guage and the proliferation of man's semantic environment limit man's comprehensive prowess" (p. 254); "even in industrial research success comes through good individuals who are left alone" (p. 209); "science will complete the integration of the world and will help unify man's microcultures and civilizations" (p. 278).

All in all, as a tract for science this book is a good read for a teenager interested in a scientific career. As an argument for the essential continuity of science and religion, it fails badly. The metaphysical stance of the scientist-as-believer is weakened by (the aptly-named) Christophorou putting facts and values on the same plane. His epistemology ignores skepticism as an essential dimension of science: at least in our Western tradition of physical science, as opposed to the wisdom of the believer, knowledge is built as a combination of critical discussion and experiment.

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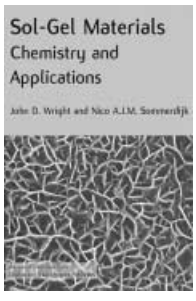
Sol–Gel Materials, Chemistry and Applications. By *John D. Wright* and *Nico A. J. M. Sommerdijk*. Gordon and Breach, Amsterdam 2001. x + 125 pp., hardcover £ 19.95 (ca. € 33).—ISBN 90-5699-326-7



The authors of this concise book on sol–gel materials have set themselves the ambitious task of bridging the gap between a conventional textbook and a comprehensive monograph, by writing a short up-to-date description of the subject. The eight chapters describe the basic chemistry of methods for synthesizing the materials, and cover recent original publications and review articles. To deal with the vast amount of experimental information in a manageable way, the authors have concentrated on two important classes of materials.

An introduction, including definitions of important numerical quantities and terms, and a brief outline of the history, is followed by a description of the reaction mechanisms involved in sol–gel syntheses of silicates. Aspects covered include the hydrolysis of the molecular starting compounds, the condensation of the monomers and gel formation, and the subsequent modification, drying, and compression of the material. An understanding of the individual reaction stages forms the basis for the following discussion of possibilities for controlling the chemistry of the sol–gel process to obtain products with specific properties. These include the production of hybrid materials and the incorporation of organic functional groups into the inorganic matrix. A knowledge of the most important processes for silicates provides the necessary background for understanding the formation of metal oxide gels. For this class of materials the hydrolysis of the "precursor" is very rapid, and the metal ions show variable coordination numbers. The chapter on characterization methods includes descriptions of the use of solid-state NMR spectroscopy, vibrational spectroscopy, small-angle scattering, EXAFS, and various techniques for determining surface areas. This is followed by two chapters on applications of the materials, for example as catalysts, as chemical sensors, and for treatment of surfaces. The book ends with a chapter on future prospects, with applications of the sol–gel method.

The text is illustrated by many figures, some reproduced from the original papers. Particularly important passages are clearly marked by shading. The comprehensive bibliographies at the ends of the chapters enable the reader to go into special topics in more depth and to obtain quick access to the latest research results. There are a few minor flaws which are nevertheless annoying; for example, the word "stoichiometry" is repeatedly used instead of "composition", and some of the reaction equations do not have the correct material balance.

The overall impression left by the book is that the authors have made an interesting and representative selection from the available mass of information. It gives a concise and informative introduction to sol–gel materials for students, beginners in the field, and everyone interested in the subject. It is a useful alternative to more detailed monographs such as *Sol–Gel Science*, by C. J. Brinker and G. W. Scherrer (Academic Press, London 1990).

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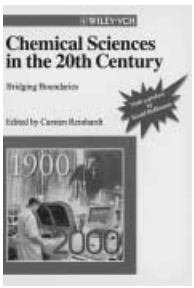
Chemical Sciences in the 20th Century. Bridging Boundaries. By *Carsten Reinhardt.* Wiley-VCH, Weinheim 2001. xviii + 281 pp., hardcover € 85.00.—ISBN 3-527-30271-9

"Chemistry stands between physics and biology". That trite statement gave rise to this book, the proceedings of a conference. As such and as was to be expected, it mixes the good and the mediocre. It has as its ambition to address the history of chemistry in the 20th century, focused upon the interdisciplinary areas at the boundaries of chemistry and physics, and of chemistry and biology. Chemical physics and physical chemistry and biochemistry, then? Oh no: quantum chemistry, geochemistry, radiochemistry, polymer chemistry, and materials science were picked. But photochemistry, electrochemistry, phytochemistry, etc. also were not drawn out of the hat. Their bad luck! But is it such bad luck?



The book is in three parts. In the first, Ana Simões and Kostas Gavroglu once again draw an affectionate and well-deserved portrait of Charles A. Coulson. In his practice of quantum chemistry, this wise man elected to be a chemist first and a mathematician second. This chapter is followed by two chauvinistic local histories, Andreas Karachalios on the Italian quantum chemist Bonino, and Marika Blondel-Mégrelis on the French theorist Barriol. I knew Jean Barriol as a courteous and kind gentleman. But his impact on French quantum chemistry pales in comparison to those of Lionel Salem, of the Pullmans, or of Raymond Daudel's school at rue du Maroc.

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The second part has a chapter by Brigitte van Tiggelen on Ida and Walter Noddack and their searches for elements 43 and 75. The former was fruitless, since physicists produced technetium. The latter was fruitful, the Noddacks discovered rhenium. Ruth Levin Sime contributes a fine chapter, arguably the best in the book (she does confront the issue of boundaries), on the search for artificial elements and the discovery of nuclear fission. Helge Kragh, in his chapter, provides a good informative background on the origins of both geochemistry and cosmochemistry.

The third part is a grab-bag of unrelated topics: Nicolas Rasmussen on research on hormones between the two world wars; Furukawa Yasu on polymer science; Mary Jo Nye on Michael Polanyi; and Bernadette Bensaude-Vincent on materials science.

The book is padded with 20% of extra material. It originated from a conference held in Munich in 1999. Each moderator for the three sessions has written up his opening remarks. Unfortunately, whereas this might have been the opportunity to remedy and to complement the voids in the chapters proper, these openers contribute little of their own. They serve as three extra prefaces, whereas the lovely overall preface by Roald Hoffmann shows him at his graceful and at his kind best.

What is at issue is the organization of the book along the divisions used for managing, funding and teaching science. Is this administrative fact sufficient reason for the classification of sciences to take over and to dry up the history of science? Bureaucratic funding of the history of chemistry, even by such outstanding organizations as the European Science Foundation or Unesco, can be a mixed blessing.

Furthermore, this volume does not shine with excellence. There is the occasional blunder, such as (p. 179) the misplaced irony about the epochal discovery in 1937 by Leon Rosenfeld and Pol Swings of CH as the first interstellar molecule; or lack of familiarity with quantum mechanics being ascribed to Polanyi (p. 253), despite the evidence of the Evans–Polanyi epochal paper; the lack of proper perspective: the exclusive focus on Berlin, leaving out the all-important Paris contribution (Chapter 8); the consistent misspelling: the Dutch "van" spelt with a capital, Van't Hoff instead of van't Hoff; circular phraseology insulting logic: "agreements on matters of evidence is a clear sign of disciplinary unity" (p. 127).

Coming now to the "boundaries" in the title, namely, to cross-disciplinary fields, one should regret the absence of any attempt at the otherwise enlightening comparative method. For instance, a parallel presentation of bioorganic chemistry (present in the book) and of bioinorganic chemistry (inexplicably absent) would have made sense. It would have been interesting to explore at some length the reasons for the fecundity of the hybrid scientist, as exemplified by Coulson; to delve into the marginal status of discoverers, such as Hermann Staudinger and his "Schmierenchemie" of macromolecules, Lise Meitner (nuclear fission), and Viktor Goldschmidt (geochemistry); and to comment a bit more on the marginalization of scientists, to which both Michael Polanyi and Kasimir Fajans fell victim.

What about the quality of the history presented here? In between standard and undistinguished, but fortunately without jargon, without the demeaning approach of the social construction of science. Still, we might have been better off with chemists, rather than historians, preparing these accounts. Our professional journals, such as this one, often carry very good historical articles; and they are peer-reviewed, for quality control. Were there a need for old-fashioned disciplinary history, such as this book offers, the chemists themselves might do a better job. True, their narratives lean towards Whig historiography, and tend to neglect the historical context, the institutional factors, and the surrounding political and national environment.

History of science has spoiled us though. We have been led to expect from it new interesting outlooks, new avenues of historical research. For example, and only examining the material in this book, two such topics might have been the different approaches of chemists and physicists to problem-solving, and an in-depth analysis of the impact of the computer. Professional historians are invaluable when they do their homework: selecting an important topic (Jean Barriol does not qualify); making imaginative use of sources, both oral and archival; answering questions raised (e.g., why did Einstein and Haber gang-up on poor Polanyi? Did bioorganic chemistry founder for lack of a textbook?); and paving the way to future research. We look up to historians for understanding the past, and then recapturing it in elegant prose, and for the vibrancy of a history of science echoing its living, throbbing subject. All such expectations are stifled in this unnecessary and unmemorable collective book.

We badly need histories of modern chemistry. We are beset instead with a Commission on the History of Modern Chemistry. Need I say more?

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