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EDITORIAL 7

The first issue of the year 2001 begins with an article by historian of chemistry Ursula Klein, who is a research director at the Max Planck Institute for the history of Science in Berlin.

Klein's ongoing research project has involved what she calls 'paper tools' such as the case of Berzelian formulas which she examines in the present article. While describing her approach as a link between semiotics and 'science and material culture', she analyzes the use to which Berzelian formulas were put in the 1820s. By close reference to the chemistry of sulphovinic acid and chloral she argues that Berzelian formulas represented a kind of 'tinkering', constrained only by the syntax of formulas and long-established concepts in organic chemistry. Their use did not, Klein maintains, follow any logical or methodological rules. Klein's general point is that scientists use paper tools, such as formulas, in much the same way that they use scientific instruments. She further claims that, contrary to the received view, scientists do not use formulas as substitutes for names, or as representations of pre-existing knowledge, but as tools for producing new knowledge.[1]

When philosophy of chemistry began to experience a revival in the late 1970s to early 1990s, much of the published work was concerned with the interface between chemistry and physics (Primas, 1983; Liegener and Del Re, 1978; Woolley, 1978; Bunge, 1982; Bogaard, 1981; Hoffman, 1990; Scerri, 1991). The other major interface, between chemistry and biology, did not receive the same degree of attention, although a number of studies were published on such questions as whether classical genetics is reduced to molecular biology (Schaffner, 1969; Kincaid, 1990).

The second article in this issue represents a much needed step towards the philosophical analysis of the more neglected chemistry–

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biology interface. Niall Shanks, who is known for his work in philosophy of physics and of biology, considers here the role of the Belousov–Zhabotinsky reaction, discovered by chemists, and which now serves as a model of self-organizing systems in biology and even further afield.

It emerges that chemical models of the Belousov–Zhabotinsky family of oscillating reactions, such as the Oregonator, can serve as functional models for a number of complex systems in biology. The modeling is not of the analogical kind, since the biological systems in question, including such phenomena as the dynamics of slime mold, and the onset of ventricular fibrillation in the human heart, are based on very different substrates than the B–Z family of chemical reactions. There are important material differences in the composition of these various systems. The common feature that they share with the B–Z reactions, as Shanks points out, is that they all show similar dynamical characteristics. The question that he addresses is the nature of such *functional modeling* as it has been termed.

How, he asks, can a chemical reaction, which lies quite outside of biology, along with its mathematical models, be so biologically relevant? Part of Shanks' conclusion is that chemistry in the form of the B–Z reaction can illuminate biological phenomena at the level of functional description and not necessarily, as commonly believed, by elucidating the specific substances and products involved in living systems. Chemistry can thus inform biology in a non-reductive manner, without necessarily claiming that biology consists of nothing but chemical systems.

The final article of this issue is by Michael Chayut, a historian of science who has published on the interface of chemistry and physics, for example, in the work of J.J. Thomson (Chayut, 1991). In the article in this issue Chayut addresses the early origins of Eugene Wigner's application of group theory to quantum mechanics, a development which has led to the widespread use of symmetry principles in modern physics. Chayut analyzes Wigner's early influences including Mark, Polanyi, von Neumann and especially Weissenberg, a little known mathematical physicist. The author shows that Wigner's work in group theory, which for many years was widely regarded as being too mathematical, even by some of the world's leading physicists, in fact originated in Wigner's early work in chemistry and crystallography. Chayut interprets this as an example of how "periphery plays an historical role in inventing new types of scientific careers, thus harnessing scientific creativity into ever widening directions of research".

The book review that brings this issue to a close is by my old friend from our student days at King's College London, Stathis Psillos, who provides a critique of the recent book on realism by André Kukla. This book is not specifically about chemistry but should be of interest to all those interested in the perennial question of whether realism or anti-realism offers a better interpretation of modern scientific theories. The study of chemistry has not featured very much in these general discussions although perhaps it should, since the question of how much reality to attribute to chemical models is frequently discussed, for example in chemical education circles.

Finally, let me draw the attention of the reader to the announcement, at the back of the issue, of our society's conference which is to be held in Loughborough, England, in August 2001. I hope to see you all there.

Just as this Editorial was going to press I received, within a space of just two days, two books devoted entirely to the Philosophy of Chemistry. The first is a beautifully edited anthology by Nalini Bhushan and the late Stuart Rosenfeld, which contains 15 articles from many of the leading authors as well as a number of chemists and philosophers who have recently been attracted to the field. What is especially gratifying about the monograph is that we begin to see some clearly emerging themes in a field which one senses is now just starting to mature.

The other new book is by Jaap van Brakel who is without doubt among the founders of the field and has stimulated interest in Philosophy of Chemistry with numerous articles as well as reviews of the state-of-the-art for about twenty years (Van Brakel and Vermeeren, 1981; Van Brakel, 1999). In his new book he sets out, in detail, his unique view of Philosophy of Chemistry as the study of *manifest* substances, which according to him is more fundamental than the prevalent microstructural emphasis. This radical attack on the reductive view of chemistry is bound to stimulate responses among other philosophers of chemistry and mainstream chemists.

The publication of these books now means that three books have appeared devoted to the new Philosophy of Chemistry. The distinction of being the first belongs to Joachim Schummer, whose book was recently reviewed in this journal (Ramsey, 2000). In addition I am aware of at least two conference proceedings which are currently being edited.[2]

NOTES

1. Ursula Klein was the organizer of an international conference on Paper Tools in Chemistry, held in Berlin in 1999, which formed the basis of a collection of articles which she is currently editing.
2. If we are to also count conference proceedings I should mention, among others, the various Erlenmeyer Colloquia, whose proceedings have been edited by Janich and Psarros.

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