered that Wasmann’s ants and books had been stored in the deep vaults of a bank. The bank lay in ruins, but the vaults were still secure. Miraculously the entire collection of ant species and the library had survived. Since the bank was in the Russian sector, Bailey had to negotiate with a Russian general, whom he befriended with many cartons of American cigarettes and several bottles of whiskey. After the proper papers were signed, Bailey and several G.I.s loaded the ants and books—some 160 insect trays, 150 small boxes, 100 bottles of specimens in alcohol, and 50,000 books and reprints—on two trucks and three jeeps and took them to the American sector. Bailey discovered, however, that some of the insects were missing, which he later found in Himmler’s country home in Waischenfeld, just over the Swiss border. Bailey shipped the ants and books back to the Maastricht Natural History Museum, where today they are still used in research.

⁷⁹“The Rape of the Ants,” *Time* 44, no. 21 (20 November 1944), science section.

References

- Anonymous (1893). *Der Ausgang des Prozesses Haeckel-Hamann*. Magdeburg: Listner & Drews.
- Anonymous (1907). "Pater Wasmanns Berliner Vorträge," *Berliner Morgenpost* (14 February).
- Anonymous (1907). "Pater Wasmann," *Kölnische Volkszeitung* (morning edition) no. 149 (20 February), p. 2.
- Anonymous (1944). "The Rape of the Ants," *Time* 44, no. 21. (20 November).
- Anonymous (1946). "Ants Rescued by Richmonder," *Richmond Times-Dispatch*. (10 February).
- Bölsche, W. (1909). *Ernst Haeckel: Ein Lebensbild*. Berlin: Georg Bondi.
- Brass, A. (1906). *Ernst Haeckel als Biologe und die Wahrheit*. Halle: Richard Mühlmann's Verlag.
- Brass, A. (1908). *Das Affen-Problem: Prof. E. Haeckel's Darstellungs- u. Kampfweise sachlich dargelegt nebst Bemerkungen über Atmungsorgane u. Körperform d. Wirbeltier-Embryonen*. Leipzig: Biologischer Verlag.
- Craig, G. (1980). *Germany, 1866-1945*. Oxford: Oxford University Press.
- Dennert, E. (1905). *Die Wahrheit über Ernst Haeckel und seine "Welträtsel, nach dem Urteil seiner Fachgenossen*, 2nd ed. Halle: C. Ed. Müller's Verlagsbuchhandlung.
- Dennert, E. (1905). *Vom Sterbelager des Darwinismus*, neue Folge. Halle: Richard Mühlmann's Verlag.
- Dennert, E. (1910). *Die Naturwissenschaft und der Kampf um die Weltanschauung* (Schriften des Keplerbundes, Heft 1). Godesberg b. Bonn: Naturwissenschaftlicher Verlag.
- Dennert, E. (1911). *Bibel und Naturwissenschaft*. Halle: Richard Mühlmann's Verlag.
- Franz, V. (ed.) (1943-1944). *Ernst Haeckel: Sein Leben, Denken und Wirken*. 2 vols. Jena: Wilhelm Gronau.
- Gasman, D. (1971). *The Scientific Origins of National Socialism*. New York: Science History Publications.

- Grimaldi, D., and Carpenter, J. (1997). "New and Rediscovered Primitive Ants (Hymenoptera: Formicidae) in Cretaceous Amber from New Jersey, and their Phylogenetic Relationships." *American Museum Novitates*, no. 3208: 1-43.
- Gursch, R. (1981). *Die Illustrationen Ernst Haeckels zur Abstammungs- und Entwicklungsgeschichte*. Frankfurt a. M.: Verlag Peter Lang.
- Haeckel, E. (1882). "Ueber die Naturanschauung von Darwin, Göthe und Lamarck," *Tageblatt der 55. Versammlung Deutscher Naturforscher und Aerzte in Eisenach, von 18. bis 22. September 1882*. Eisenach: Hofbuchdruckerei von H. Kahle, pp. 81-91.
- Haeckel, E. (1882). *Die Naturanschauung von Darwin, Goethe und Lamarck*. Jena: Gustav Fischer.
- Haeckel, E. (1892). *Der Monismus als Band zwischen Religion und Wissenschaft, Glaubensbekenntniss eines Naturforschers*. Bonn: Emil Strauss.
- Haeckel, E. (1905). *Der Kampf um den Entwicklungs-Gedanken: Drei Vorträge gehalten am 14, 16, und 19 April 1905 im Saale der Sing-Akademie an Berlin*. Berlin: Georg Reimer.
- Haeckel, E. (1907). *Das Menschen-Problem und die Herrentiere von Linné: Vortrag, gehalten am 17. Juni 1907 in Volkshause zu Jena*. Frankfurt a. M.: Neuer Frankfurter Verlag.
- Haeckel, E. (1910). *Sandalion: Eine offene Antwort auf die Fälschungs-Anklagen der Jesuiten*. Frankfurt a.M.: Neuer Frankfurter Verlag.
- Haeckel, E. (1910). "Mein Kirchenaustritt," *Das freie Wort* 10: 714-17
- Hamann, O. (1892). *Entwicklungslehre und Darwinismus. Eine kritische Darstellung der modernen Entwicklungslehre*. Jena: Hermann Constenoble.
- His, W. (1880-1885). *Anatomie menschlicher Embryonen*. 3 vols. with 3 atlases. Leipzig: Verlag von F. C. W. Vogel.
- Holt, N. (1975). "Monists & Nazis: A Question of Scientific Responsibility," *Hastings Center Report* 5: 37-43.
- Horton, R. (1903). "Ernst Haeckel's 'Riddle of the Universe,'" *The Christian World Pulpit* 63: 353-56.
- Hossfeld, U. (2005). "Haeckels 'Eckermann': Heinrich Schmidt (1874-1935)," in Matthias Steinbach and Stefan Gerber (eds.), *Klassische Universität und akademische*

Provinz: *Die Universität Jena von der Mitte des 19. bis in die 30er Jahre des 20. Jahrhunderts* (Jena: Bussert & Stadelers, 2005), pp. 270-288.

- Koop, R. (ed.) (1941). *Haeckel und Allmers: Die Geschichte einer Freundschaft in Briefen der Freunde*. Bremen: Arthur Geist Verlag.
- Loofs, F. (1899). "Offener Brief an Herrn Professor Dr. Ernst Haeckel in Jena," *Die Christliche Welt* 13: 1067-72.
- Lustig, A. (2002). "Erich Wasmann, Ernst Haeckel and the Limits of Science." *Theory in Biosciences* 121: 252-59.
- Lustig, A. (2004). "Ants and the Nature of Nature in Auguste Forel, Erich Wasmann, and William Morton Wheeler," *The Moral Authority of Nature*, eds. L. Daston and F. Vidal. Chicago: University of Chicago Press, pp. 282-307.
- Nöthlich, R. (2002). *Ernst Haeckel-Wilhelm Bölsche, Briefwechsel 1887-1919*. (Ernst-Haeckel-Haus-Studien, vol. 6/1). Berlin: Verlag für Wissenschaft und Bildung.
- Plate, L. (1907). *Ultramontane Weltanschauung und moderne Lebenskunde, Orthodoxie und Monismus*. Jena: Gustav Fischer.
- Richards, R. J. (2002). *The Romantic Conception of Life: Science and Philosophy in the Age of Goethe*. Chicago: University of Chicago Press.
- Richards, R. J. (2005). "The Aesthetic and Morphological Foundations of Ernst Haeckel's Evolutionary Project," in Mary Kemperink and Patrick Dassen (eds.), *The Many Faces of Evolution in Europe, 1860-1914*. Amsterdam: Peeters, pp. 25-50.
- Ruse, M. (2005). *The Evolution-Creation Struggle*. Cambridge: Harvard University.
- Scheehan, J. (1978). *German Liberalism in the Nineteenth Century*. Chicago: University of Chicago Press.
- Schmidt, H. (1909). *Haeckels Embryonenbilder: Dokumente zum Kampf um die Weltanschauung in der Gegenwart*. Frankfurt a.M.: Neuer Frankfurter Verlag.
- Schönborn, C. (2005). "Finding Design in Nature," *New York Times*. 7 July: A27.
- Selenka, E. (1903). *Menschenaffen (Anthropomorphae): Studien über Entwicklung und Schädelbau*, vol. 5 of *Zur Vergleichenden Keimesgeschichte der Primaten*. Wiesbaden: C. W. Kreidel's Verlag.
- Tagliabue, J. (1996). "Pope Bolsters Church's Support for Scientific View of Evolution," *New York Times*. 25 October: A1.

- Teudt, W. (1909). *“Im Interesse der Wissenschaft! Haeckel’s “Fälschungen” und die 46 Zoologen”* (Schriften des Keplerbundes, Heft 3). Godesberg bei Bonn: Naturwissenschaftlicher Verlag.
- Wasmann, E. (1891). *Die zusammengesetzten Nester und gemischten Kolonien der Ameisen*. Münster i. W.: Aschendorff’schen Buchdruckerei.
- Wasmann, E. (1901). “Gibt es tatsächlich Arten, die heute noch in der Stammesentwicklung begriffen sind?” *Biologisches Zentralblatt*, 21: 685-711, 737-52.
- Wasmann, E. (1904). *Die moderne Biologie und die Entwicklungstheorie*, 2nd ed. Freiburg im Breisgau: Herdersche Verlagshandlung.
- Wasmann, E. (1905). “Offener Brief an Hrn. Professor Haeckel (Jena),” *Kölnische Volkszeitung* 46, no. 358 (2 May): 1-2.
- Wasmann, E. (1907). *Der Kampf um das Entwicklungsproblem in Berlin*. Freiburg im Breisgau: Herdersche Verlagshandlung.
- Wasmann, E. (1909). *The Berlin Discussion of the Problem of Evolution*, authorized translation. St. Louis, Mo.: Herder Book Co.
- Wasmann, E. (1914). *Modern Biology and the Theory of Evolution*. Trans. A Buchanan. St. Louis, Mo.: B. Herder.
- Weber, H. (2000). “Der Monismus als Theorie einer einheitlichen Weltanschauung am Beispiel der Positionen von Ernst Haeckel und August Forel,” in *Monismus um 1900: Wissenschaftskultur und Weltanschauung*, ed. P. Ziche. Berlin: Verlag für Wissenschaft und Bildung.
- Weikart, R. (2002). “Evolutionäre Aufklärung? Zur Geschichte des Monistenbundes,” in *Wissenschaft, Politik und Öffentlichkeit*, eds. M. Ash and C. Stifter. Vienna: Universitätsverlag, pp. 131-48.
- White, A. (1955). *A History of the Warfare of Theology with Science in Christendom*. 2 vols. New York: George Braziller.
- Wilson, E. O. (1971). *Insect Societies*. Cambridge: Harvard University Press.
- Wooberman, G. (1906). *Ernst Haeckel im Kampf gegen die christliche Weltanschauung*. Leipzig: J. C. Hinrichs’sche Buchhandlung.