Research Article

Monographs on the Universe: Americans Respond to Ernst Haeckel's Evolutionary Science and Theology, 1866–1883

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Ernst Haeckel was one of the nineteenth century's most famous and influential scientists and science popularizers. According to one historian of biology, he was "the chief source of the world's knowledge of Darwinism" in his time.[1] At the same time, he endeavored to set up his own pantheistic-evolutionary theology in the place of Christianity. This study makes use of new information technologies to gather documents which have been largely unavailable to historians until recently. Halverson finds that Haeckel's ideas met with a poor reception in the United States because American journalists, ministers, and scientists insisted on maintaining a sharp separation between science and theology, while Haeckel was intent on merging the two under an evolutionary-pantheistic framework. Although often regarded as an advocate of the "conflict thesis," on his own terms he was a deeply religious man who wanted to reform, rather than abolish, theology.

Ernst Haeckel (1834–1919) was one of the nineteenth century's most prominent scientists and science popularizers.[2] He was a specialist in marine invertebrate zoology who undertook detailed studies of medusae, radiolarians, and sponges, proposed the first phylogenetic histories, predicted the discovery of "Java Man," and proposed the "biogenetic law" in embryology. He was also a gifted artist, whose paintings of sea creatures and other animals continue to amaze for both their beauty and detail. But it was not his work as a zoologist or as an artist that earned him a place in the public imagination — it was his tireless advocacy of all things Darwinian. He was one of the first scientists in Germany to embrace Darwin's *Origin of Species* and, for 50 years, he was one of its leading public advocates, both in Germany and throughout the world.[3]

Haeckel was not content with spreading the good news that Darwin had forever changed natural history. He insisted on revolutionizing theology as well. Scientific progress, Haeckel argued, had exposed Christian theology as utterly absurd. It would have to give way before the pantheistic theology of Bruno, Spinoza, and Goethe, which alone was truly rational. Haeckel called it "monism," as opposed to the "dualism" of Christian theology. As the name suggests, the principal theme of monism was unity. Haeckel argued that there were not two separate substances, realms, or areas of knowledge: one the province of the mental, the spiritual, the supernatural, and the other of crude, lifeless matter. On the contrary, mind and matter were but different aspects of the same underlying substance, which was all there ever had been, or would be. In its totality, it was God.

Haeckel saw himself as another Martin Luther, bringing a second, scientific Reformation to the public.[4] His enormously popular science books presented their readers with a heady mix of Darwinian biology, pantheistic theology, and anti-Christian polemics. In German-speaking Europe, Haeckel's monism was not a very radical idea. Similar arguments had been made in the previous generation by Jacob Moleschott, David Friedrich Strauss, and Ludwig Büchner.[5]

In the English-speaking world, however, it was radical, and it transgressed a long-standing boundary between science and Christian theology. For where science was the ascertainment of certain fact on the basis of empirical evidence, theology was the ascertainment of transcendent and eternal truth on the basis of divine revelation. The skepticism of American readers towards Haeckel's attempt to merge the two can be fairly summarized in the words of one contributor to the *National Quarterly Review*, who ridiculed his latest offering as a "monograph on the universe."[6] By juxtaposing the limited and specialist character of a "monograph" with the vast comprehensiveness of "the universe," this contributor reinforced the boundary that Haeckel was intent on transgressing.

His comments were characteristic of the more general reception of Haeckel's science-theology in the United States. Between the years 1876 and 1883, American journalists, ministers, and scientists overwhelmingly rejected Haeckel's bid to unite evolutionary

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biology with pantheistic theology. They attacked both poles of his thought: his science as undisciplined speculation, and his theology as impious atheism, thereby reinforcing the boundary which, in their view, was supposed to separate science and theology. I will show that it was their insistence on maintaining the boundary that Haeckel was intent on effacing which primarily accounts for the failure of his ideas to win a substantial following in the United States during these years. In their view, his synthesis failed as both science and theology.

Historiography and Method

As Mario Di Gregorio has observed, despite his great fame in his own lifetime, Haeckel "would have been very surprised probably to find that very soon he was to be completely forgotten by the public."[7] Indeed, it is remarkable how little scholarly attention this important intellectual has received until quite recently. What attention he had previously received was largely from Daniel Gasman in his book, *The Scientific Origins of National Socialism*. Gasman's portrait of Haeckel was quite disparaging.[8] In his view, "Haeckel's prophetic synthesis of romantically-inclined Volkism with evolution and science…provided an ideological basis for National Socialism."[9] Gasman's view of Haeckel's science was equally negative: "Although he considered himself to be a close follower of Darwin, there was, in fact, little similarity between them.... [Haeckel] ultimately helped to deny Germany a true Darwinian revolution."[10] Despite the mixed reviews his book received when it was published, Gasman's *Scientific Origins* had considerable influence on a generation of scholarship.[11] Modern scholarship unites, however, in rejecting his thesis, on the grounds that it is monocausal, anachronistic, and based on insufficient evidence.[12]

In *The Tragic Sense of Life*, Robert Richards is concerned with rescuing Haeckel's reputation from Gasman, as well as from other scholars who have been highly critical. In Richards' view, Haeckel was "Darwin's authentic intellectual heir," and, "undeniably, a scientific and even an artistic genius."[13] When evaluated fairly, Richards argues, the depth of Haeckel's intellect and accomplishments cannot be denied.[14] Associations with National Socialism, however, are entirely spurious, and have their roots in fundamentalism, opposition to evolutionary biology,

careless scholarship, and other vices.[15] Rightly understood, Richards maintains, Haeckel was the great, unacknowledged, unjustly-besmirched genius of the nineteenth century, whose merit lay not only in his advocacy of evolutionary biology, or in his own artistic and scientific fecundity, but in his opposition to all things clerical and ignorant.[16] Richards' biography is fiery in spirit and rich in detail, but its efforts to rehabilitate its hero are not entirely successful. Haeckel may have been vindicated from the charge of having been a "proto-Nazi," but it is a long way from "not a proto-Nazi" to "scientific genius," and the distance is not traversed by the argument and evidence Richards offers.

In *From Here to Eternity*, Mario Di Gregorio has steered a middle course, understanding Haeckel as neither a proto-Nazi nor "Darwin's authentic intellectual heir," but a scientist with a very shaky grasp on what Darwin actually advocated, and who was principally interested in Darwin's views, and science more generally, as a springboard for his own monistic religion.[17] Haeckel may have presented himself as a second Martin Luther, leading a scientific Reformation, but beneath his aggressive rhetoric, Gregorio argues, lurked a profoundly conservative program.[18] Haeckel did not want to reshape the society he lived in, but to give it a new, Darwinian rationale. The Christian clergy was to be shown the door, certainly, and scientists set up in their place, but everything else was to carry on more or less as before.[19] Gregorio's argument is thoroughly researched and persuasively reasoned.

Prior scholarship on Haeckel has tended to acknowledge his interest in theology but to focus on his science. Haeckel, however, viewed his work as a scientist as preparation for a larger synthesis, which, read on its own terms, was emphatically theological. Haeckel believed that empirical science was the sure foundation on which the new, scientific, rational theology would be based. This study follows Haeckel in considering his science and his theology as a whole. It also strives to place his work in a transnational context which has received little attention in the past.

In Haeckel's time, the invention of high-powered microscopes opened new avenues for scientific discovery. A world of tiny organisms became available for inspection for the first time, and the new science of microscopy flourished. In a similar way, recent technological developments have opened new avenues for historical discovery. Until quite recently, it has been difficult to write intellectual history from any other perspective than the top-down — which is to say, from the perspective of the intellectuals themselves. The reason has been the arrangement of the archival material. To locate the books written by or about Ernst Haeckel is quite feasible. But to locate all the chapters, magazine articles, book reviews, lectures, encyclopedia entries, and other sources written about him in his own lifetime, would have made impossible demands on the time of even the most dedicated researcher. Haeckel himself could not have known everything that was being written about him. Today, however, a much more accurate and complete view is available. According to court documents produced during a legal dispute between Google and

the Author's Guild, between 2004 and 2013, Google Books digitized more than 20 million volumes — or, in other words, about one-seventh of the world's total.[20] Among these are compendia of periodicals, edited and published under the periodicals' own names within several years of their original publication, and preserved on library shelves to this day. Often, they have been rendered in formats which allow for keyword searches, thus making it possible to bring the perspectives of once-obscure historical actors to light. As a result, a bottom-up perspective has become possible. In this respect, the positions of the Victorian microscopist and the modern electronic researcher are similar. The object of our study was present all along, but it has only become accessible with the advent of new technology. This study takes advantage of new information technology to render such a perspective on one of the nineteenth century's most prominent scientists and science popularizers.

Haeckel's Evolutionary Science and Pantheistic Theology

In 1870, Haeckel's native Prussia led the North German Confederation to victory over Napoleon III's Second Empire. Their victory was crushing: the main Imperial army was surrounded at Sedan, the Emperor taken prisoner, and his regime left to collapse. Otto von Bismarck, who had engineered the war for just this purpose, used the exhilaration of the moment to have his sovereign promoted from King of Prussia to Emperor of Germany and his nation from the "Germanies" to the German Empire. The French were forced to pay a huge indemnity, to surrender the border province of Alsace-Lorraine, and to endure the humiliation of having the German Empire proclaimed in Louis XIV's Hall of Mirrors. Many Germans concluded, understandably, that war was both noble and profitable. This experience of the war lent an aura of intrinsic plausibility to the argument on which Haeckel, and not a few of his contemporaries, were to stake their reputations: that struggle was the good and necessary path to improvement for the individual, the nation, and the race.[21] Indeed, Darwin had shown it was true. Life was not characterized by the degradation of sin and the hope of salvation, as Christian theology taught, and it certainly was not ruled over by a wise and benevolent providence. On the contrary, Haeckel explained:

> *If we contemplate the common life and the mutual relations between plants and animals (man included), we shall find everywhere, and at all times, the very opposite of that kindly and peaceful social life which the goodness of the Creator ought to have prepared for his creatures — we shall rather find everywhere a pitiless, most embittered,* Struggle of All Against All. *Nowhere in nature, no matter wherever we turn our eyes, does that idyllic peace, celebrated by the poets, exist; we find everywhere a struggle and a striving to annihilate neighbors and competitors. Passion and selfishness — conscious or unconscious — is everywhere the motive force of life.*[22]

Christian theology, beginning from the premise of an omnipotent and benevolent Creator, could not but

regard evil and suffering as an anomaly. They presented for Christian theology a problem to be explained. But if, as John Hedley Brooke has commented, "one can see why it has been said that the theologian's problem had become Darwin's solution" the converse can also be said: the theologian's "problem of evil" became the Darwinian's "problem of altruism."[23] For how, if nature was a continual storm of ruthless violence, could the existence of selflessness and cooperation be accounted for? The good and all-powerful God of Christianity, for whom the existence of evil was an affront, became, as Haeckel's comments show, the malevolent and all-powerful "god" of Nature, for whom the existence of altruism became an affront. In both cases, considerable theoretical sophistication had to be deployed in order to reconcile the cohabitation of seemingly incompatible principles beneath the same general, explanatory framework.

Haeckel leaned heavily on the optimism which saturated the Victorian era in order to address this problem. Struggle and suffering were good, he taught, because they lead to progress.[24] After all, anyone who was acquainted with the facts of biology, as Charles Darwin had revealed them, could see that the struggle of various creatures for their existence produced the highest and most exalted type of organism: humans in general, and Northern-European, male, professional scientists like Ernst Haeckel in particular. And anyone could see that the struggle of science against Christianity was also beneficent, since, according to Haeckel, it was leading to the general recognition that science provided the most credible answers to the most important questions, where Christian theology could offer nothing but obfuscation and oppression. That was why, he argued, evolutionary biology was sure to encounter such stiff clerical opposition. Because Christianity thrived on ignorance, and science on knowledge, how could they help but come into conflict? Left implicit in his argument, any German could see that the recent struggle against France in the Franco-Prussian War of 1869–1870 led to long-desired national unification in the declaration of the German Empire. It was easier to make the case for the beneficence of struggle, and more intuitive to affirm it, against the backdrop of such an event. Thus Haeckel's "most embittered struggle" recreated in nature what Bismarck's "blood and iron" approach had already created in national politics.

In both the German Empire and in the United States, the dislocations produced by industrialization were keenly felt. In both, it propelled business owners and professionals to positions of power once occupied by the agrarian aristocracy — the "Junkers" in Germany, and the "Planters" in the United States. Haeckel believed that evolutionary biology demonstrated the existence of a "law of progress," whereby higher forms of life must arise from lower.[25] By presenting evolutionary biology as a story of progress, Haeckel was, in effect, presenting himself to the new industrial elite as a spokesman, someone who could legitimate their aspirations to prestige and power in terms at once scientific and theological.[26] The rise of the higher organisms from the lower, according to Haeckel's "law of progress," recreated in nature the story of the industrial

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elite's own rise to power in society, as did the rise of evolutionary biology against other types of explanation in the scientific community.[27]

Thus, rapid political and economic changes conspired with the tremendous impact of Darwin's *Origin* to call into doubt the intellectual authority of the Protestant and Catholic clergies who had presided over a world so recently thrown into confusion. This was part of the circumstance that the "social Darwinists" — T. H. Huxley, Francis Galton, William Graham Sumner, John Fiske, Ernst Haeckel, and others, but, above all, Herbert Spencer — exploited. Evolutionary biology would legitimate the new society as theology had the old.

It is not surprising, in light of these developments, to discover a hardening of positions all around. On the Catholic side of Christian theology, the First Vatican Council met in the years 1869–1870, and formulated the doctrine of papal infallibility in order to bolster the authority of the Roman Catholic Church. The announcement was met with disgust and anger by both the Protestant clergy and secular intellectuals who wanted to see science displace theology — even as they advanced their own competing and equally uncompromising claims to primacy. On the Protestant side, B. B. Warfield, the student and successor of Darwin's opponent, the Presbyterian theologian Charles Hodge, developed his doctrine of plenary inspiration, which powerfully informs Protestant fundamentalist theology to this day. According to this view, the Bible is the word-by-word, line-by-line autograph of the Almighty, and therefore cannot be in error.[28] Combined with a reassertion of the traditional Protestant emphasis on the "plain meaning" of the text, plenary inspiration amounted to an uncompromising declaration of primacy on the part of the Protestant clergy or, at any rate, those of the Protestant clergy who adopted it.

Secular, scientifically-inclined intellectuals, too, often hardened their outlook during these years. In 1874, the chemist and future president of the American Chemical Society John William Draper published his *History of the Conflict between Religion and Science* — a highly polemical attack on Christianity in general, and Catholicism in particular. He argued that the Catholic clergy had always feared the advance of knowledge and had done everything in its power to suppress it.[29] Hence, Christianity and science represented polar extremes in the quest for knowledge — the one an enemy, the other a hero, locked in a cataclysmic struggle for the fate of humanity. Draper's book bears approximately the same relation to the history of religion and science as George McReady Price's *Outlines of Modern Christianity and Modern*

Science does to the history of life and the earth.[30] The pseudohistorical "conflict thesis" launched by Draper's book, and the pseudoscientific "flood geology" launched by Price's, have served similar functions for the contending parties of extremists. Both propagate a mythology which pits their own champions against a benighted tyranny of "experts" — clerical or scientific, their role in the drama is the same — with nothing less than the survival of truth as the prize to be secured.

Haeckel, writing from a similar point of view, made ample use of conflict mythology in his books. His strategy was to direct his volleys primarily at the Catholic Church but to argue in such a way that a committed Protestant could hardly fail to understand that their own faith was under attack. It is, indeed, difficult to overstate Haeckel's bitterness on this point. As Mario Di Gregorio has explained, "it often seems as if Haeckel took events as personal offences from the personal God of the Christian tradition."[31] Gregorio and Richards agree that the roots of his animosity lay in the death of his beloved wife, Anna Sethe, at about the same time he became convinced of the omni-explanatory power of evolutionary biology.[32] Lonely, embittered, protected by a powerful patron (the Duke of Weimar), and conscious that he was on the cutting edge of scientific discovery, Haeckel saw little reason to restrain himself. He asked, in a characteristic passage:

> *How do matters stand with regard to the morality of the priests who announce themselves as the ministers of God's Word, and whose duty is therefore above all others to carry out the saving doctrines of Christianity in their own lives? The long, unbroken, and horrible series of crimes of every kind which is offered by the history of the Roman Popes is the best answer to this question. And just as these "Vicars of God on earth" did, so did their subordinates and accomplices, so, too, have the orthodox priests of other sects done; never failing to set the practice of their own course of life in the strongest possible contrast to those noble doctrines of Christian love which were constantly on their lips. And as with Christianity so it is with every other religious and moral doctrine.*[33]

Christians also insulted God with their "low dualistic conception" which "corresponds with a low animal stage of development of the human organism." He wrote:

> *The more developed man of the present day is capable of, and justified in, conceiving that infinitely nobler and subtler idea of God which alone is compatible with the monistic conception of the universe, and which recognizes God's spirit and power in all phenomena without exception.... By it we arrive at the sublime idea of the Unity of God and Nature.*[34]

Haeckel was thus, by his own account, a pantheist in the line of Bruno, Spinoza, and Goethe — more, not less, religious than his theological opponents — and dedicated to all-out war against the Christian clergy.[35] But it has always been a challenge for pantheists to clarify the question of wherein their doctrine

differs from atheism. After all, a person who can put God in the place of Nature, and speak enthusiastically of the identity of the divine with the mundane, can just as easily put Nature in the place of God, and never speak of the divine at all. The "sublime idea of the Unity of God and Nature" logically precluded any differentiation between the two and could be difficult to distinguish from atheism. But it would have been difficult for Haeckel to openly declare himself an atheist, for in the Victorian era the value and importance of *some* form of religion was generally agreed upon. As a practical matter, pantheism served to deflect charges of atheism, which, as we will see, were not slow in coming. But this is not to say that it was insincere. According to Gregorio, Haeckel was "deeply religious, and thought it important to understand, and then expose to the public, the kind of meaning science could give to human life."[36] He seems, like Robert Boyle in the seventeenth century, to have thought of himself as a priest of nature. Hence if God and Nature were a unity, so too were theologians and scientists, and so too theology and science — so thorough was Haeckel's evolutionary monism.

On this conception of science, conflict with the Christian clergy was both inevitable and right. Indeed, what could have been more Darwinian? In the "most embittered" struggle for their existence, only the fittest theologians would survive. It was a contest, Haeckel declared, between the "more developed man of the present day," with his "infinitely nobler and sublimer idea of God," and those still in a "low animal stage of development," with their "low dualistic conception of God."[37] "The history of evolution," he wrote, "is the heavy artillery in the struggle for truth," before which "whole ranks of dualistic sophisms fall … as before the chain shot of artillery." It was for just this purpose, Haeckel declared, that he wrote, for "the chief value of [scientists'] hard-won knowledge of details lies in the general results which more comprehensive minds will one day derive from them."[38]

Reception of Haeckel's Science and Theology in the United States[39]

It is no wonder, then, that his work met with such a hostile reception in the United States. Journalists and ministers frequently attacked him as an atheist attempting to hijack science for his own purposes. "In the beginning was the nebula, and all things came out of the nebula," a journalist working for the *New Outlook* wrote with disgust, dismissing Haeckel's arguments.[40] "It gives a painful idea of the intellectual and moral status of a people [i.e., Germans, especially German intellectuals such as Haeckel]," the *North American Review* commented, "when the prospect of destroying the faith of mankind in a God is received with cheerful enthusiasm; and it is evident that we have here a reaction against bigotry which is as morbid and unnatural as was the ecclesiastical superstition it attacked."[41] The *International Review* complained, "While he can see nothing inconceivable in the idea of eternal and immutable laws, on the other hand he sees nothing in the possible work of a creator except what is arbitrary, capricious, or miraculous."[42] Haeckel was often represented in the periodical press as a person on the outermost

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extremes of reasonable discussion, at least when it came to religious topics, because he saw science and revealed religion as irreconcilable opponents.

Ministers were occasionally amiable, as in the *Unitarian Review and Religious Magazine*, which — though regretting his polemics and dismissing much of Haeckel's argument as speculation — found that "there are no real facts which Haeckel presents of which any liberal theologian need be afraid."[43] But the response of Charles Hodge, a very prominent Presbyterian theologian, was more typical. He devoted a sub-chapter of his book, *What is Darwinism?*, to Haeckel. "Haeckel says," he wrote, "that Darwin's theory of evolution leads inevitably to Atheism and Materialism. In this we think he is correct."[44] The *American Church Review* also objected to Haeckel's presumed atheism, writing that "this supposed consequence of the Darwinian philosophy is over and over again presented as the crowning merit of the author, and as the grandest achievement of the age, or of any age."[45] The *Methodist Quarterly Review* was more representative, however, thundering that "Atheism plus Darwinism equals Brutalism: the beastliest philosophy to ever nightmare the human soul."[46] Although Haeckel was, on his own terms, a pantheist rather than an atheist, for American ministers this was a distinction without a difference. As Haeckel himself had written, "*Where faith commences, science ends.*"[47]

Charges of atheism were not as frequent in scientific publications. From a technical point of view, such charges would have been irrelevant, and would have simply replicated Haeckel's original sin of transgressing the boundaries between science with theology. As we will see, however, scientists found other grounds on which to contest his views. In sum, accusations of atheism presented a major hindrance to the dissemination of Haeckel's ideas in the United States. His claim to stand for true, scientific religion was routinely and angrily rejected.

In his *History of Creation*, Haeckel noted that "the reproach which is oftenest made against the Descent Theory [i.e., Darwinian biology] is that it is not securely founded, not sufficiently proven," and pointed these critics to his recent study of sponge physiology for their answer.[48] Darwin was indeed reproached frequently with having transgressed established canons of scientific rationality. The situation in Darwin's time can be usefully, if

...of the omni-explanatory power of evolutionary biology

anachronistically, compared to that of string theory in our own. String theory offers a powerful explanatory framework for physics, with the potential to unify quantum mechanics and relativity, and has enthusiastic advocates. For all anyone knows, it could be true. But it also has critics who reject it as speculative and unempirical, and hence not "real" science.[49] If string theory gains sufficient support within the physics community to become established as the "theory of everything" — the "holy grail" which scientist-popularizers such as Stephen Hawking have been promising for decades — then a similar adjustment to the canons of scientific rationality might follow. In that case, criticisms which are now being offered by string theory's opponents could easily be made to seem — in hindsight, and by the eventual victors in the debate — rigid, dogmatic, perhaps even personally-motivated or dishonest. It would become challenging to think oneself back into the frame of mind from which those criticisms originated. Something very much like this seems to have occurred in the case of evolutionary biology, only magnified many times over, since it involved not only scientific questions, but also political and theological inquiries.

Such debates about acceptable methods have higher stakes than the success of any particular theory. The preeminence of science — as not just a body of good guesses, but of established knowledge, which are entitled to an extraordinary degree of deference from both the public and other intellectual communities — depends on claims to methodological rigor. Therefore, contests over disciplinary boundaries are implicitly contests about the credibility of science as a whole. On the one hand, scientists must be free to go where the evidence takes them, otherwise they are followers of an arbitrary creed. On the other hand, if just any sort of theory can pass for science, then the claim to methodological rigor is compromised, and again the enterprise can be made to seem arbitrary. The paradox is not easily resolved, for to assert either methodological rigor or explanatory freedom too strongly is to open science to external attack.

In Darwin's time, the need for methodological rigor tended to receive the greater emphasis. As James R. Moore has explained, "the standard of proof in scientific explanation remained, in Darwin's day, one of full and final certainty."[50] Newton's *hypothesis non fingo* set the tone for an age which regarded the truth of his theories as permanently established, and, like Euclid's geometric axioms, closed to future revision.[51] The scientist's freedom to follow where the evidence led was thus secured by his reciprocal obligation to report, not speculation, but certain knowledge. But Darwin admitted in his correspondence that he had not done that. He wrote:

> *The manner in which I wish to approach the whole subject & in which it seems to me may fairly be approached, I can best illustrate by the case of Light.— The Ether [sic] is hypothetical, as are its undulations; but as the undulatory hypothesis groups together & explains a multitude of phenomena, it is universally now admitted as the true theory. The undulations in the ether are considered in some*

> *degree probable, because sound is produced by undulations in air. So natural selection, I look at as in some degree probable, or possible, because we know what artificial selection can do.— But I believe in Nat[ural] Selection [sic], not because, I can prove in any single case that it has changed one species into another, but because it groups & explains well (as it seems to me) a host of facts in classification, embryology, morphology, rudimentary organs, geological succession & Distribution [sic].*[52]

Thus the explanatory virtue of fruitfulness was to take the place of that of certainty as the most important criteria of evaluation.[53]

If Darwin's views were controversial by the canons of scientific rationality current in his time, Haeckel's science-theology was clearly out of bounds. He was easily pilloried as an undisciplined speculator, and, in view of his aggressive handling of scientific evidence, the charge stuck. His polemical style only compounded the perception. Haeckel wrote with the authority of a Newton — a person who "framed no hypotheses" — but did so in favor of a Darwinian science which was exactly that, whose author did not pretend otherwise, and which was continually exposed to attack for precisely this reason. He was claiming more certainty, and doing so on a less certain basis, than the norms of his time permitted.

Scribner's Monthly reprimanded him for his "overweening positiveness respecting many matters upon which there is fair ground for a difference of opinion." Turning the tables on his anti-clerical polemics, this contributor argued that "he would have done well to say less concerning the *odium theologicum* and display less of the *odium scientificum*."[54] The *International Review* warned that "the reader needs… to be on his guard against assumptions of what should be proved, and vague reasonings from analogy."[55] The point was also taken up in a "letter to the editor," written to the *Nation*:

> *To read some of the writers on the Darwinian theory, one would imagine we were on the eve of another Inquisition; the imaginary martyrdom suffered by Haeckel must be nearly intolerable.... But are we not more in danger of the opposite extreme? Is not religious intolerance in a fair way of being replaced by scientific intolerance?*[56]

Haeckel's dogmatic and polemical style was frequently criticized in the American periodical press.

Ministers, who had much more to take offense at in Haeckel's work, and whose territory Haeckel was invading, were correspondingly more severe in their criticism. "The lofty and repeated shrieks of Herr Haeckel are not so much science as atheism struggling to ensconce itself under a scientific structure," the *Methodist Quarterly Review* warned.[57] "He invents groups of 'ancestors' which nobody ever saw," the *Churchman* complained, "of whose existence there is no trace or phenomenal proof.... Who accepts the original postulate, and swallows all the subsequent guesses, will write Q. E. D. after the infallible conclusion."[58] The *American Church Review* was equally caustic: "Mr. Haeckel's book may be described as a

Haeckel was a panthiest, more, not less, religious than his theological opponents and dedicated to an all-out war against the Christian clergy

collection of mistakes and confusion in two volumes.... such a labored mass of pretensions and inconsequence we have seldom seen."[59] Less irately, but in the same vein, *Bibliotheca Sacra* commented that "Schmidt and Haeckel are too ready to reason upon the subject from *a priori* principles, and are offensively dogmatic."[60] It is noteworthy that the most persistent line of defense employed by these ministers was not that Darwin's views, or Haeckel's, were incompatible with revelation, but that they were incompatible with the principles of science.

Criticisms of Haeckel, on the grounds that he was an undisciplined speculator, were hardly confined to journalists or ministers. They were also made by the scientists for whom Haeckel claimed to speak. They frequently accused him of mishandling his evidence. "Haeckel's work is inaccurate to a startling extent," Charles Sedgwick Minot, writing for the *American Naturalist*, noted, for "He figures in detail things he cannot have seen, because they do not exist, and he describes phenomena that do not occur.… [I]t is unsafe to quote his writings as authorities in matters of fact." Minot further regretted that Haeckel was regarded "with almost unqualified admiration" by some of his younger colleagues.[61] Elsewhere, Minot wrote that Haeckel had "resigned his right to be reckoned an equal in the circle of serious investigators," through his mishandling of scientific evidence, and listed, in support, numerous researchers who had criticized Haeckel.[62] In *Popular Science Monthly*, his fellow materialist and popular science writer, Karl Vogt, dismissed Haeckel as "the zoological pope," and chastised "the brusqueness with which he has striven and still strives to impose his exceedingly poetic fancies upon others."[63] They could hardly have been more clear, or unequivocal, in their condemnation.

His most consistent opponent within the scientific community, by far, was Alexander Agassiz. He was the son of Darwin's old nemesis, Louis Agassiz, and, like Haeckel, a specialist in marine invertebrate zoology. Haeckel frequently used Alexander's father as a prop in his attacks on defenders of the "low dualistic conception" of God, and the "Creation theory" which went with it. The enmity must have been deeply personal for Haeckel, for he was still denouncing Louis Agassiz in 1904 — more than three decades after

his death.[64] Louis Agassiz held Haeckel in a similarly low regard, as Stephen Jay Gould — who discovered the old naturalist's copy of Haeckel's *Natural History of Creation*, complete with marginalia, in the Harvard library — has shown.[65] Alexander Agassiz, who adored his father, wrote scathingly about Haeckel in the *American Journal of Science and Arts*:

> *A man so skilled in coarse invective, who has risen to such a height of intolerance, is proof against anything so tame as fact or argument.... absurd claims to omniscience… deliberately falsifies facts… manufactures with names and figures an archetype which never existed… all the bitterness of his bigotry and dogmatism… with scientific productions like these we have no concern.... Haeckel's claim to be recognized as a true and devoted student of nature will be forgotten. In its place he will gain, what he seems to seek, the front rank amongst scientific demagogues.*[66]

The *Boston Society of Natural History* commented that his drawings were "wholly diagrammatic and could not have been drawn from either actual or optical sections," while the *American Journal of Microscopy* observed that his "misrepresentations necessarily justify more than the customary precaution in accepting as facts his evidence in other directions, wherever room is left for the slightest reasonable doubt."[67] Haeckel did not seem to have many defenders in the American scientific establishment, though his quieter contributions to the physiology of marine invertebrates were discussed on much the same terms as those of any researcher.

American journalists, ministers, and scientists occasionally complained about Haeckel's materialism as well. "Man and beast and potatoes are put on the same level," wrote Irenaeus Prime for the *New York Observer and Chronicle*, "having no functions except the corporeal, and with no principle of life which survives the dissolution of the corpus."[68] Another journalist, writing for the *International Review*, complained "that while… no power is admitted outside of matter itself, we are required to assume, without any cause, the existence of matter and its potencies and tendencies, the whole of which are coolly taken for granted and reasoned on."[69] Observing German-American communities, a journalist for *The Atlantic* wrote that "the minds that form theirs are German; they read Büchner, Vogt, and Haeckel. The German radical or the German materialist is not as fair-minded as the American who entertains the same views. It were hard to find any one more positive or more impatient of contradiction."[70] American journalists often rejected Haeckel's materialism as speculative and superficial.

Ministers also objected to Haeckel's materialism. The *American Church Review* thought it obvious that living things were designed on an ideal plan, for:

> *what would be the value… of the materials of a ship, or of a locomotive, without the spirit-power that contrived and adjusted the several parts, and ordered their relations to one another? Of what value would the wood and the iron used in these grand achievements*

> *of human genius be, without the spiritual intelligence that conceived and adjusted the relations of these materials, and foresaw and ordered the result of those relations?*[71]

The *Methodist Quarterly Review* ridiculed Haeckel's materialism: "Spinoza, Haeckel, with pantheist and atheists generally, boast of reducing all things to a single primal substance. Is it not a poor, tame, groveling boast?"[72] In a more analytic vein, the *Presbyterian Quarterly and Princeton Review* devoted a lengthy article, in which Haeckel featured prominently, to criticizing "Materialism in Germany."[73]

American scientists were divided on the question of Haeckel's materialism. The *American Journal of Microscopy* reported of a conference: "it was generally agreed that the theory of evolution includes the origin of life by natural processes from inorganic matter, and that such an origin is no more improbable than any other tenet of evolution."[74] The *American Naturalist* affirmed that "the essential elements of the problem [i.e. of life] are undoubtedly to be expressed in terms of matter and force without respect to what the nature of that matter may be."[75] But *The Popular Science Monthly* dismissed Haeckel's materialism, writing that it was "quite in the spirit of the false philosophy… which has been so pernicious to German science."[76] Materialism was, in sum, frequently rejected on the grounds that it was speculative, superficial, and contrary to common sense, though Haeckel was hardly alone, among scientists, in defending it.

American journalists, ministers, and scientists accused Haeckel of violating norms of scientific rationality by indulging in undisciplined speculation and dogmatic polemics. They rejected his claim to represent empirical, fact-driven science, and also genuine theology. Though, by his own lights, he was a pantheist, and more, not less, pious than Christian theologians, he seemed to most American journalists and ministers an atheist and a materialist, and hence representative of the very antithesis of genuine piety. American scientists were also severe in their criticism of his larger, synthetic project. They attacked his credibility as a scientist on the grounds that he falsified and mishandled evidence. They tended to abstain from commenting on his pantheism, however, and to return mixed results concerning his materialism. When they did evaluate his materialism, it was as a scientific, not a theological, proposition.

As we have seen, Haeckel's American readers were aware that science, as they conceived it, was not Haeckel's main concern. He said, and they agreed, that his principal motive for pursuing it was to further a larger project, for "the chief value of [scientists'] hard-won knowledge of details lies in the general results which more comprehensive minds will one day derive from them."[77] In his view, this was the unification of true science with true theology; from the standpoint of American commentators, it was a speculative and unworthy product, packaged in

offensively dogmatic language. Thus, Haeckel's "monographs on the universe" could not be accepted, either as genuine science or genuine theology.[78] In the fluid situation which resulted from the publication of *Origin*, the boundaries of science as a whole were being redrawn — a development which could not but concern theologians, involving as it did the nature of God, the authority of scripture, and the goodness of creation. In this respect, Haeckel's unification of science and theology represents a road not taken. ◆

Endnotes

[1] Erik Nordenskiöld, *The History of Biology: A Survey*, trans. Leonard Bucknall Eyre (London: Kegan Paul, Trench, Trubner, 1929), 515.

[2] Mario A. Di Gregorio, *From Here to Eternity: Ernst Haeckel and Scientific Faith* (Göttingen: Vandenhoeck & Ruprecht, 2005), 17; Nick Hopwood, *Haeckel's Embryos: Evolution, Images, and Fraud* (Chicago: University of Chicago Press, 2015), 3; Robert J. Richards, *The Tragic Sense of Life: Ernst Haeckel and the Struggle Over Evolutionary Thought* (Chicago: University of Chicago Press, 2008), 2.

[3] Richards, *Tragic Sense of Life*, 2, 94.

[4] Gregorio, *From Here to Eternity*, 574.

[5] Described in Frederick Gregory, *Scientific Materialism in Nineteenth Century Germany* (Dordrecht,Holland: Springer, 1977), *passim*.

[6] Edward I. Sears, ed., "The Cell-Theory and some of its Relations," *The National Quarterly Review*, 30 (1875): 325, accessed April 15, 2018, http://hdl.handle.net/2027/iau.31858045492257.

[7] Gregorio, *From Here to Eternity*, 544.

[8] Stephen Jay Gould, *Ontogeny and Phylogeny* (Cambridge, MA: Belknap Press of Harvard University Press, 2003) has also discussed Ernst Haeckel, but it is almost exclusively concerned with one aspect of Haeckel's work, his "biogenetic law," and reliant on Gasman's *Scientific Origins* for biographical and contextual information.

[9] Daniel Gasman, *The Scientific Origins of National Socialism: Social Darwinism in Ernst Haeckel and the German Monist League* (London: Macdonald & Co., 1971), xxxviii.

[10] Gasman, *Scientific Origins*, 10–11.

[11] C. A. Culotta, "Review of *The Scientific Origins of National Socialism. Social Darwinism in Ernst Haeckel and the German Monist League,* by Daniel Gasman," *Isis* 63, no. 4 (Dec. 1972): 587–588; Ralph H. Bowen, "*The Scientific Origins of National Socialism: Social Darwinism in Ernst Haeckel and the German Monist League* by Daniel Gasman," *The American Historical Review* 78, no. 3 (Jun. 1973): 711–712.

[12] Gregorio, *From Here to Eternity*, 561; Richards, *Tragic Sense of Life*, 448–453; Richard Weikart, *From Darwin to Hitler: Evolutionary Ethics, Eugenics and Racism in Germany* (New York: Palgrave MacMillan, 2004), 70.

[13] Richards, *Tragic Sense of Life*, 8, 376, 439.

[14] Ibid., xviii, 108, 166, 439.

[15] Ibid., 448–453.

[16] Ibid., xviii, 398–403, 500–503.

[17] Gregorio, *From Here to Eternity*, 200–201, 364–376, 570–574.

[18] Ibid., 21, 574.

[19] Ibid., 21–25, 27–29, 560–563.

[20] That is to say that the total number of unique editions of books which appear in library records, not of individual physical copies. Thus one English edition of Haeckel's *Natural History of Creation*, printed 20,000 times, would count as one book, not 20,000. *Authors Guild, Inc. vs. Google, Inc.*, 1 (S.D. N.Y. 2013), accessed April 15, 2018, https://www.scribd.com/document/184162035/Google-Books-ruling-on-fair-use-pdf; "Books of the World, Stand Up and be Counted! All 129,864,880 of You," *Google Book Search*, August 5, 2010, accessed April 15, 2018, http://booksearch.blogspot.com/2010/08/ books-of-world-stand-up-and-be-counted.html.

[21] Mike Hawkins, *Social Darwinism in European and American Thought, 1860–1945: Nature as Model and Nature as Threat* (New York: Cambridge University Press, 1998), 137.

[22] Ernst Haeckel, *The History of Creation, or, The Development of the Earth and its Inhabitants by the Action of Natural Causes, 2 vols.*, trans. E. Ray Lankester (New York: D. Appleton, 1876), v. 1: 20, accessed April 15, 2018, http://hdl.handle.net/2027/chi.27459469. Italics in the original. See also Hopwood, *Haeckel's Embryos*, 63.

[23] John Hedley Brooke, *Science and Religion: Some Historical Perspectives,* Canto classics edition (Cambridge: Cambridge University Press, 2014), 431.

[24] Hawkins, *Social Darwinism*, 135.

[25] Haeckel, *History of Creation*, v. 1: 16. There has been some controversy over the question of whether Haeckel should be considered a "Darwinian" in the sense of having faithfully communicated Charles Darwin's own views, or some reasonably cogent interpretation thereof. According to Mario Di Gregorio and Peter Bowler, Haeckel misunderstood Darwin and should not be counted a "Darwinian." According to Robert Richards, Haeckel was Darwin's "authentic intellectual heir." Certainly, this is how Haeckel understood himself. "There is no doubt," he wrote, referring to Darwin's work in *Origin*, "that this immense extension of our intellectual horizon must be looked upon as by far the most important, and rich in results, among all the numerous and grand advances which natural science has made in our day." In order to avoid entering into the question, the term "evolutionary biology" has been preferred to "Darwinian biology" throughout. Peter J. Bowler, *Evolution: The History of an Idea, 25th anniversary ed.* (Berkeley: University of California Press, 2009), 187, 190–93, 240; Gregorio, *From Here to Eternity*, 19; Richards, *Tragic Sense of Life*, 376; Haeckel, *History of Creation*, v. 1: 1.

[26] Bowler identified this as a more general strategy of the Darwinian and social Darwinian intellectuals. As he has insisted, following Robert M. Young, "Darwinism is social." Bowler, *Evolution*, 97–98, 144; Gregorio, *From Here to Eternity*, 26.

[27] Hawkins, *Social Darwinism*, 143–144.

[28] Christopher Ben Simpson, *Modern Christian Theology* (New York: Bloomsbury T&T Clark, 2016), 155–57.

[29] John Draper, *History of the Conflict between Science and Religion* (New York: Appleton, 1874).

[30] George McReady Price, *Outline of Modern Christianity and Modern Science* (Oakland,

CA: Pacific, 1902).

[31] Gregorio, *From Here to Eternity*, 546.

[32] Ibid.; Richards, *Tragic Sense of Life,* 105–106.

[33] Ernst Haeckel, *Freedom in Science and Teaching: From the German of Ernst Haeckel* (London: C. Kegan Paul & Co., 1879), 97–98.

[34] Haeckel, *History of Creation,* v. 1: 70–71.

[35] Gregorio, *From Here to Eternity*, 45–46; Hopwood, *Haeckel's Embryos*, 66.

[36] Gregorio, *From Here to Eternity*, 573.

[37] Haeckel, *History of Creation*, v. 1: 70. See also Hopwood, *Haeckel's Embryos*, 66.

[38] Ibid., 79–80.

[39] For the sake of analytic clarity, this section has been organized into three sub-sections, each of which discusses a frequently-recurring argument against Haeckel's views — that they were atheistic, that they were dogmatic/speculative/unreliable, and that they were materialistic. Each subsection has been divided by the type of publication in which the argument occurs — journalistic, theological, and scientific.

[40] Taylor Lewis, "Uppermost Topics: An Impersonal God," *New Outlook* 40 (Jan.-June 1875): 146, accessed April 15, 2018, http://hdl.handle.net/2027/coo.31924066372271.

[41] "Carl Vogt," *The North American Review* (1821–1940) 110, no. 227 (Apr. 1870): 284.

[42] "Recent English Books: History of Creation," *International Review* (Jul. 1876): 537.

[43] S. J. Barrows, "Ernst Haeckel and His Theory of Development," *The Unitarian Review and Religious Magazine* 6 (July-Dec. 1876): 293, accessed April 15, 2018, http://hdl.handle.net/2027/iau.31858032670311.

[44] Charles Hodge, *What is Darwinism?* (New York: Scribner, Armstrong, and Company, 1874), 95.

[45] "The Infallibilities," *The Churchman* 39 (Jan.-Jun. 1879): 5, accessed April 15, 2018, http://hdl.handle.net/2027/mdp.39015086588673.

[46] "Quarterly Book Table," *The Methodist Quarterly Review* 59 (1877): 102, accessed April 15, 2018, http://hdl.handle.net/2027/umn.31951d003199172.

[47] Haeckel, *History of Creation*, v. 1: 9. Italics in the original.

[48] Ibid., xiv.

[49] See, for instance, Natalie Wolchover, "A Fight for the Soul of Science," *Quanta* (December 16, 2015), accessed April 15, 2018, https://www.quantamagazine.org/physicists-and-philosophers-debate-the-boundaries-of-science-20151216.

[50] James R. Moore, *The Post-Darwinian Controversies: A Study of the Protestant Struggle to Come to Terms with Darwin in Great Britain and America, 1870–1900* (Cambridge: Cambridge University Press, 1981), 195.

[51] *Hypothesis non fingo:* "I frame no hypotheses."

[52] Darwin to Cuthbert Collingwood, March 14, 1861, *Darwin Correspondence Project*, accessed April 15, 2018, https://www.darwinproject.ac.uk/letter/?docId=letters/DCP-LETT-3088.xml;query=14%20march%201861;brand=default.

[53] Moore, *Controversies*, 194–205.

[54] "Haeckel's Evolution of Man," *Scribner's Monthly* 19 (Nov. 1879–Apr. 1880): 149.

[55] "Recent English Books: History of Creation," 537.

[56] J. H. Richards, ed., *The Nation: A Weekly Journal Devoted to Politics, Literature, Science,*

and Art 23 (Jul. 1–Dec. 31, 1876): 286, accessed April 15, 2018, http://hdl.handle.net/2027/uc1.b000550405.

[57] D.D. Whedon, ed., "English Reviews," *The Methodist Quarterly Review* 61, fourth series, vol. 31, (1879): 753, accessed April 15, 2018, http://hdl.handle.net/2027/nyp.33433081737920.

[58] "The Infallibilities," *The Churchman* 39 (Jan.-Jun. 1879): 5, accessed April 15, 2018, http://hdl.handle.net/2027/mdp.39015086588673.

[59] James Craik, "The Revived Materialism," *The American Church Review* 32 (1880): 429, accessed April 15, 2018, http://hdl.handle.net/2027/hvd.ah68tw.

[60] George F. Weight, "Recent Works Bearing on the Relation of Science to Religion," *The Bibliotheca Sacra*, vol. 33, eds. Edwards A. Park, George E. Day, J. P. Thompson, and D. W. Simon (Andover: Warren F. Draper, 1876), 453, accessed April 15, 2018, http://hdl.handle.net/2027/nyp.33433081752416.

[61] Charles Sedgwick Minot, "A Sketch of Comparative Embryology," *The American Naturalist: An Illustrated Magazine of Natural History* 14 (1880): 249, accessed April 15, 2018, http://hdl.handle.net/2027/mdp.39015000399777.

[62] Charles Sedgwick Minot, "Criticisms of Haeckel," *The American Naturalist: An Illustrated Magazine of Natural History* 11 (1877): 368–371, accessed April 15, 2018, http://hdl.handle.net/2027/mdp.39015000399504. They were: the German physiologists Victor Hensen and Theodor Bischoff, the German zoologists Carl Semper, Robby Kossmann, and Eduard Oscar Schmidt, the German Chemist F. E. Schulze, the British morphologist Francis Balfour, the Russian zoologist Elias Mecznikow, the young French zoologist Jule Barrois, as well as the already-mentioned American zoologist, Alexander Agassiz.

[63] Karl Vogt, "Pope and anti-Pope," *The Popular Science Monthly* 14 (Nov. 1878–Apr. 1879): 321.

[64] Ernst Haeckel, *The Wonders of Life: A Popular Study of Biological Philosophy,* trans. Joseph McCabe (New York: Harper & Brothers, 1905), 352.

[65] Stephen Jay Gould, "Agassiz' Later, Private Thoughts on Evolution: His Marginalia in Haeckel's Natürliche Schöpfungsgeschichte (1868)," in *Two Hundred Years of Geology in America: Proceedings of the New Hampshire Bicentennial Conference on the History of Geology*, ed. Cecil J. Schannder (Hanover, NH: Univ. Press of New England, 1979), 277–282.

[66] Alexander Agassiz, "Botany and Zoology," *The American Journal of Science and Arts* 11, whole no. 111 (Jan.–Jun. 1876): 74, accessed April 15, 2018, http://hdl.handle.net/2027/hvd.32044102904091.

[67] J. S. Kingsley and H. W. Conn, "Some Observations on the Embryology of the Teleosts," in *Memoirs Read before the Boston Society of Natural History: Being a New Series of the Boston Journal of Natural History*, vol. 3 (Boston: Boston Society of Natural History, 1878–1894), 198. http://hdl.handle.net/2027/mdp.39015035552648. Nordenskiöld has concurred in their assessment, see *History of Biology*, 517; "Transactions of Societies," *The American Journal of Microscopy and Popular Science*, 5 (1880): 39, accessed April 15, 2018, http://hdl.handle.net/2027/hvd.32044081507246.

[68] Samuel Irenaeus Prime, "Made Without a Maker," in *Irenaeus Letters: Originally Published in the New York Observer* (New York: The New York Observer, 1881), 335, accessed April 15, 2018, http://hdl.handle.net/2027/mdp.39015010794108.

[69] "Recent English Books: History of Creation," 537.
[70] F. F. Lalor, "The Germans in the West," *The Atlantic Monthly: A Magazine of Literature, Science, Art, and Politics* 32 (1873): 459–470.
[71] James Craik, "The Revived Materialism," *The American Church Review* 32 (1880): 428–447, accessed April 15, 2018, http://hdl.handle.net/2027/hvd.ah68tw.
[72] Borden P. Bowne, "Studies in Theism," *The Methodist Quarterly Review* 61, fourth series, vol. 31 (1879): 775–778, accessed April 15, 2018, http://hdl.handle.net/2027/nyp.33433081737920.
[73] "Materialism in Germany," *Presbyterian Quarterly and Princeton Review, New Series* 4 (1875): 273–305, accessed April 15, 2018, http://hdl.handle.net/2027/umn.319510028071579.
[74] "Transactions of Societies," *The American Journal of Microscopy and Popular Science* 3 (1878): 263, accessed April 15, 2018, http://hdl.handle.net/2027/hvd.32044081507253.
[75] John A. Ryder, "The Gemmule vs. the Plastidule as the Ultimate Physical Unit of Living Matter," *The American Naturalist: An Illustrated Magazine of Natural History* 13 (1879): 17, accessed April 15, 2018, http://hdl.handle.net/2027/nyp.33433007813425.
[76] Emil du Bois-Reymond, "The Seven World-Problems," *The Popular Science Monthly* 20 (Nov. 1881–Apr. 1882): 435, accessed April 15, 2018, http://hdl.handle.net/2027/njp.32101010904744.
[77] Haeckel, *History of Creation*, 79–80.
[78] "The Cell-Theory and some of its Relations," *The National Quarterly Review* 30 (1874): 325, accessed April 15, 2018, http://hdl.handle.net/2027/iau.31858045492257.

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