Schubring, G., 1996. Hermann Günther Grassmann (1809–1877)—Visionary Mathematician, Scientist and Neohumanist Scholar, Proceedings, Rügen, Germany, 23–28 May 1994. Kluwer, Dordrecht.

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Of the Human Heart: A Biography of Benjamin Peirce
By Edward R. Hogan. Bethlehem (Lehigh University Press). 2008. ISBN 978-0-934223-93-5, 429 pp. $80.00

Readers of *Historia Mathematica* will know Edward R. Hogan for his articles on 19th-century American mathematics covering men such as George Baron, Robert Adrain, and Theodore Strong. Hogan, now retired from East Stroudsburg University, has produced a biography of Benjamin Peirce quite unlike his articles in this journal. In contrast to I. Bernard Cohen's scientific biography of Peirce [Cohen, 1980], Hogan takes a much more personal approach in his work. Hogan utilizes letters exchanged between Peirce and his scientific friends—most notably Alexander Dallas Bache—as well as correspondence between Peirce and family members like his wife Sara, to reconstruct a life dedicated to building a nascent community of professional scientists in the United States.

Hogan calls his work a "documentary biography" (p. 10). He tells us that his decision to relate Peirce's life story through his own correspondence is at least partially due to Peirce's desire, as related in a letter to Bache, to be saved from "eulogistic biographers" (p. 9). Although there are places in the book in which lengthy quotes from this correspondence interfere with the flow of the story, the overall result is an interesting and very personal look at the changing face of American science throughout a large portion of the 19th century.

Of the Human Heart begins in the middle of Peirce's career, with the relatively unknown Harvard astronomer/mathematician announcing to the world that the discovery of Neptune—an event trumpeted by the world's scientists as a shining example of the predictive powers of 19th-century celestial mechanics—was little more than blind luck! Peirce caused a major stir in the world scientific community by claiming that the predictions made by Urbain Jean Joseph Le Verrier and John Couch Adams as to the location of Neptune's orbit—predictions based on the perturbations of the orbit of Uranus—did not actually agree with the discovery of Neptune made by Johann Gottfried Galle. As might be expected, Le Verrier was incensed that the American would question his role in this important discovery. Surprisingly, some in the American scientific community were equally appalled that Peirce had the audacity to challenge the French mathematician. All told, however, the majority of American scientists were proud of Peirce's role in the dispute, fueled no doubt by the support he received from Gauss who confirmed Peirce's claim that Galle's discovery had been a "happy accident" (p. 19).

The Neptune incident actually marks one of the few places in Hogan's book that directly addresses Peirce's scientific or mathematical work. Later, the author does discuss in some small detail Peirce's two major contributions to mathematics: a criterion for rejecting outliers in a data set and his work in algebra culminating in his *Linear Associative Algebra* of 1870. In particular, Hogan details Peirce's path to this important work in algebra, its warm reception in England and the cool reaction of German mathematicians, and even the hesitant way in which it was praised by Americans unable to grasp its significance. Louis Agassiz, the Swiss-American naturalist and geologist, commenting after a presentation by Peirce to the National Academy of Sciences, had this to say about the mathematician's work:

> I have listened to my friend with great attention and have failed to comprehend a single word of what he has said. If I did not know him to be a man of great mind... I could have imagined that I was listening to the vagaries of a madman... I am forced to the conclusion that there are modes of thought familiar to him, which are inaccessible to me... (p. 298).

Various circumstances conspired to prevent Peirce from publishing *Linear Associative Algebra* upon its completion. Employees of the United States Coast Survey (of which Peirce was superintendent) did run off one hundred lithograph copies for distribution, but the work was not actually published until 1881, a year after Peirce's death.

While Hogan does not delve deeply into Peirce's mathematics, he does offer the story of an interesting life in service to American science. Although little in the way of new information about Peirce's contributions to the development of a professional scientific community appears in the current work (see for instance Bruce, 1988), we do find a very personal look at the evolution of American science through the letters exchanged between Peirce and his associates. These men, who referred to themselves as the Lazzaroni, formed a loosely organized group of Americans dedicated to the professionalization of science in their country.

Peirce began his association with the leading men of American science early in his life when he adopted Nathaniel Bowditch as his mentor. As a child, Peirce was a schoolmate and friend of Bowditch's son, Ingersoll. Hogan chronicles the subsequent relationship between Peirce and the senior Bowditch through warm letters exchanged between the two men. Bowditch's esteem for Peirce was such that he asked the young man—while still a student at Harvard—to read and edit his translation of Laplace's *Celestial Mechanics*, a service that Peirce competently carried on for over a decade.

Throughout his career, Benjamin Peirce continued to develop relationships with the best scientists in America. Alexander Dallas Bache, one of his fellow Lazzaroni, also became his best friend. Bache, the second superintendent of the Coast Survey (Peirce later succeeded him in this position), joined with Peirce and other Lazzaroni members such as Joseph Henry, Louis Agassiz, and James Dwight Dana in various undertakings designed to accelerate the development of science in America and to provide professional opportunities for scientists in the United States. Hogan uses the correspondence between Peirce and various members of this scientific elite to trace their attempts to establish a high-quality observatory in the country, to create the National Academy of Sciences as an organization for successful and serious-minded scientists, to provide educational, occupational, and publishing opportunities aimed at supporting professional science in America, and several aborted attempts to create a national university patterned after the emerging German universities. Peirce played a central role in nurturing this emerging community of professional scientists through his activities with the Lazzaroni, his teaching at Harvard, and his role as superintendent of the Coast Survey.

In addition to his substantial role in the development of American science, Hogan describes the personal side of Benjamin Peirce (or more precisely, allows Peirce to describe himself through his letters), from his relationship with his wife, children and other family members to his views on the Civil War. Hogan's work reveals a serious scholar with a tender, somewhat playful, personality. In one address to the American Association for the Advancement of Science, Peirce revealed his difficulty in finding the appropriate "wit" with which to open his talk: "The mystic theory of mirth transcended all the powers of modern analysis, and the lives of laughter follow such a zigzag electric course, with such constant solutions of continuity that they have absolutely no radius of curvature and engulf no geometric laws of progress" (p. 166). Peirce's remarks were nearly drowned out by the roars of laughter emitting from his audience.

In a fascinating look into another, perhaps darker, side of Benjamin Peirce, Hogan delves into Peirce's views concerning the escalating hostilities between the North and the South leading up to the Civil War. Surprisingly, in spite of his deep religious faith and a lifetime spent in the geographic center of the anti-slavery movement, Peirce had strong sympathies for both the South and for slavery. His close relationship with South Carolinian John Le Conte and his wife, Josephine, did nothing but encourage these sentiments. In fact, for a period before the onset of the war Peirce expressed in several instances his desire to obtain a position in the South. In his defense, however, Hogan points out that when the war began Peirce "shed his Southern sympathies and became fiercely loyal to the Union" (p. 219).

Although *Of the Human Heart* cannot be said to make substantially new contributions to the historiography of 19th-century American science and mathematics, Hogan's decision to approach a life in science and the promotion of science from a personal and intimate point of view makes for interesting reading. It also helps to clarify some of the influences—personal, political, and social—upon scientists in this critical period in the history of American science.

After finishing the book, the reader certainly feels that Hogan has accomplished his task of allowing Benjamin Peirce to tell his own life story.

References

Bruce, R.V., 1988. The Launching of Modern American Science, 1846–1876. Cornell University Press, Ithaca, NY.
Cohen, I.B., 1980. Benjamin Peirce: "Father of Pure Mathematics" in America. Arno Press, New York.

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Axiomatik und Empirie. Eine wissenschaftstheoriegeschichtliche Untersuchung zur Mathematischen Naturphilosophie von Newton bis Neumann (Axiomatics and empiricism. An investigation from the point of view of the history of the theory of science of mathematical natural philosophy from Newton through Neumann)
By Helmut Pulte. Darmstadt (Wissenschaftliche Buchgesellschaft). 2005. ISBN 3-534-15894-6. 502 pp. No price given

Mechanics is a mathematical and a physical discipline. Its history is therefore a subject that should appeal to both historians of mathematics and historians of the physical sciences. However, as Pulte points out, it has received too little attention from both camps. Historians of mathematics have paid some attention to the development of the mathematical formalism of mechanics and physicists have dealt with the subject as the foundation of physical science. Pulte's book analyses the philosophical status and foundations of the developing science of mechanics. It is a deep, original, and important contribution to our understanding of both the history of mechanics and the foundations of the mathematical and physical sciences as a whole from 1600 up to 1900.

When classical physics was challenged during the early 20th century the crisis led to a thorough change in its principles. This was made possible by an already established awareness that the principles of mechanics (and geometry) were alterable. Pulte's book deals with the process that led to this awareness. He argues that this process was not primarily (if at all) driven by empirical problems, but by a critique from above, i.e. by a philosophical and mathematical analysis of the basic principles. He rejects the view that mathematical physics was hypothetico-deductive from the time of Newton on. Instead, he argues that until the early 19th century the basic principles of mechanics were not considered hypotheses, but rather necessary and certain axioms. Only with Jacobi this philosophical conviction was abandoned in favor of a conventionalist or hypothetical view of the principles. Pulte's book is a thorough argument for this thesis. But it is much more. It is a wide ranging history of the theory of mechanics and thereby of the theory of physics. Pulte has been occupied with this subject for two decades. His book can be considered the ripe fruit of his research.

The book is about what the author calls "Wissenschaftstheoriegeschichte" (history of the theory of science). It is mainly based on a close reading of the works of working scientists, their philosophical reflections as well as their more technical mathematical theories and deductions. It is a history of philosophy of mechanical practice. Pulte also takes the views of what he calls school philosophers into account, but only the views of two philosophers, Kant and Fries, are analyzed in some detail. He has chosen to discuss these two philosophers because their philosophical ideas were informed by science, and because they contributed to the dissolution of the classical axiomatic view of natural philosophy. Otherwise the major players in the book are Newton, Euler, Lagrange, Jacobi, Riemann and Carl Neumann.

Edward R. Hogan, ,Of the Human Heart: A Biography of Benjamin Peirce (2008) Lehigh University Press,Bethlehem 978-0-934223-93-5 429 pp. $80.00. Todd Timmons. Journal: Historia Mathematica.Â An investigation from the point of view of the history of the theory of science of mathematical natural philosophy from Newton through Neumann) (2005) Wissenschaftliche Buchgesellschaft,Darmstadt 3-534-15894-6 502 pp. No price given. Jesper LÃ¼tzen.