surgery. As Fye demonstrates, the Mayo Clinic's contributions to cardiology, particularly cardiac surgery, reflected its role as an incubator of invention and innovation.

The final section of *Caring for the Heart* explores the dynamics that linked subspecialization with the introduction of new diagnostic and therapeutic technologies. Diagnostic innovation begat surgical innovation; surgical innovation begat diagnostic innovation. Patients recovering from acute heart attacks and open-heart surgery required specialized monitoring, leading to the implementation of coronary care units based on the intensive care concept. Cardiac catheterization, first employed at the Mayo Clinic in the 1940s, enabled heart specialists to measure blood pressure and oxygen content and diagnose congenital heart defects. Catheters proved to be particularly versatile. By the 1960s, cardiologists employed them to introduce contrast media and visualize arterial blockages (coronary angiography), which in turn led to the adoption of specialized catheters in the 1980s to remove arterial obstructions (angioplasty) or place mesh stents inside arteries.

Caring for the Heart represents the product of a nearly four-decade-long career as a medical historian and practicing cardiologist. Fye introduces and explains complex medical conditions, diagnostic technologies, and therapeutic procedures in clear and accessible language. He balances oft-told accounts, such as the development of heart transplantation, with lesser-known ones, like the efforts to keep President Franklin Delano Roosevelt's heart troubles under wraps. He also offers the first definitive account, based on Mason Sones's own procedure notes, of the serendipitous production of the first selective coronary angiogram. The narrative incorporates accounts of patients both famous and unknown, and Fye masterfully weaves together a substantial collection of institutional records and archival materials as well as published sources and oral histories. *Caring for the Heart* is a welcome addition to the historiography of science and medicine, which is still relatively light when it comes to the history of heart disease and cardiovascular medicine.

Todd M. Olszewski

Todd M. Olszewski is an assistant professor in the Health Policy and Management Program at Providence College in Providence, Rhode Island. His interests include the biomedical sciences, health policy, and cardiovascular disease in twentieth-century America.

Nick Hopwood. *Haeckel's Embryos: Images, Evolution, and Fraud*. viii + 388 pp., illus., tables, bibl., index. Chicago/London: University of Chicago Press, 2015. $45 (cloth).

By the first quarter of the twentieth century, more people had learned of evolutionary theory through the voluminous writings of Ernst Haeckel (1834–1919) than through any other source, including the works of his good friend Charles Darwin. Haeckel's *Welträtsel* (1899) sold over four hundred thousand copies before World War I—and that just in the German edition; it was translated into upward of thirty other languages, including Esperanto. His monographs on marine organisms won him carloads of accolades, prizes, and medals from his scientific confreres. Because of a tragedy that deeply wounded him as a young man and haunted him through his later years, he turned against religion, using Darwinian theory like the jawbone of an ass to smite those thinkers who attempted to introduce superstition into science. The counterattacks of his critics have targeted illustrations in Haeckel's two popular accounts of evolutionary theory, images that represented the central principle of his evolutionary science: namely, that ontogeny recapitulated phylogeny, the view—shared with Darwin—that the embryo went through the same morphological stages as its phylum had gone through in evolutionary descent. His images of vertebrate embryos became staples of scientific demonstration and objects of vitriolic contention. These images and their trajectory are the subject of Nick Hopwood's historically meticulous and acute study *Haeckel's Embryos: Images, Evolution, and Fraud*.

The first thing that strikes you about this large-format, glossy-paged book is its beautiful design. The University of Chicago Press has made this a spectacular production, while keeping the cost modest. Nearly

every page carries an illustration that conveys graphically what Hopwood traces verbally with care and detail. The book can be read at several levels. At the most abstract, it is a story about the production, circulation, and transformation of scientific images. At the next level down, it recounts the history of the sources, techniques, and execution of Haeckel's embryo images. At the more discursive level, Hopwood follows the controversies surrounding the embryo images, from the damaging review of Haeckel's first popular book to the quasi-rehabilitation of his images in the age of evo-devo. Hopwood credits Haeckel with the innovation of representing embryos of different vertebrates by a comparison grid of two or more species at two or more developmental stages in embryogenesis. Using this grid, Haeckel showed that at the earliest period of development vertebrate embryos looked quite similar and only later began to diverge in morphology. This scenario recapitulates, so Haeckel argued, the evolutionary trajectory of species descent from a common ancestor. The principle and its illustrative evidence met objections both from Haeckel's scientific opponents and from his religious critics. Hopwood follows out the entwined history of these objections by focusing on three important moments in their trajectory toward the present day.

The first occurred in 1868, when Haeckel was condemned by Ludwig Rütimeyer and his mentor, the embryologist Wilhelm His, for a lack of integrity and for playing a game with truth, in that he manipulated and distorted his images. Haeckel responded to these accusations in various ways; seen from our perspective, however, they chiefly mark the difference between His's mechanical approach to the formation of embryonic structures and Haeckel's phylogenetic and organic approach. At the time, though, the charges of fraud were loosed into the intellectual community, and they continued to dog Haeckel well into the afterlife of his work.

In 1899 they were renewed when Haeckel's *Welträtsel*, with its incendiary attacks on religion, was published. The Protestant and Catholic reaction became a conflagration that ignited newspaper coverage both in Europe and in America. Hopwood provides a generous account of the various charges and countercharges that enveloped the old Darwinist during this period.

The final three chapters of Hopwood's book bring the reader to the late twentieth century. Creationists and those in the Intelligent Design movement were provided leverage by an article in *Science* carrying the title "Haeckel's Embryos: Fraud Rediscovered." The article, written by an editor, was based on the work of the embryologist Michael Richardson and his team; they had compared photographs of early-stage embryos with Haeckel's images of the same species. The differences were dramatic. Richardson was quoted as contending that Haeckel's images "were turning out to be one of the most famous fakes in biology." He later moderated his indictment, but Creationists now had visual evidence of the perfidy of the evolutionary cabal: dogmatic biologists forged images to contrive evidence for evolution.

Hopwood gives a good account of the prehistory and impact of the *Science* article, but he might have probed a bit deeper, especially since his own title might suggest to the unwary that he too endorses the charge of fraud. Further digging reveals a disturbing story. Richardson and his team had argued, in an article on which the *Science* piece was based, that at the earliest period vertebrate embryos did not exemplify the so-called phylotypic stage, when embryos were supposed to display a generic similarity. Richardson and his group compared their photographs of embryos with depictions by Haeckel, by His, and by many embryologists writing in the contemporary period who also maintained that embryos went through a phylotypic stage. But in that article they accused no one of fraud—not Haeckel, not His, not any contemporary embryologists. Why, then, was only Haeckel accused of fraud in the *Science* article and not any of the many recent embryologists who also found a phylotypic stage, embryologists who had the advantage of over a century of technological development in optical instrumentation and in theoretical advance? Moreover, the photographs in the *Science* piece misrepresented the supposed differences. Though the caption to the photos declared that they were sized to the same scale, the photo of the salamander was pumped up to about twice the size of the others. Moreover, while Haeckel explicitly said he had removed the yolk sac and other maternal attachments from his depicted embryos, that was not the case for several of the embryos in the photos. Photographs do not always tell a reliable story, but they can be quite persuasive.

Hopwood finishes his history with an ironic vindication of Haeckel's principle of recapitulation. The work of evo-devo geneticists has shown that embryos do, after all, recapitulate the common structures of evolutionary ancestors.

In a complex work such as Hopwood's, it would be surprising if an error or so did not slip in and if an interpretation of this or that event did not differ from the way other scholars might treat it. But these issues cannot blemish such an accomplished book—handsome in design and impressive in execution.

Robert J. Richards

Robert J. Richards is the Morris Fishbein Distinguished Service Professor in the History of Science at the University of Chicago. He is a professor in the departments of history, philosophy, and psychology. His most recent books are Was Hitler a Darwinian? Disputed Questions in the History of Evolutionary Theory *(Chicago, 2013) and, with Michael Ruse,* Debating Darwin *(Chicago, 2016).*

Robert Michael Brain. *The Pulse of Modernism: Physiological Aesthetics in Fin-de-Siècle Europe*. (In Vivo: The Cultural Mediations of Biomedical Science.) xxxii + 348 pp., illus., bibl., index. Seattle/London: University of Washington Press, 2015. $50 (cloth).

In his classic essay "Aufbau/Bauhaus: Logical Positivism and Architectural Modernism" (*Critical Inquiry*, 1990), Peter Galison argued that we should go beyond "merely identifying parallelisms between movements" in historical analyses of the arts and sciences. Instead, as Galison did in tracing links between the positivists and modernists, we ought to pursue the "real links" binding practitioners together and explain the shared elements of their philosophy and work. Robert Michael Brain's *The Pulse of Modernism* is exemplary in this respect: through a reconstruction of "physiological aesthetics," it leads us into a vibrant (and vibratory) world of psychophysical experiments, gestural aesthetics, onomatopoeic texts, immersive paintings, anarchist evolutionary theories, and, above all else, automatically generated lines. Indeed, the humble line runs (so to speak) through the whole book, beginning in Chapter 1 with an exceptionally rich account of self-registering instruments and their application to physiology, before moving on in later chapters to consideration of lines that underlie avant-garde paintings, and the breaking up of the prosodic line of traditional French poetry.

Between these sections there are chapters on the notion of organism developed by late nineteenth-century physiologists, and the extension of their work to human societies through the analysis of language. The payback, as it were, for these rather detailed accounts is that they are brought to bear on the later chapters on aesthetics: the visionary organicism of the physiologists served as a justification for a broadly evolutionary account of aesthetics; the close attention to language, again considered evolutionarily, was a justification for the radical phonetic experiments of the Futurists.

This summary should give a glimpse of the intricate arrangement of the book and the clear picture it gives of the relations between *fin-de-siècle* and *aube-de-siècle* artists and scientists. Paraphrase of much of the material is impossible, but the first chapter, which as mentioned deals with self-registering instruments, deserves an attempt. Not only is it a prehistory and close description of the various devices for automatic measurement of phenomena, but it is also a brilliant historical epistemology of these devices, and a thorough historical sociology of their inventors and users. The hero here is Étienne-Jules Marey, guru of the graph: "Let us keep for other needs the insinuations of eloquence and the flowers of language," he wrote. "Let us trace the curves of phenomena that we want to know and compare with one another" (p. 6). But, going beyond this rhetoric, Brain carefully spells out the implications of automation, showing that records of pulses, steam engines, and nerve impulses "functioned as both indexes and as representations" (p. 23). Into the gap between these two conceptions of the line stepped expert experimentalists, who saw themselves "on a continuum of sensibility" that joined them directly to their