IN THE BEGINNING THERE WAS ACTION

NIKOS PSARROS, *Die Chemie und ihre Methoden. Eine philosophische Betrachtung*, VCH-Wiley, Weinheim, 1999, x + 338 pp. (ISBN 3-527-29816-9)

If you think that noncircularity in scientific theories and definitions, taken seriously, is a mere pipe dream, you are wrong. At least according to the founders and followers of the so-called Erlangen school in philosophy, like P. Lorenzen, P. Janich, and Nikos Psarros. Their constructivist epistemology implies that there is indeed a non-circular route from elementary encounters with reality to elaborate scientific theories. But, whereas logical positivists had tried to find those elementary encounters in observational acts and their linguistic expressions – Carnap's protocol sentences, Popper's basis sentences, you name it – with all the well known problems of theory ladeness and the like lurking in the background, constructivists locate those first things in basic *operations*, fundamental pre-scientific practices in which the scientist meets the world. Sharing their antirealistic attitude concerning theoretical concepts and entities with the neo-positivist stance, constructivists construe scientific theories, not out of observations, but out of theory-free actions ('*Handlungen*'). Lorenzen thus re-construed logic-mathematical concepts (Lorenzen 1973), Janich re-construed physics (see for instance Janich 1980, Janich 1997) and Psarros, in his book *Die Chemie und Ihre Methoden*, is now reconstructing chemistry.

That this is a highly ambitious enterprise should be clear from the beginning. Psarros' protochemical opus (Janich names the result of such a methodological catharsis a protoscience, hence *protophysics* and *protochemistry*) is written for both chemists and philosophers and tries to cover the whole of chemistry, starting with its basic vocabulary (for colors, smells, *etc.*) and operations (mixing, purifying, *etc.*) up to theoretical domains like thermodynamics, reaction kinetics, and even quantum chemistry. Since the basic chemical operations, which are the starting point of Psarros' reconstruction, are often also the historically prior ones, Psarros' book contains an impressive number of historical aperçus and details and thus is interesting to the historian of chemistry as well.

The general impetus of Psarros' book, however, is corrective. The chemically educated reader thus should be prepared to learn that most of his fundamental preconceptions about the theoretical corpus of chemistry are mistaken. According to Psarros, theoretical concepts like that of the molecule do not have counterparts in the real world, not even in the chemist's laboratory. They are nothing but theoretical constructs, yet constructs with a highly integrative explanatory power. Further, readers will learn that a considerable amount of what they think are chemical laws are not at all laws. They are not descriptive but prescriptive and thus have the status of norms which, followed correctly, guarantee the success of the basic operations that chemists perform in their laboratories. For instance, the 'law' of constant proportions (as well as the law of mass conservation) is by no means a law according to Psarros. This is because, taken as a law, it would be either not true or circular. The former because the law of constant proportions is trivially not valid for all chemical compounds (berthollide compounds are not covered). If, alternatively, a ceteris paribus condition were introduced, stating that the law is valid only for the non-berthollide case, this distinction has to be made on theoretical grounds (for instance by distinguishing different types of chemical bonds). To establish such a theory, however, different kinds of compounds have to be synthesized already; which presupposes the application of the very 'law' that was to be ex-

plained. A typical case of a *petitio principii*, says Psarros. According to him, the only methodologically kosher way of introducing this 'law' is to treat it as a *norm* or *recipe*. The norm ensures that the chemical transformations chemists perform in the lab fulfil certain normative standards which are required to reach various goals (like the synthesis of chemically pure compounds).

Even though chemistry, being to a great extent a practical science, is without doubt a more promising candidate for the constructivist's task of methodologically and epistemologically building on firm operational grounds than, say, physics, Psarros' chemical discussion cannot convince, even concerning the most basic definitions. For instance, he defines the property of being liquid by having the 'predicators' (a 'predicator' is a specific term Lorenzen uses for properties that are introduced by means of showing and demonstrating, Lorenzen 1987) of being non-changeable in volume but changeable in form under the conditions of daily life if no external force is exerted. However, looking at the glass of water on my desk, clearly a liquid does not change its form if no force is exerted upon it. So either the rather vague concept of 'daily life conditions' ('*lebensweltliche Bedingungen*'[1]) has to be defined so as to embrace possible interactions with the liquid, which would contradict the second condition, or the concept of force has to be weakened, so as to exclude small forces, a theoretical distinction that would defeat Psarros' own standard of using only theory-free pre-scientific concepts. The same objections apply to more elaborate definitions like that of the temperature of a system where Psarros gives a learned historical overview over temperature scales and measuring devices, but then, in the central part of his own construction of a temperature scale, introduces the norm of the *linear expansion of a heated body* (p. 111). This norm requires that the follower of this norm is capable of heating a body steadily. It seems to me that this is only possible if a reliable means of measuring temperature differences is already established. The re-construction thus, according to Psarros' own standards, becomes circular. At this point, he merely refers to historical practices of differentiating between different temperatures of a melting oven (p. 112); this is not very persuasive given the fact that the whole discussion is precisely about the point of avoiding circularity by starting with non-theoretical practices. Whether there really are, *cum grano salis*, *non-theoretical* practices, or operations that can be taken as primitive is a crucial question that Psarros, in this book, does not really help to answer.

The last objection concerns the philosophical discussion in Psarros' book that is particularly unsatisfying. For one thing, it is somewhat old fashioned and does not really refer to contemporary discussions within philosophy of science. For instance, one of the main arguments for a realistic position in the classical realism-antirealism debate of the last decades has been the so-called *miracle argument* (Putnam 1975). If the theoretical concepts with which a theory is operating are just conventions and norms, how could they have ever been so successful in describing, predicting, and producing real phenomena? Because Psarros fully acknowledges the practical success of chemistry but adopts an explicit anti-realistic position, this question seems to be of particular importance to his account. For example, in the case of what Psarros calls the 'norm' of constant proportions, one could ask whether the norm 'bites' just because it 'mirrors' a certain feature of reality itself, namely the fact that most compounds behave according to that norm. Alternatively, it is easy to imagine a completely berthollide world in which such a norm simply would have no meaning because the world just would not 'work like that'. The realistic implications of questions like that bare interesting objections to the operationalist; yet they are not even touched by Psarros, nor does he comment on other

'classic' debates in the philosophy of science that are related to that point.[2]

Another example for the antiquated character of Psarros' philosophical discussion is his treatment of natural laws and scientific explanations. Here, he fully adopts the so-called received view à la Hempel and Nagel (Nagel 1961) without even mentioning all the well known problems the account faces (see for instance Cartwright 1980, van Fraassen 1980); this is why the 'received view' is commonly considered to be outdated. Since Psarros repeatedly refers to the 'integrative' and unificatory aspect of laws and other theoretical constructs as one of the main reasons for their existence it would be much more consistent if he adopted a unificationist account of natural laws (*e.g.* Lewis 1983).

On the other hand, Psarros is indebted to the received view in such a way that, by giving up its picture of a deductively closed corpus of scientific theories, he would face severe difficulties in maintaining his rigorous methodological ideal of building up the whole of a scientific theory 'starting from scratch'. A goal that, as already mentioned, operationalists like Janich and Psarros share with the logical positivists and that to me does not really seem to be up-to-date. Giving up this picture while still emphasizing the crucial character of scientific practices and operations would bring Psarros closer to the so-called new experimentalist school in the philosophy of science; a school that considers the operations and practices scientists perform in their laboratories as something that have 'a life of their own' while being strongly disconnected from the more general theoretical '*Überbau*' (see for instance Hacking 1983). Again, this related position Psarros only mentions in a footnote (p. 7).

Apart from these shortcomings, one should acknowledge Psarros' book as a major contribution to the 'new' philosophy of chemistry covering an overwhelming amount of chemical details and philosophical issues. Furthermore, his attempt to write the book in such a way that it is accessible to chemists as well as to philosophers deserves admiration. I am sure that Psarros, as in his earlier publications, will provoke many fruitful discussions with this major work; among chemists and philosophers as well as *between* chemists and philosophers. And this, without doubt, is a merit.

Notes

[1] The concept of '*Lebenswelt*' goes back to Husserl's phenomenology and is notoriously difficult to define. It characterizes the whole and primordial epistemic nexus of the 'world we are living in' (see Held 1986).

[2] Recent work within the philosophy of chemistry that discusses the problems of realism-antirealism in chemistry more carefully (Schummer 1996) is just swept away in one sentence (p. 19).

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