whole, Rao has a hands-on approach, and at each stage he urges his young readers to carry out simple experiments and observe what happens: for example, add a small quantity of zinc powder to a solution of copper sulfate. In the final chapter there are recipes for making aspirin (from salicylic acid and acetic anhydride) and nylon fibres (from sebacoyl chloride and hexamethylene diamine).

I must admit that from the title I had expected a somewhat different content. No one is going to understand chemistry from reading this book. What it can do is to help the reader to understand what chemistry is about. Rao's book is definitely not directed towards readers of this journal, but if it encourages a single young person to pursue chemistry with anything like Rao's own enthusiasm and creativity, then it will have fulfilled its purpose.

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The Biological Chemistry of the Elements. By *J. J. R. Frausto da Silva* and *R. J. P. Williams.* Oxford University Press, Oxford 2001. 575 pp., softcover £ 39.95.—ISBN 0-19-850848-4

With this second edition the authors have provided a significant update to their 1991 textbook. That earlier edition has trained many students and researchers in the area of the biological impact of the inorganic elements. This new edition is even better than the original, both in terms of organization and content. It is easier than before to use as a textbook or as a reference source owing to the detailed indexing. It provides the most up-to-date and extensive compilation of operational concepts in bioinorganic chemistry of any single textbook available today.

The authors have retained the original structure of the text, which has two parts: six chapters on the physical and chemical factors that control the elements within living systems, and 12 chapters on specific groups of elements. Two other chapters (7 and 20) deal with networks of interactions and feedback within cells and between cells and the environment. These chapters are unique and are not found in any other popular textbook on bioinorganic chemistry. Chapter 7 provides a holistic approach to the operation of a cell, including internal spatial localization and timing of cellular functions. Chapter 20 extends this systems approach by further developing the concept of a total cellular "metallome" (free and chelated), which is in contact with the environment through exchange. The authors suggest how the metallome is integrated with the genome and proteome to create an interactive system that can compete for survival. The beginnings of evolution are suggested here.

Like the original text, this edition is not written in a traditional style based on structures or physical properties of isolated molecules found within a biological context. Instead the pedagogical style emphasizes the functional value of the elements in living organisms. Thus, the first seven chapters are organized in the form of a discussion of living systems as a network of flows of material, energy, and information, both within a structured cell and between it and the environment. The revisions to Chapters 9–19 focus primarily on including a section on the networking of interactions of the elements and on genetic control of the cellular molecules involved in the uptake and distribution of the elements.

The significant advances that have been made in determining the structures of the molecules of life are not uniformly emphasized in this new addition. However, this material is readily available to readers in the form of several monographs (including two handbooks of metalloproteins published in 2001 by Huber et al. and Bertini et al.) and databases (Braunschweig Enzyme Database (BRENDA); Protein Data Bank (PDB); PRosthetic groups and Metal Ion SitEs in proteins (PROMISE); Metalloprotein Database at Scripps; The Inorganic Crystal Structure Database (ICSD); The EF-Hand Calcium-Binding Proteins). With the additional help of these structure databases, the educator can present an up-to-date survey of bioinorganic chemistry using the new edition of this textbook as the conceptual framework for understanding how biological systems use chemical principles to thrive.

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Heme, Chlorophyll, and Bilins. Methods and Protocols. Edited by *Alison G. Smith* and *Michael Witty.* Humana Press, Totowa 2002. 340 pp., hardcover $ 125.00.—ISBN 0-896-29111-1

The "pigments of life" perform essential tasks as cofactors in many biological transformations. Their importance for the evolution of life on our planet and for maintaining the processes of life is overwhelming. Research into the structure, functions, and processes catalyzed by this extraordinary family of pigments has long fascinated many eminent scientists. Published results have described details of the variations in structure and the determination of biosynthetic routes, and many of the central proteins containing "pigments of life" as cofactors have even been crystallized. One can assume that the exploration of these pigments is now a mature field of research. The amount of knowledge acquired over more than 100 years is huge. It is probably correct to say that the research centered around the tetrapyrrole-based pigments is no longer the hot topic that it used to be. Nevertheless, many important fundamental questions are still unsolved, and tetrapyrroles have found an ever growing number of new applications. It is fair to say that research around the "pigments of life" continues, and the number of published papers is so great that no scientist is able to follow all the developments in detail. As in many other fields, monographs have been published regularly to help the newcomer and the experienced researcher. In particular, *The Pophyrin Handbook,* a ten-volume work, was published in 2000.

The book edited by Smith and Witty about natural tetrapyrroles is a collection of chapters written by 20 different authors and experts in the field. With just over 330 pages, it is obvious that one cannot expect a comprehensive treat-

