

ERIC R. SCERRI

EDITORIAL 5

(Received March 29, 2000)

The first paper in this issue is written by Michael Akeroyd who is well known in the philosophy of chemistry community for having organized three successful summer workshops in England. The last of these meetings at Sidney Sussex College, Cambridge was reported in *New Scientist* by Lila Guterman (Guterman, 1998). At the second of Michael's meetings in Ilkley, Yorkshire, the International Society for Philosophy of Chemistry was formally established and subsequent annual meetings have all been held in conjunction with the summer workshop, most recently in Columbia, SC and soon again in Poznan, Poland.

Akeroyd has published a number of articles on philosophical aspects of chemistry and has tended to focus on the work of Popper and Lakatos, especially in connection with chemical developments such as those concerning theories of acidity (Akeroyd, 1991). In the first article in this issue Akeroyd considers some difficult questions surrounding the early development of physical organic chemistry in the work of Christopher Ingold. Those who know Michael well will not be surprised to learn that he concludes that the best philosophical account of this scientific development is to be found in the views of Imre Lakatos.

The other main article in the issue is a translation by Paul Needham, of a paper by Duhem, which is exclusively on chemistry and provides a detailed analysis of some key issues in theoretical chemistry at the turn of the twentieth century.

Duhem was, without doubt, one of the most influential and prolific historians and philosophers of science of the modern era, in addition to having had highly successful careers in chemistry and physics. He was, for example, a leading thermodynamicist known for his contribution to the Gibbs–Duhem equation (Miller, 1963). In



*Foundations of Chemistry* 2: 95–98, 2000.

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philosophy of science his name is enshrined in the Duhem–Quine thesis. Duhem’s contribution was the development of a devastating argument to show the difficulty in trying to assess the consequences of any particular experimental finding for any particular scientific theory. One must wonder how Popper, who was doubtlessly aware of Duhem’s work, could go on to make refutation such a central plank of his own philosophical view given Duhem’s logical analysis to show that it is never clear where to point the ‘arrow of *modus tollens*’.<sup>1</sup>

Although he is generally cast as a positivist, Duhem’s position is completely *sui generis* and incorporates some elements of realism as Paul Needham, the translator of this article, has well documented in his own writings (Needham, 1998). A less well known fact about Duhem is that he died, at the relatively young age of 55, largely due to overworking according to one of his biographers (Jaki, 1991). His publications amounted to twenty thousand pages, not of hand-written manuscript, but printed pages. This vast output included a three-volume study of Leonardo da Vinci, the ten-volume *Système du Monde* and his classic work in philosophy of science, *The Aim and Structure of Physical Theory* (Duhem, 1981). Duhem’s interest in thermodynamics, which fueled his well-known antagonism towards atomism, began at an early stage in his academic career. In his doctoral thesis he argued that the spontaneity of chemical reactions could be related to chemical potential. This position was contrary to the view of the highly influential chemist Marcellin Berthelot, who believed that spontaneity is governed by enthalpy. As any high school student of chemistry now knows Berthelot was wrong but Duhem’s position, then regarded as heresy, was enough to ensure that his thesis was rejected. Undaunted by this rebuttal Duhem had the work published privately, an act which, coupled to his committed Catholicism, meant that Duhem never achieved the academic position which he deserved in the prevailing French academic climate.

Duhem believed that scientific theories do not provide explanations but only a form of classification of facts. In the article in this issue Duhem points out that this notion can be most clearly appreciated in the case of chemistry, which is of course the classifying science *par excellence*. In the article Duhem consistently denies the

existence of atoms while still discussing the theoretical significance of terms like 'atomic weight' and 'atomicity' as used by other chemists. For example, Duhem points out that the belief that the formula of a compound implies the presence of actual atoms of the elements in question, arranged in a specific molecular configuration, leads to serious contradictions. He does this by pointing to certain crystal structures, which are alleged to have completely different atomic structures by the atomists, but produce identical crystal lattices.

The issue closes with a witty, entertaining and insightful book review, by Jack Morrell, of a recent collection edited by David Knight and Helge Kragh. The book, which is based on a series of meetings in various European locations and entitled 'The Making of the Chemist', documents the professionalization of chemistry in numerous countries. We look forward to the day when philosophers of chemistry will be equally successful in obtaining funding to hold a similar series of international meetings as did the historians who contributed to the volume under review.

#### NOTE

1. Although I have not made a study of this issue, a quick examination of Popper's *Logic of Scientific Discovery* reveals three references to the Duhem–Quine thesis, but Popper appears surprisingly untroubled by Duhem's point.

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*Department of Chemistry,  
Purdue University,  
West Lafayette, IN 47907,  
U.S.A.  
E-mail: [scerri@purdue.edu](mailto:scerri@purdue.edu)*