entists say and what they do. Structures can affect the development of science in ways that are not predictable. *French DNA* is a relatively short book that is very readable and informs as well as provokes. I recommend it to all who would find an anthropology of the contemporary by a 'philosophic observer' to be meaningful. As with *Making PCR*, though, there is no index.

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Pioneering Ideas for the Physical and Chemical Sciences. Josef Loschmidt's Contributions and Modern Developments in Structural Organic Chemistry, Atomistics, and Statistical Mechanics, ed. by W. FLEISCHHACKER & T. SCHÖNFELD, Plenum Press, New York, 1997, pp. 320 (ISBN 0-306-45684-2)

The long subtitle clarifies the scope and aims of the 33 contributions to the volume in honor of Josef Loschmidt (1821-1895), edited by Wilhelm Fleischhacker and Thomas Schönfeld from the Institutes for Pharmaceutical Chemistry and Inorganic Chemistry, respectively, at the University of Vienna. The papers are grouped according to three topics: "Organic Structural Chemistry" (12 papers); "Physics and Physical Chemistry" (14 papers); and finally "Loschmidt's Biography, Loschmidt's World" (7 papers). The declared heterogeneity of research interests ranges over philosophical and historical issues as well as today's experimental and theoretical approaches to molecular reality.

On a commemorative occasion, such diversity is not without danger, but for our purpose it is welcome because the reader may find also a few papers and several passages of interest concerning philosophy of chemistry. Papers and passages may be discussed with reference to two principal topics. Not surprisingly, the first topic regards Loschmidt's own philosophy and the philosophy of science of his times; surprising is rather the shaky quality of many assessments of Loschmidt's place in the history of chemical thought. The second topic regards aspects of the philosophy of chemistry as today's scientists propose it. Many papers could be interesting for an attentive reader because one can see, just under the surface level of the texts, the militant philosophy and applied epistemology of the authors. However, this textual level is implicit, and as such it will remain outside the scope of the present review.

The most promising article on Loschmidt's philosophy is that by PETER M. SCHUSTER, entitled 'From Curiosity to Passion: Loschmidt's Route from Philosophy to Natural Science'. Schuster reports many interesting facts about Loschmidt's early academic interest in Herbart's philosophy, when he was a twenty-year-old student of Franz Exner, professor of Philosophy in Prague. However, since Loschmidt moved to Vienna at the age of 21 to study physics and chemistry, Schuster's claim of a decisive, long lasting influence of Herbart' philosophy on Loschmidt's molecular conceptions seems to me not enough grounded. In the middle of the nineteenth century, the physical and chemical literature was rich of suggestions about the (ontological) relationship between atoms and ether. The concept of atoms as 'spheres of activity' was well-known among physicists and chemists, since it was extensively worked out by Boscovich and (among many others) used by Berthollet (*cf.* H. Kragh: 'The Aether in Late Nineteenth Century Chemistry', *Ambix*, **36** (1989), 49-65). Schuster states that "Loschmidt never gave up Herbart's conceptions of atoms as penetrable orbitals, and interpreted what we call today orbitals as 'ether spheres'" (p. 274).

In a similar anachronistic view, C.R. NOE ('Loschmidt and Venn. Symbolic Logic in Chemistry and Mathematics') claims that Loschmidt's "sphere concept, which was 'off-limits' for organic chemists for a long time […] can be seen as a forerunner of modern orbital theory" (p. 96). M. JENNER boldly amplifies the same idea ('The Periodic System of the Elements and Prout's Hypothesis. Use and Interpretation by Josef Loschmidt'): "This paper [of 1887] proves Loschmidt to be an early forerunner of the quantum theory, *specifically* of Niels Bohr's famous paper of 1913, in which a theoretical interpretation of the Balmer-lines of hydrogen was obtained (Loschmidt's paper also mentions *specifically* these lines)" (p. 212, italics added). The volume is not lacking in priority claims and extravagant praises, sometime preposterous (*e.g.*, I.D. RAE, p. 121; A. BADER, p. 79). However, at least a couple of contributions provide a more balanced appraisal of Loschmidt's chemical theory (G.P. SCHIEMENZ, 'Spheres from Dalton to Loschmidt. Insights into the Ways of Thinking of a Genius' p. 86), and a more realistic analysis of his perception of the Viennese scientific context (R. ROSNER, 'Organic chemistry in Austria and Loschmidt's ›Chemische Studien‹"p. 117).

As mentioned above, a second thematic area present in the volume is contemporary philosophy of chemistry, as it is proposed in a more or less 'pervasive' form in several papers. Just in the first contribution to the volume, MAX PERUTZ discusses the role of the hydrogen bond and related molecular geometry in physiology, and then explicitly asks the question: "What is the significance of these structures for our conception of *living matter*?" Perutz's answer is that "*Living molecules* […] combine complexity with a high degree of order which is maintained by a multiplicity of hydrogen bonds and other weak interactions" (pp. 9, 11; italics added).

ALBERT ESCHENMOSER debates the nucleic acid structure problem in terms of chemical etiology in his ample and interesting contribution. Not only does he coherently treat the difficult topic (etiology, as the science of causes), but he also proposes a scheme for elucidating the chemical etiology of nucleic acids that is (almost) explicitly hermeneutic, as is his appraisal of the research: "It is difficult to predict the outcome of such etiological studies, but eventually, and if we are lucky, we might eventually comprehend on a chemical level why the nucleic acids of today are those actually found" (p. 47).

Other points of interest can be found in W.M. HECKL's paper on visualization and nanomanipulation of molecules in the scanning tunnelling microscope technique. One of his issues is: "How would an artist view or paint a molecule? This would be an aesthetic view of a molecule […]. This is probably not the

best method for a chemist, but certainly for somebody interested in art. Such an approach should not be neglected, and we will see later an example of the molecular art, that is a painting done with thousands of molecules" (p. 184). The actual image (fig. 12, p. 189) is reminiscent of the prehistoric cave pictures. Philosophically more promising seems to me his concept of 'quasiepitaxy' that explains the 'visibility' of an absent molecule: "The ultimate limit is the removal of a single molecule of adenine from the surface […]. The resulting hole can be used to deduce the shape, size and position of a molecule […]. Single molecule dynamics has been imaged in this case, because the molecular hole was found to change its site, showing diffusion at room temperature". Heckl presents his play with the ghost of a molecule as an example of "molecular nanomanipulation from an artist's point of view" (pp. 188, 190). In VIKTOR GUTMANN's brief and interesting paper 'Considerations about the ›Constitution of the Ether‹', there is a certain (unintentional) connection with Heckl's paper, because here the reader can find many relevant ideas about the separation of an atom or a molecule from the continuum.

The essay of CARL DJERASSI is on a different, more general level of philosophical interest. Its title 'Natural Product Structure Elucidation: 1950 → 2000' suggests a historical narrative, but the author explains the real intentions of the inquiry with a question that deserves to be reported at length: "as the number and power of new physical methods increased, structure elucidation has turned from chemistry into applied spectroscopy and computer-driven X-ray crystallography. What are the costs and rewards associated with these methodological changes and what intellectual and practical motivation now inspires modern natural product chemists?" (p. 15). I leave the task of pondering on the many points touched by Djerassi up to the reader, in particular the epistemological and professional effects of the "irrevocable loss of degradative chemistry in the natural product field" (p. 23). Instead, I conclude this review pointing out a plain and straight consequence of Djerassi's reflections on the disappearance of a relevant number of classical laboratory procedures: the epistemological analysis of these procedures belongs to the history of chemical philosophy rather than to the analysis of the actual way of thinking of contemporary chemists.

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