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or *represent* aspects of nature or the language-user's own general or circumstantial experience. In his book Professor Bazerman rarely avoids assuming as obvious the distinction between language and that which language is about, so that statements like the following are typical: "Experimental reports attach themselves to the nature that surrounds the text through the representation of the doings, or experiment" (p. 62). It is not hard to see that if one assumes that scientific language is *about something else*, one is left with little to say about that "something else", for it becomes the choice between two ontological danglers, "experiences" and "things in themselves"—language, apparently, is either about the one or the other. Nor is one left with much to say about language, if it is seen merely as conducive of knowledge rather than integral to it.

Yet, on reflection, nobody reading a scientific article today, whether an account of an experiment in laser optics or a theory of turbulent flow around two-dimensional bluff bodies, thinks that the sense of the article (or its primary function) consists in *referring to or representing* some past or potential state of affairs. (It would be rather like thinking that numerals and operators of arithmetic are about numbers and operations.) Steven Shapin's sense of "virtual witnessing", a style of writing experiments he attributed to Robert Boyle in an article in 1984, brings us closer to a correct conception of the function of language. What makes the reader a virtual witness is that he sees the experiment carried out in front of him in language, he does not see language reaching out to some other realm. (Alternatively, think of language as a calculus with which one does science.) But even though an update on fundamentals would have been welcome, Bazerman does not actually need an attitude on language-world dualism since he intends to argue a very different case, that throughout history scientists have spent their time grappling with the conventions of language and communication. His views emerge piecemeal in a series of well-researched and interesting case studies. In the one on Newton he argues that the *Opticks* "is far from the spontaneous workings of the creative mind. The book is a hard-won literary achievement forged through some trying literary wars" (p. 124). A large part of what constitutes winning a literary war in science according to Bazerman (and what constituted Boyle's genius according to Shapin), is convincing the relevant community that there is just one language in which the common problems of the subject can be expressed properly, and that it should be preferred over others in use.

The one-against-many literary wars are the exception, of course, but through them one may come to see that gradual changes to the literary devices of science, what Bazerman calls "the development of linguistic means for statements that move toward relatively stable meaning and assent among people sharing wide numbers of social variables (even while sharing participation in scientific activity)" (p. 13), betray a constant struggle in the history of science at a level which is easy to miss. For example, his chapter on 'The changing account of scientific doings in the *Philosophical Transactions of the Royal Society, 1665–1800*' should be understood as an analysis at that level. Professor Bazerman, who teaches composition at the City University of New York, is a fine writer although his arguments would have benefited had he kept the book to two-thirds of its length. It may still lead a few to revise their ideas about what needs explaining and what constitutes explanation in the history of science.

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FRANÇOIS DUCHESNEAU, *Genèse de la théorie cellulaire*, Collection Analytiques 1, Montreal, Éditions Bellarmin, and Paris, Librairie philosophique J. Vrin, 1987, 8vo, pp. 388, illus., Can \$25.00.

Despite the importance of cell theory in nineteenth-century biology, it has received relatively little historical attention. This volume provides a synthesis of the origins of cell theory in the period between 1824, when Dutrochet formulated a theory of the common structural units of plants and animals, and 1856, when Virchow pronounced his theory of continuous cell division—*omnis cellula e cellula*. Duchesneau argues that hitherto accounts of the origins of cell biology have been positivistic, seeing developments as responses to improved observations and

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techniques. Instead he emphasizes theoretical aspects of diverse views of the cell, and provides an exposition of the views of major contributors to the debate on structural units following Dutrochet. There are accounts of the ideas of Raspail, Müller, Schwann, Remak, and Kölliker as well as Virchow. Duchesneau traces a shift from an anti-vitalistic programme to Müller's emphasis on the living organism. A welcome feature of the book is the attempt to relate French and German cell biology, so correcting the distortions of earlier German accounts of the history of cell biology as a German national achievement. Yet in relying on a textual exposition, no attempt is made to assess the transmission and influence of the various theories, to locate cellular research in the various institutional settings, or to consider the interaction between observational techniques and theories. Archival sources and editions of letters have not been used. Scientific innovations seem to have taken place in a cultural and social vacuum with no reference being made to how, for example, Raspail and Virchow related their political radicalism to their scientific endeavours. The neglect of these broader dimensions means that, despite the author's erudition, a definitive history of the origins and early years of cell theory has yet to be written.

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JÜRGEN SANDMANN, *Der Bruch mit der humanitären Tradition: die Biologisierung der Ethik bei Ernst Haeckel und anderen Darwinisten seiner Zeit*, Forschungen zur neueren Medizin- und Biologiegeschichte 2, Akademie der Wissenschaften und der Literatur Mainz, Stuttgart, Gustav Fischer, 1990, 8vo, p. 218, DM 88.00.

The Nazis (and certain historians of Nazism) claimed that the German Darwinist Ernst Haeckel (1834–1919) was a precursor of their belief in racial struggle, the unity of man and nature, and a eugenically-based morality. Others have pointed out that Haeckel was a popular inspiration for liberals, socialists, feminists, and pacifists. In this conflict, Haeckel's substantial scientific achievements in embryology have been overlooked. A balanced scholarly reconstruction of the development of Haeckel's opinions on social and ethical issues is also long overdue. In an attractively-produced monograph, Sandmann has attempted to analyse Haeckel's voluminous publications. The results are not wholly convincing.

Sandmann claims that from his youth Haeckel was a mechanistic materialist, who by 1870 had formulated an inhumane creed of Social Darwinism; for example, he advocated euthanasia of babies with birth defects and socio-biological rationales for executing murderers. Haeckel is seen as elaborating an anti-Christian and naturalistic code of scientific ethics in his writings. Unfortunately, Sandmann's grasp of historical methodology is poor. His account is a highly selective "scissors and paste" compilation of quotations suiting his thesis. No attempt is made to consider other strands of Haeckel's thinking, or his great changes in emphasis over the years. Thus differences of opinion between Haeckel and the scientific materialists Büchner and Moleschott are overlooked, as are features of Haeckel's thinking that were consistent with Johannes Müller's anti-mechanistic organicism. Indeed, Haeckel continued to criticize mechanists like His. Haeckel's use of embryological explanations of development should have been scrutinized as these emphasize processes of the division of labour and organic integration rather than Darwinian natural selection. Given that he derived the concept of the "cell state" from Virchow (a noted liberal), perhaps Haeckel was less of an original thinker than Sandmann claims. There is no analysis of the use of social analogies in Haeckel's scientific work, although his researches into embryology provide a key for many of his views on psychology and society. Sandmann fails to detect changing opinions on Christianity and the emergence of pantheistic sympathies by the 1890s. An artificially simplified image is maintained. Sandmann has not used any of the extensive archival sources in Haeckel's house, the Villa Medusa in Jena, which would have enabled him to present a more nuanced and historically convincing account. The selection of "other Darwinists" mentioned in the title is limited to a few monists. No consideration is given to such major figures among Haeckel's students as Semon (a Jew—although Sandmann claims that Haeckel was an anti-Semite) and Oscar Hertwig, about whom a monograph is long