circumstances of the interwar period; despite some difficulties, especially in attempts at direct investment, it was able to develop business operations in exports of dyestuffs and fertilizers and in licensing the Haber–Bosch process for the synthesis of ammonia.

- "German chemical firms in the United States from the late nineteenth century to the post-World War II period" (37 pp.), by Mira Wilkins (USA), discusses the complexities of the interactions between German and American companies which competed and cooperated, and it emphasizes the major effects of the two world wars.
- "German chemicals and American politics, 1919–1922" (24 pp.), by Kathryn Steen (USA), concludes Part II.

Part III is devoted to "The Industry since 1945", and consists of the following articles:

- "The Richard Willstätter controversy: The legacy of anti-Semitism in the West German chemical industry" (20 pp.), by S. Jonathan Wiesen (USA).
- "Capacity losses, reconstruction, and unfinished modernization: The chemical industry in the Soviet Zone of Occupation (SBZ)/GDR, 1945–1965" (39 pp.), by Rainer Karlsch (Germany).
- "The dynamics of industry structure: The chemical industry in the U.S., Western Europe, and Japan in the 1980s" (34 pp.), by Ashish Arora (USA) and Alfonso Gambardella (Italy).
- "I. G. Farben revisited: Industry and ideology ten years later" (8 pp.), by Peter Hayes (USA).
- "Gravity and the rainbow-makers: Some thoughts on the trajectory of the German chemical industry in the twentieth century" (9 pp.), by Raymond Stokes (UK).

This book is meticulously documented with material from archives and correspondences as well as published sources, and it includes numerous tables and figures. A detailed (22-page) index facilitates the location of information.

The German chemical industry is a source of challenge and insight for anyone wishing to understand the history of the twentieth century. Consequently, this scholarly but eminently readable book will be of great interest to historians of modern Germany, of science and technology, of business, of politics, and of economics.

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**Place of Science in a World of Values and Facts.** Edited by *Loucas G. Christophorou.* Kluwer Academic, New York 2001. 300 pp., softcover $ 39.50.—ISBN 0-306-46580-9

A more suitable title for this book would have been "Proud To Be A Scientist". After 31 years in an obviously fulfilling career, a senior scientist sums up his experience. Dr. Christophorou, after spending the first part of his career at Oak Ridge National Laboratory and at the University of Tennessee, transferred to the National Institute of Standards and Technology in Gaithersburg, Maryland. An expert in the study of electron–molecule interactions, he is a low-energy physicist.

Whenever the author's beliefs are rooted in first-hand knowledge, this makes for powerful statements which one can embrace enthusiastically: science is the honor of mankind—it does not answer to the needs of society—it works autonomously and almost independently of society—modern economies build on technical innovation—technology is rooted in science—small science is unjustly neglected—bureaucratization of science is bad—there is a growing sociological split between true scientists and mere science workers—being a scientist can turn one into a better person—induction and deduction are both called for—hi-tech communication is the people's ultimate means of civil disobedience. A good part of the book amounts to a "self-portrait of a happy scientist". To give its flavor, let me quote from the author's description of the inductive method in the physical sciences: "There was only the scientist observing nature passionately, fighting with himself and the limitations of his interrogating technique, contemplating the meaning of his observations, and carefully but boldly edging toward the truth. A beautiful intimate dance with mystery!" (p. 94).

Chapter 1 introduces the scales of space and time, spanning some 30 to 35 orders of magnitude. Chapter 2 calls for respect of the ecological balances on Planet Earth. Chapter 3, the longest, is a narrative of physics from Greek antiquity till Richard P. Feynman. Chapter 4 deals with elementary particles and some of the instruments of physics. Chapter 5 presents the main principles of research, such as pragmatism and parsimony. Chapter 6, about the scientist and the science worker, argues in the manner of Boris Pasternak that "gregariousness and mass mentality are the refuge of mediocrity". Chapter 7 is a plea for basic science and for small science. Chapters 8–11, waxing philosophical and religious, are wordy, unoriginal, and dispensable.

Physics enjoys its hegemony over much of the history and philosophy of science. Likewise this book treads once again the Galileo–Newton–Einstein route, and it concerns itself with physical laws and the nature of time and space. Such dominion of physics translates into a sister science such as chemistry being viewed as a colony. The scientism of the author is only matched by his elitism as a physicist.

Too many physicists, outsiders to chemistry, translate their axiomatic reducibility of chemistry to physics into an unwarranted belief that chemistry has indeed been reduced to physics. Christophorou is no exception. The naive ignorance of chemistry, typical of some physicists (would they tolerate the converse behavior on the part of chemists?), occasionally shows its dull gleam: "Wohler (sic) discovered urea in 1828" (p. 68); "by the early 1930s … chemistry was being understood through physics" (p. 103).

The title given to this book, *Place of Science in a World of Values and Facts*, deserves comment. Unattractive because too flat, it is nevertheless informative, both with respect to some of the subject matter (a weak tract for the unity of science and religion) and with respect to the writing style, too often made of trite statements. These are not even wrong, even though often the opposite assertion would be no less true. Some examples: "The laws of physics will have to be modified if they are to account for the phenomena of life" (p. 256); "lan-

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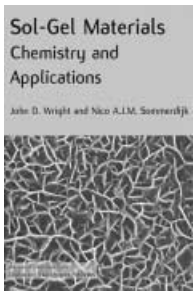
**Sol–Gel Materials, Chemistry and Applications.** By *John D. Wright* and *Nico A. J. M. Sommerdijk*. Gordon and Breach, Amsterdam 2001. x + 125 pp., hardcover £ 19.95 (ca. € 33).—ISBN 90-5699-326-7




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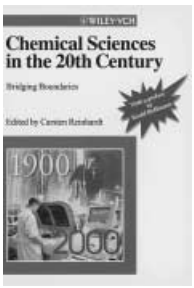
**Chemical Sciences in the 20th Century.** Bridging Boundaries. By *Carsten Reinhardt.* Wiley-VCH, Weinheim 2001. xviii + 281 pp., hardcover € 85.00.—ISBN 3-527-30271-9

"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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