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be separated from the *original* affair that climaxed in 1633, and the *subsequent* affair, which began after his condemnation and continues to the present day. Looking first at the structure of the original affair, he sees an undeniable conflict that takes the form of religion versus science, namely, religion attacking science. "The scientist Galileo," he writes, "was persecuted, tried, and condemned by institutions and officials of the Catholic religion" (p. 250). The subsequent affair also consists of a conflict between science and religion, but this time it takes the form of science versus religion. For the past four centuries, the Roman Catholic Church has been under fire from scientists and alleged representatives of the scientific method for its treatment of Galileo. This can be seen in the writings of Milton, Voltaire, and Einstein, which Finocchiaro considers merely the tip of an iceberg of anticlerical feeling. On the other side, the proclerical side, we find various apologists, such as Pierre Duhem and Paul Feyerabend, who attempted to defend the church and blame Galileo.

Finocchiaro claims to have followed Galileo's ideal of open-mindedness and to have dug below the surface of anticlerical criticism and proclerical apologetics. He believes he has found what he characterizes as a phenomenon of myth-making and mythologizing, that is, the rise, evolution, and fall of cultural myths. In the seventeenth century, various questions were raised about the physical truth of the motion of the earth, but science gradually established incontrovertibly that Galileo had been right on this issue. Galileo was also criticized for his hermeneutical principle that scripture is not a scientific authority; cultural developments also vindicated him in this regard, as is evidenced by the fact that this is now the official position of the modern Roman Catholic Church.

As it became increasingly clear that Galileo could not be validly accused of being a bad scientist, a bad theologian, or a bad logician, he started being blamed for other reasons. Some authors began to stress the legal aspect of the trial, charging that he had been guilty of disobeying the church's admonition regarding Copernicanism. Others blamed him for his epistemological realism and argued that the condemnation would have been avoided if epistemological instrumentalism had prevailed. In chapter five, Finocchiaro offers an interesting reappraisal of the first steps that the Inquisition took in 1615-1616 and that led to the condemnation of Copernicus. A high-ranking official, Michelangelo Seghizzi, is said to have enjoined Galileo to abandon completely the Copernican theory and, henceforth, not to hold, teach, or defend it in any way whatsoever. But it is also recorded that Galileo had just seen Cardinal Bellarmine who had issued a friendlier warning. Finocchiaro finds a number of inconsistencies in the available accounts, and he argues that Pope Paul V did

not intend an injunction as stringent as the one that was formulated by Seghizzi. This lack of clarity is important as it was to affect Galileo's trial seventeen years later.

Finocchiaro is also concerned with what he calls "the current spectacle of the Galileo affair." On the one hand, we witness the phenomenon of a rehabilitation movement within the Roman Catholic Church, which is exemplified in Annibale Fantoli, *The Case of Galileo* (2003). On the other hand, we see the rise of "socially oriented critiques of Galileo by leftist sympathizers and self-styled progressives," and we marvel at "the conflict between these two points of view, as well as the irony of the switching of sides" (p. 256).

In the context of the current controversies over the relationship between science and religion and between institutional authority and individual freedom, Finocchiaro pleads for a more fair-minded appraisal of the facts. We must take seriously the arguments for rejecting the ancient geostatic worldview voiced by Galileo's opponents but also defend him from uncritical praise or biased condemnation.

Few, if any, readers of this journal will want to dissent from the author's advice. It is commonsensical. We can perhaps regret that Finocchiaro did not quote recent works on Galileo in which we find a serious and scholarly attempt to explain what happened and to suggest what we can learn from the unfortunate and misguided battle between science and religion. One could mention, among other works, J. L. Heilbron's *Galileo* (2010) that offers an objective assessment of the clash between science and religion.

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THE GESTATION OF GERMAN BIOLOGY: Philosophy and Physiology from Stahl to Schelling by John H. Zammito. Chicago, IL: University of Chicago Press, 2018. 354 pages + 147 pages of notes, indices of names and of subjects. Hardcover; \$45.00. ISBN: 9780226520797.

John Zammito has published a substantial corpus of works on Immanuel Kant and contemporaries. He served as Weir Professor of History at Rice University from 2007 to 2019; this year he migrated to Rice University's Baker Residential College, where he is Baker College Chair for History of Science, Technology, and Innovation. Beyond his primary body of work on the history of ideas in the Enlightenment period, he has also authored a useful commentary on the modern ("post-positivist") history of the philosophy of science. He notes in his acknowledgment section that the present work is the result of ten years of labor. The thoroughness of his account is impressive; the book is not a quick read, and especially not if one takes the time to

glean the source documentation and commentary in the lengthy section of notes.

During the early eighteenth century, the mechanical-mathematical description of natural phenomena promoted by Descartes, Gassendi, Boyle, and Newton, was in its glory. Its clarity and cleanness of approach, especially manifest in Newton's *Principia*, provided strong support for the Cartesian reduction of living systems to machines. And beyond, it established the fruitfulness of experiments. But whereas a machine approach to living systems could prove successful in some dimensions, such as depicting a circulatory system as a device of plumbing and pump, other aspects of living systems proved more problematic. For example, the ability of life forms to organize themselves as they developed from an embryo, to take in nutrients and grow, and to repair and reproduce themselves argued that organisms were more than Cartesian-Newtonian clockworks. Enlightenment savants sought a more holistic model for organismal design, one which would include phenomena such as self-organization and goal-directed behaviors, while at the same time not falling back on Aristotelian, Hermetic, or other hidden spiritual forces. A clear identification of processes common to major groups of life, or perhaps all of life, would prove necessary.

The materials at hand were primarily those from two sources or practices: the long tradition of natural history, with its reservoir of comparative data for systematic organization; and medical physiology, which itself had a complicated and often contentious relationship with contemporaneous chemical researches. Both traditions were replete with teleological referents. Zammito chronicles the attempt by Enlightenment scientists and savants to articulate an overarching theoretical framework, or at least a research program, by which to unify these practices. By the mid-to-late eighteenth century, a major geographic center for this effort was concentrated in emerging German universities and medical schools, although prominent natural historians elsewhere, such as Boerhaave, Camper, Linnaeus, Maupertuis, and Buffon were marshalling data and ideas which pushed the discussion. Zammito judiciously dissects the ligaments of experiment, theory, and personality, which became intertwined as the new discipline of biology was birthed. I attempt to sketch some of the highlights of Zammito's narrative below.

The poet/physiologist Albrecht von Haller (1708–1777) is the focal personage of Zammito's early narrative, and a foil for further developments in the middle 1700s. Haller, a devout Bernese Calvinist, studied at Boerhaave's medical school in Leiden during the middle 1720s and then undertook advanced mathematical training with Johann Bernoulli in Basel. Along the way,

he became a respected anatomist as well as a convinced proponent for the experimental approach to physiology. Haller would land a position in anatomy at the University of Göttingen, where he published a critical edition of Boerhaave's works, as well as providing an introduction to the German translation of the first volumes of Buffon's *Histoire Naturelle*. In 1753, a substantive lecture delivered to the Göttingen Academy was published. In this lecture, Haller addressed two topics of physiological import: the "sensitivity" of nerves, and the "irritability" of muscular tissue. While Haller himself was inclined to interpret these as resulting from mechanism, this publication, as well as his several years of experiments (often on live animals), triggered a wide discussion on the nature of organisms and their behaviors. In 1753, Haller returned to Bern, where he would write works on embryology and compile massive bibliographies of physiological publications. Sensibility and irritability remained at the forefront of a growing list of phenomena demanding a different level of interpretation than that of wheels and pulleys.

Johann Friedrich Blumenbach (1752–1840) is central to the middle third of Zammito's narrative: he "came to be the patriarch of German life sciences well into the nineteenth century" (p. 186), taking on the role of biological authority following Haller's death in 1777. Blumenbach studied at Göttingen, where he received his appointment as extraordinary professor in 1776 and promotion to ordinary professor in 1778. He also served as an industrious curator of the university's natural history collections. His many publications included a two-volume *Handbook of Natural History* (1779–1780), which underwent many subsequent revisions, and a *Handbook of Comparative Anatomy* (1805). His students included Alexander von Humboldt, C. F. Kielmeyer, and G. R. Treviranus among others. He traveled and corresponded widely. While revering Haller, Blumenbach differed significantly on embryology: he sided with the rising epigenetic school of organismal development, rather than Haller's preformationist thought. Following Caspar Friedrich Wolff, Blumenbach believed that epigenesis, in turn, required an innate or immanent organizational principle within the organism, which Blumenbach famously named "Bildungstrieb" or formational drive. Propagation, nutrition, and regeneration were to be included as aspects of the Bildungstrieb.

Like Buffon, Blumenbach realized that Earth and its life were far older than the then-common belief of a few thousands of years. He took up the subject of fossils in the first and subsequent editions of the *Handbook of Natural History*, affirming a lengthy history to Earth and life. Engaging with the geology of his compatriot Abraham Werner as well as the Swiss Calvinist André de Luc, he opposed a cyclical view of geohistory then being elaborated by James Hutton. The distribution of

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fossils in successive stratal horizons argued that Earth catastrophes (“revolutions”) resulted in major extinction events followed by repopulations of Earth’s surface by new life forms. These biotic replacements, in fact, could well be a potential effect of the *Bildungstrieb*. However, Blumenbach did not feel free to postulate continuities in the history of life. Rather, following a major catastrophe, the *Bildungstrieb* would be forced into new directions, and new life forms (in many cases, not totally unlike prior forms) would naturally emerge.

The latter portion of Zammito’s volume includes a chapter on Carl Friedrich Kielmeyer (1765–1844) and his influence on the course of nineteenth-century-biological science. Zammito contends that Kielmeyer, although a student of Blumenbach’s, did not derive his biophilosophy from the Göttingen professor. Kielmeyer published little, but he influenced a broad cadre of his students at Stuttgart, as well as others, through unpublished and published class notes; he himself furnished annotated versions of his class notes to his friend Cuvier and to Goethe. His published 1793 address, “On the interrelations of the organic forces in the series of different organizations, the laws and consequences of these” set forth a rationale for organizational and research principles for what Treviranus would later term “biology” (1802). Kielmeyer described organic systems as supervening on organic chemistry but as entirely natural, thus requiring a new layer of laws and an organizational schema which, in turn, required a historical-hierarchical structure to the realm of living creatures. Zammito documents the energizing effect of this proposal for the biology of the first half of the nineteenth century.

A running dialogue between these early biologists and contemporary philosophers, including Diderot, Herder, Kant, Goethe, and Schelling, helped variously to clarify or complicate epistemological issues or the warrant for research. Schelling’s proposal, which he termed “*Naturphilosophie*,” affirmed that life’s organization could be investigated via natural principles and appeared to resolve some of the epistemological issues posed by Kant. It would prove inspirational to Ignaz Döllinger, and through Döllinger, to the anatomists von Baer, von Pander, and Oken. However, Schelling’s conjunction of *Naturphilosophie* with Spinozism led to disenchantment with *Naturphilosophie* among German scientists of the next generation.

Zammito’s book is thorough and thoughtful. He is fluent in the primary literature and effortlessly dialogues with both past and contemporary interpreters. In places, he graciously but unapologetically disagrees with some of his colleagues. It may well be the case, as Stephen Gaukroger claims in his jacket recommendation, that “*The Gestation of German Biology* is his

crowning achievement.” It is of great use as a reference and highly recommended.

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MEDICINE AND HEALTH

FEARFULLY AND WONDERFULLY: The Marvel of Bearing God’s Image by Paul Brand and Philip Yancey. Downers Grove, IL: InterVarsity Press, 2019. 272 pages. Hardcover; \$14.59. ISBN: 9780830845705.

I first read Paul Brand and Philip Yancey’s books, *Fearfully and Wonderfully Made* and *In His Image*, in the 1980s. I loved them so much that, when I began teaching anatomy courses as a faculty member in the mid-1990s, I made *Fearfully and Wonderfully Made* required reading for students in my human anatomy courses. Now, after more than two decades of reading student journal responses to this thoughtful and deeply meaningful book, I can say with confidence that it has been an excellent tool in helping students integrate anatomy and their Christian faith. Therefore, when *Fearfully and Wonderfully: The Marvel of Bearing God’s Image* was released, I couldn’t wait to read it. *Fearfully and Wonderfully* combines the original two books into one volume. Brand died in 2003, so to write this revised and updated combined edition, Yancey went back to his original interview notes and Brand’s writings, and also incorporated updated information.

The familiar verses of Romans 12:4–5 introduce us to the image of the Body of Christ as an analogy for the church. In Romans, Paul teaches us that every part of that Body plays its own important role. In *Fearfully and Wonderfully*, Brand, through the pen of Yancey, expands the scriptural image of the church as the Body of Christ with unforgettable stories of Brand’s work with lepers in India and in the United States. For example, he asks the reader to consider the body’s skeleton. Our skeleton provides more freedom than restriction compared to organisms that have an exoskeleton, such as a crayfish. In an analogous way, God’s laws are intended to free us rather than restrict us. I was particularly convicted when he pointed out that, like an exoskeleton, rigid, rule-focused faith does not accommodate the kind of growth and adaptation that a grace-focused internal skeleton does. He reminds us of the importance of touch and the miracle of the compliancy of skin, urging us to consider the value of compliancy when we (Christians) work and live among others who may not share our beliefs and values. And he asks us to think more deeply about what the Lord’s Supper means if we more fully understand the structure and function of blood.