to the environment. However, he points to a continuing tradition of interest in physiological ecology, especially on the part of Germans like Hans Fitting and Heinrich Walter.

From a historical perspective, I think the early German ecologists were important quite apart from their modest subsequent influence. Looking back to the past, we find it very easy to assume that the appropriate linkages among ideas have always been the ones we share today, but Cittadino's book warns us that the Darwinism we know is not necessarily the one people have always known. Some historians have recently argued that real Darwinism hardly existed in late-19th-century Germany. In all likelihood, they were simply looking for the wrong kind of Darwinist. As Cittadino so ably shows, the physiological ecologists developed their own brand of Darwinism—as authentic and distinctive as any other.

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Waging Geology

The Highlands Controversy. Constructing Geological Knowledge Through Fieldwork in Nineteenth-Century Britain. DAVID R. OLDROYD. University of Chicago Press, Chicago, 1990. x, 438 pp., illus., + plates. $65; paper, $29.95. Science and Its Conceptual Foundations.

The Highlands controversy was one of a series of 19th-century debates about how the stratigraphic succession of the British Isles should be unraveled. Because British geologists were pioneers in the study of stratigraphy, the debates involved questions about stratigraphic methodology as well as about the nature of the succession, and, moreover, the divisions of the stratigraphic column that resulted had a significance that extended well beyond the boundaries of Britain. Roderick Murchison, intensely ambitious and always ready to extend his own stratigraphic empire, was at the center of three of the most prolonged struggles. The first was over the interpretation of certain rocks in Devon in southwest England: Murchison, arguing for a "Devonian system" with characteristic fossils, prevailed over the first director of the Geological Survey, Henry de la Beche, albeit having had to modify his initial stand in significant ways. The second was about whether certain Welsh strata should be included in the Silurian system, as Murchison insisted, or in the Cambrian system, as Adam Sedgwick contended. This was eventually resolved by the acceptance of Charles Lapworth's proposed new intermediate system, the Ordovician, but not before the two erstwhile friends had turned into bitter enemies. We have excellent treatments of these two controversies by Martin Rudwick, *The Great Devonian Controversy* (University of Chicago Press, 1985), and James Secord, *Controversy in Victorian Geology* (Princeton University Press, 1986).

Now in a third book, beautifully produced by the University of Chicago Press, David Oldroyd gives a lucid and scholarly account of the third controversy. Murchison postulated that the strata of Scotland ascended in a regular sequence from the Fundamental Gneiss of the Hebrides and the northwest coast toward the east. James Nicol protested that this was not the case; instead, he argued, there was a huge fault running from the north coast through Skye. Archibald Geikie, the rising star of the Geological Survey, entered the fray on Murchison's side but was gradually forced to change his mind as a third alternative was developed by amateurs such as Charles Callaway and Charles Lapworth. Eventually consensus was reached that the complex geology of the Highlands was the result of low-angle thrusting and related metamorphism caused by forces acting from the southeast. Oldroyd's recounting of the story is charmingly enlivened by his obvious love of the countryside over which he tramped in the footsteps of Geikie and Lapworth and Callaway.

But the authors of these three volumes see them as more than simply contributions to the history of geology; they also see them as contributions to the study of science more broadly conceived. Indeed, a colleague once remarked to me that he hoped that studies of 19th-century stratigraphic controversies might serve as a base for working out some of the basic conceptual frameworks of science studies in this decade just as studies of puritanism and science had done in the 1960s. In particular, these three authors see their work as contributions to the study of scientific controversy, a topic that has been at the center of recent research in the history, philosophy, and sociology of science. To the dismay of their non-relativist colleagues, relativists have argued that the resolution of controversy depends on social, not cognitive, factors. These three studies present a remarkable and relevant data base for adjudicating the issue. Like Rudwick and Secord, Oldroyd is meticulous in his use of sources and admirably clear in his final analytic chapter. Like them, he concludes that geological knowledge was socially constructed. But again like them, he draws back from the extreme claims of some sociologists of knowledge and maintains that although evidence did not perhaps fully determine the outcome of the controversy, evidence *did* constrain the knowledge that was produced. Hence these three historians have reached consensus that both social and cognitive factors contributed to the closure of controversies. Whether this mediating consensus, based on one subdiscipline in one country in one century, will bring to closure the controversy about controversy in history, philosophy, and sociology of science only time will tell.

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Some Other Books of Interest

Trends in Theoretical Physics. Vol. 1. P. J. ELLIS and Y. C. TANG, Eds. Addison-Wesley, Redwood City, CA, 1990. xvi, 412 pp., illus. $49.50.

Upon its establishment in 1987 the Theoretical Physics Institute at the University of Minnesota developed as part of its program a colloquium series in which distinguished speakers would present overviews of a wide range of topics in the field. Prompted in part by the consideration that "there seems to be no journal which deals with the whole field of theoretical physics at a level accessible to the non-specialist," the organizers have in this volume brought together the results of the first (1988–89) series of lectures. Two of the lectures deal with subjects in astronomy—G. E. Brown on information provided by Supernova 1987A (Shelton) about the equation of state of nuclear matter at high densities and M. Ruderman on the search for gamma rays from stars. Representing plasma and condensed matter physics are lectures by D. Montgomery on relaxed states in driven, dissipative magnetohydrodynamics and C. M. Varma on the heavy fermion problem. Quantum gravity and string theory are assessed by S. Deser and D. J. Gross respectively. Other lectures deal with the non-relativistic description of the three-nucleon system (F. S. Levin), detection of the quark-gluon plasma (G. Bertsch), the standard model in elementary particle physics (M. K. Gaillard), tunneling in many-fermion systems (J. W. Negele), quantum mechanics and macroscopic realism (A. J. Leggett), quantum chromodynamics (S. J. Brodsky), and electroweak interactions with nuclei (J. Walecka). The lectures vary in degree of technicality, but the "non-specialists" to whom they are addressed are clearly physicists rather than lay persons. A second volume in the series is planned.—**K.L.**