

be commended for explicitly articulating his own model as well as analyzing in his first appendix other models used in the historiography of science. But his model is problematic, particularly in light of the subject matter to which it is applied. Richards believes that scientific conceptual systems are comparable to organisms or biological species that compete for survival with rivals within a common environment. In the case of the history of science, the environment is composed of complex intellectual, cultural, social, and psychological factors that exert pressure on developing conceptual systems; the rivals are other conceptual systems, the struggle keenest among those that are most similar; and the survivors are those systems of scientific ideas that best adapt to the different conceptual pressures of the environment while meeting the challenge of their competitors.

Does it make sense to adopt a Darwinian historiographical approach, no matter how sophisticated, to study Darwinism? Will we be provided with a position outside Darwinism from which to examine it? Richards argues that his natural selection model (NSM) is superior because he can draw on the virtues of all other models. Yet he rarely strays from a consideration of the intellectual context of scientific ideas. Apparently his notion of social context is limited to an analysis of psychological factors as in his study of James or a discussion of the politics of the scientific community as presented in the chapter on Baldwin. Furthermore, Richards's NSM does not escape the charge of reductionism that he levels at the sociobiologists. Conceiving of the development of humanly created scientific ideas as if analogous to the evolution of species in nature is reductive at its very roots and in flagrant contradiction with Richards's attempt to rescue nineteenth-century Darwinian thought from its putative materialism.

In an interesting section on the politics of scientific ideas, Richards discusses how Baldwin's knowledge of the structure of scientific communities enabled him to foster the survival of his ideas, a sure sign of the fitness of his work (p. 490). After reading Richards's book, I suspect that he perceives not only the ideas of scientists to be subject to the process of natural selection but also the ideas of historians of science. Richards's relish for the novelty of his own views, his aggressive attacks on competing historiographical models, and his attempt to overwhelm the reader with information (the book runs well over six hundred pages) all seem to make sense in this light. So does his doubtful claim that in formalizing the natural selection model he has articulated explicitly what a new generation of Darwin scholars have implicitly assumed (p. 558). Perhaps Richards is only imitating the successful evolutionary strategy of Bald-

win, who "knew that controlling the terms under which ideas traveled and making others use your language identified the ideas with you" (p. 490). But what will likely survive is Richards's revisionist interpretation of nineteenth-century theories of mind and behavior and not his attempt to build an evolutionary history of science.

BERNARD LIGHTMAN
York University

PETER GALISON. *How Experiments End*. Chicago: University of Chicago Press. 1987. Pp. xii, 330. \$14.95.

In choosing for his title the phrase "how experiments end," Peter Galison has put initial, primary emphasis on the criteria that experimentalists adopt for believing their evidence (observations) to be conclusive. But this consideration is only part of the penetrating analysis included in this volume. As Galison points out, most histories of science stress theoretical, conceptual development. But the relation between theory and experiment is of profound importance for a genuine understanding of the scientific endeavor—all the more so in recent decades.

Galison has set himself two goals: analyzing modern experiments in microphysics with sufficient detail to capture the debates and assumptions that lead experimentalists to accept an effect as valid and charting the course of twentieth-century changes on the road to experimental commitment. The fact that the examples chosen by Galison to illustrate his perspective are all from twentieth-century physics is not surprising in light of his own background and interests. He is the holder of two Ph.D.s from Harvard University—one in elementary particle physics, one in the history of science.

The history of twentieth-century physics is a fascinating and complex field. In the decades since 1900, research in experimental physics has changed from relatively isolated investigations performed in laboratories of individuals to large team efforts involving huge, expensive equipment with computerized monitoring and recording devices. Furthermore, researchers have moved from the realm of macrophysics to that of microphysics in terms of events being investigated. These changes have affected the way experimentalists approach their equipment and interact with their fellow experimenters and with their theoretical counterparts.

Another relevant development of recent decades is the extent to which physics has become interesting to historians, philosophers, and sociologists of science. Galison is well acquainted with

the works of such scholars and sets his own presentation in the context of contemporary analytical thought.

He has chosen to illustrate the methods, outlooks, and behavior of experimental physicists of recent decades by focusing on just a few examples, happily so in my opinion. The examples considered are the relation of magnetism and rotation, the discovery of the muon, and the demonstration of the existence of neutral currents. All three topics have intrinsic interest, and they were investigated by more than one set of experimenters, each approaching the task from a different perspective. This method of presentation not only clarifies the significance of the results but also demonstrates that progress in physics does not proceed along a smooth, straight course. By choosing such a limited number of examples, Galison is able to devote enough attention to each to provide a more complete history of the episodes described than is presently available anywhere else.

The readers who will be most intrigued by this approach and most informed and enlightened by this presentation are persons with backgrounds and interests most closely paralleling Galison's. It would be regrettable, however, if others did not delve into the contents of this book, even where the details of the physics involved are not always comprehensible to them. Galison provides good introductory material, accessible to any interested, educated person, and has two summary chapters to reiterate, clarify, and expand his points.

This is a carefully written and well-researched piece of scholarly investigation, worthy of careful attention and effort on the part of the reader who will be rewarded by attaining a higher level of understanding of contemporary physics in particular and science in general.

KATHERINE R. SOPKA
Four Corners Analytic Sciences

RUSSELL C. MAULITZ. *Morbid Appearances: The Anatomy of Pathology in the Early Nineteenth Century*. (Cambridge History of Medicine.) New York: Cambridge University Press. 1987. Pp. ix, 277. \$47.50.

This clever book's clever title does not fully prepare the reader for what is to come. Russell C. Maulitz has written a comparative *Rezeptionsgeschichte* of Xavier Bichat's tissue-based pathological anatomy in France and England. In his native land, Bichat was still a relative outsider to the medical establishment at the time of his premature death in 1802, but within a few decades he had become what Maulitz calls a "talismanic" figure

(p. 5), and his approach occupied the very core of French medicine. Across the Channel it was a different story. The medical world learned of the work of Bichat and his successors through translations, journal reports, and the experience of a generation of students who went to Paris following the Napoleonic wars, but French-style pathological anatomy was not easily established on English soil.

Maulitz attributes the success of pathological anatomy in France not merely to its intrinsic scientific merits but also to a peculiar conjunction of intellectual, professional, and institutional factors. Its introduction roughly coincided with the union of medicine and surgery, formally joined by the revolutionary reorganization of medical education in 1794. In the Old Regime, Maulitz argues, physicians and surgeons were characterized by essentially different mentalities, the one holistic and primarily humoralist with a theoretical bent, the other localist and primarily solidist with a clinical orientation. Pathological anatomy provided a common language. It associated disease with local lesions, but the tissues in which they occurred were widely distributed and allowed the disease to manifest itself more generally in the body. The tissues belonged to solid organs, but their membranes produced fluids whose quantity and quality were altered by disease. Theory was linked not only to empirical observations at the dissection table but also to physical diagnosis (which could later be correlated with post mortem findings) and intervention (such as paracentesis to drain excessive fluid). These concerns came together in the work of Bichat's greatest continuator, René-Théophile-Hyacinthe Laennec. Maulitz sees Laennec's *Traité de l'auscultation médiate* (1819), with its celebrated discussion of the stethoscope, as primarily a work on pathological anatomy.

In England, Maulitz suggests, the tripartite division of physicians, surgeons, and apothecaries held firm and militated against the new synthesis. Pathological anatomy found adherents on the fringes and outside of the medical establishment in Scotland (especially Edinburgh), at the new University of London (1828), among Dissenters and reformers such as Thomas Hodgkin, and among the new breed of surgeon-apothecaries who worked as general practitioners and challenged the claims of the old privileged bodies. But the establishment resisted, and some physicians sought to create a distinctly English pathological anatomy, closer in spirit to John Hunter than to Bichat.

Although some of his themes will be familiar to specialists, Maulitz's closely argued book breaks new ground in a well-worked field; it is a measure

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