City, is sincere in believing that professionalism can, or even should, triumph over politics.

Sincere he is. He proves it with a final chapter that takes issue with the politicians and environmentalists who put pollution high on their list of priorities. Despite his own long commitment to controlling its effects, Eisenbud argues not only that pollution problems are getting too much attention (and money) but that the technology that causes pollution is on balance a good thing for society. His reasoning is good, as usual, and his conclusion challenging and important. Eisenbud hopes to turn the antitechnology environmentalist tide that carried his own career from insurance inspector to high federal and municipal office. It is doubtful he will succeed. Mayor Lindsay's way is still perforce the way of the democratic world, a world nevertheless more reasonable and honest for the likes of Eisenbud.

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Ribosomology

The Ribosome. Structure, Function, and Evolution. WALTER E. HILL, PETER B. MOORE, ALBERT DAHLBERG, DAVID SCHLESSINGER, ROGER A. GARRETT, and JONATHAN R. WARNER, Eds. American Society for Microbiology, Washington, DC, 1990. xxiv. 678 pp., illus. $99; to ASM members, $86. From a conference, East Glacier Park, MT, Aug. 1989.

Systematic studies of ribosome structure and function were initiated in the late 1950s, making the ribosome the first RNA-protein particle to come under serious scrutiny. In the last ten years or so, other ribonucleoprotein particles, such as spliceosomes, have commandeered the spotlight, and ribosomes have received less attention. Nevertheless, a core of investigators has continued attempts to reveal the ribosome's secrets of how to assemble, translate, regulate, and so forth. Periodic meetings among this group have usually been accompanied by a book recounting recent progress. The latest book of this kind is *The Ribosome: Structure, Function and Evolution.*

The fact that ribosomology now is of substantial age, at least on the time scale of molecular biology, is illustrated by the inclusion of two historical chapters: a very personal view of the major breakthroughs in translation mechanisms and regulation of ribosome synthesis in *Escherichia coli* by Masayasu Nomura and a more technical historic account by Alexander Spirin.

The remaining part of this rich collection of 57 reviews is divided into nine sections, and virtually all aspects of ribosome structure and function are addressed, as well as selected aspects of ribosome formation. The reader of the book will immediately notice that the major focus in the field is still the *E. coli* ribosome. This is understandable given the enormous number of person-years that have been required to bring knowledge of this "model ribosome" to its impressive level of sophistication. In addition, the studies on other ribosomes demonstrate that many important aspects of ribosome structure and function have been highly conserved through evolution.

A major portion of the book is devoted to studies of the architectural details of the ribosome, with an emphasis on rRNA structure. In fact, the book clearly shows that ribosomology, like many other areas of molecular biology, is in an RNA-centric era; only a few chapters provide information about the ribosomal proteins and translation factors. The bias of most contributors to this volume seems to be that rRNA is responsible for most of the catalysis performed by the ribosome, although Draper offers the view that RNA and protein have been coevolving for so long that we probably are at least "2 times 10^9 years too late to entirely disentangle protein and RNA functions." The RNA-centric view is currently supported by the fact that virtually all ligands of protein synthesis (that is, tRNA, translation factors, antibiotics) can be footprinted on the rRNA, suggesting that these ligands at least contact the rRNA during protein synthesis. Several chapters present detailed refinements of rRNA secondary structure and describe the initial maneuvers in elucidating rRNA three-dimensional structure by crosslinking, electron microscopy, oligonucleotide hybridization, and phylogenetic studies of rRNA sequences. The book also summarizes an enormous collection of data mapping contact sites between ribosomal proteins and rRNA, studies that should ultimately lead to a complete three-dimensional model of this complex organelle.

Not all ribosomologists focus on rRNA structure. The book also reviews several new insights into ribosome function and formation. A few examples of fascinating news: RNA helicases participate in the initiation of protein synthesis by eukaryotic ribosomes; prokaryotic translation initiation factors help the ribosome to select the correct reading frame during translation initiation; a third binding site for tRNA ushers out tRNAs after they have completed their journey through the A and P sites and delivered their amino acid to the growing peptide chain; prokaryotic rRNA synthesis is stimulated by a transcription initiation factor working on an upstream activating site; small nuclear RNAs are involved in processing of eukaryotic rRNA.

Another interesting topic covered in several chapters is the variety of elements (both internal and external to the ribosome) that modulate accuracy of translation. These include the structure of ribosomal components, codon context, and overexpression of proteins. Finally, the book contains a few chapters on the evolution of ribosomal components and the use of these studies in assigning evolutionary relationships between organisms. Among these chapters is one of the few that focus on ribosomal proteins. Interestingly, some ribosomal proteins are conserved in all biological kingdoms, whereas others seem to be specific to eubacteria or eukaryotes.

The strengths of this book are its encyclopedic nature and the care with which virtually all chapters have been written. This book is much more than just the proceedings of a meeting. Its weakness is the inevitable result of collecting contributions from so many authors; there are many redundancies and the level of detail is uneven. However, the latter is also a strength that should make the book interesting to a wider audience. Some chapters are excellent introductions to general problems such as analysis of RNA structure and protein-RNA interactions. Other chapters are sophisticated reading for the aficionados. This book is recommended as a "hitchhiker's guide to the ribosome" for everyone with an interest in translation, RNA-protein structures, and macromolecular structure-function relationships.

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A Theory of Molecules

Atoms in Molecules. A Quantum Theory. RICHARD F. W. BADER. Clarendon (Oxford University Press), New York, 1990. xviii, 438 pp., illus. $120. International Series of Monographs on Chemistry, 22.

Recent progress in computational algorithms and hardware performance has enabled theorists to make quantum-mechanical calculations that produce accurate estimates for experimentally measurable properties of molecules, such as equilibrium geometries, dipole moments, and total energies. The degree of accuracy varies with the size of the system under consideration, but even for molecules as large as $C_{60}F_{60}$ quantitative predictions are now possible. One should not forget, however, that, to paraphrase the famous statement by Mulliken, our ability to produce numbers does not necessarily imply that we can tell what the electrons in molecules are doing. Full understanding of the intricacies of chemical bonding can be attained only with the help of interpretative tools that facilitate analysis of the electronic wavefunctions obtained from quantum-mechanical calculations.

The concept of the atom is as old as chemistry itself. Like their predecessors, modern chemists find atoms indispensable in understanding and systematizing properties of molecules. Yet inspection of the postulates of quantum mechanics makes it clear that atoms cannot be identified in molecules unless additional assumptions are made. Although there are infinitely many distinct ways of dissecting molecular properties into contributions from individual atoms, the approach that achieves this end with a minimum degree of arbitrariness is obviously preferable.

The quantum theory of atoms in molecules, pioneered by Bader, is without doubt the most self-contained and general of such approaches. It takes advantage of the fact that, within the nonrelativistic Born-Oppenheimer approximation, partitioning of the Cartesian space into regions (called "attractor basins") demarcated by zero flux surfaces in the electron density results in open quantum-mechanical subsystems whose properties satisfy several fundamental relations, such as the (hyper)viral and Ehrenfest theorems. In other words, validity of such relations for the subsystems is the sole condition from which the partitioning ensues.

Bader's book covers a multitude of issues related to the concept of atoms in molecules. The topological properties of the electron density and the related topics of molecular structure and its change are discussed first. This is followed by an exposition of the quantum-mechanical properties of attractors in molecules. This part of the book is presented with mathematical rigor, but the fact that the theory of atoms in molecules actually consists of two overlying layers of interpretation seems to be largely ignored. Readers would benefit from the realization that, although the definitions of attractors, their basins, and the critical points in the electron density together with the associated attractor interaction lines are rigorous and supportable by quantum-mechanical arguments, their identification with atoms and bonds is a different matter. In fact, such identification is based on a purely empirical observation that the majority of molecules in their ground-state equilibrium geometries do not possess non-nuclear attractors. This assumption is not always true, however. In fact, there are numerous known examples of molecules with either non-nuclear attractors or with unusual bond paths—many more than Bader would have us believe. Of course, this does not invalidate the first part of the theory, which deals with characterization and classification of molecules in terms of the properties of the critical points and the attractors. However, the decision whether the existence of such "anomalous" systems represents failure of the second part of the theory or of "chemical intuition" should be left to the reader.

Overall, *Atoms in Molecules: A Quantum Theory* is a very comprehensive monograph that I would strongly recommend not just to quantum chemists but also to anyone interested in a systematic and mathematically rigorous approach to understanding chemical and physical properties of molecules. Those who are not familiar with Bader's theory and manage to work through the formidable mathematics will appreciate its formal elegance and conceptual beauty. Those who know the theory and would like to have a convenient compendium with all the relevant equations and references handy will be equally satisfied. Those who expected a lot of new material not previously covered in the numerous publications by Bader and his co-workers probably will be slightly disappointed. One may hope that new editions with updated material (and possibly some exercises and answers for graduate students) will follow in the future.

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Books Received

Adhesive Bonding. Lieng-Huang Lee, Ed. Plenum, New York, 1991. xx, 476 pp., illus. $95.

Advances in Assisted Reproductive Technologies. Shlomo Mashiach *et al.*, Eds. Plenum, New York, 1990. xviii, 1077 pp., illus. $150. From a congress, Jerusalem, April 1989.

Aging and Environmental Toxicology. Biological and Behavioral Perspectives. Ralph L. Cooper, Jerome M. Goldman, and Thomas J. Harbin, Eds. Johns Hopkins University Press, Baltimore, MD, 1991. x, 301 pp., illus. $65. Johns Hopkins Series in Environmental Toxicology.

Application Specific Integrated Circuit (ASIC) Technology. Norman G. Einspruch and Jeffrey L. Hilbert, Eds. Academic Press, San Diego, CA, 1991. xii, 368 pp., illus. $89.95. VLSI Electronics, Microstructure Science, vol. 23.

Applied Computational Statistics in Longitudinal Research. Michael J. Rovine and Alexander von Eye. Academic Press, San Diego, CA, 1991. xiv, 237 pp., illus. $34.50.

Archaeology. Theories, Methods, and Practice. Colin Renfrew and Paul Bahn. Thames and Hudson, New York, 1991. 543 pp., illus. Paper, $24.95.

Arctic Passages. A Unique Small-Boat Journey Through the Great Northern Waterway. John Bockstoce. Hearst Books (Morrow), New York, 1991. 256 pp., illus. $22.95.

The Arts and Crafts of the Swat Valley. Living Traditions in the Hindu Kush. Johannes Kalter. Thames and Hudson, New York, 1991. 180 pp., illus. $35. Translated from the German by Sebastian Wormell.

Assessing the Nation's Earthquakes. The Health and Future of Regional Seismograph Networks. Panel on Regional Networks, National Research Council. National Academy Press, Washington, DC, 1990. xii, 67 pp., illus. Paper, $15.

Atmospheric Particles and Nuclei. G. Götz, E. Mészáros, and G. Vali. Akadémiai Kiadó, Budapest, 1991. 274 pp., illus. $38.

Beyond the Large Farm. Ethics and Research Goals for Agriculture. Paul B. Thompson and Bill A. Stout, Eds. Westview, Boulder, Co, 1991. xii, 312 pp., illus. Paper, $36.95. Westview Special Studies in Agriculture Science and Policy.

Biogeochemistry. An Analysis of Global Change. William H. Schlesinger. Academic Press, San Diego, CA, 1991. xii, 443 pp., illus. Paper, $39.95.

Biogeochemistry of Major World Rivers. Egon T. Degens, Stephan Kempe, and Jeffrey E. Richey, Eds. Published for the International Council of Scientific Unions and the United Nations Environment Programme by Wiley, New York, 1991. xxiv, 356 pp., illus. $175. Scientific Committee on Problems of the Environment 42.

The Climate Change. The IPCC Response Strategies. Intergovernmental Panel on Climate Change. Island Press, Washington, DC, 1991. lxii, 272 pp., illus. $55; paper, $34.95.

Combinatorial Homotopy and 4-Dimensional Complexes. Hans Joachim Baues. De Gruyter, New York, 1991. xxviii, 380 pp., illus. $89.50. De Gruyter Expositions in Mathematics, 2.

Communication and Control. Networks and the New Economics of Communication. G. J. Mulgan. Guilford Press, New York, 1991. vi, 302 pp. $35. Guilford Communication Series.

Competitiveness of the U.S. Minerals and Metals Industry. Committee on Competitiveness of the Minerals and Metals Industry, National Research Council. National Academic Press, Washington, DC, 1990. xx, 140 pp., illus. Paper, $19.95.

Complex Systems Dynamics. An Introduction to Automata Networks. Gérard Weisbuch. Addison-Wesley, Redwood City, CA, 1991. xviii, 189 pp., illus. $40.95. Santa Fe Institute Studies in the Sciences of Complexity. Lecture Notes, vol. 2. Translated from the French edition (Paris, 1989) by Sylvie Ryckesbusch.

Crew Size and Maritime Safety. Committee on the Effect of Smaller Crews on Maritime Safety, National Research Council. National Academy Press, Washington, DC, 1990. xxii, 162 pp., illus. $22.95.

Critical Aspects of the Plate Tectonics Theory. V. Beloussov *et al.*, Eds. Theophrastus Publications, Athens, Greece, 1990. 2 vols. Vol. 1, Criticism on the Plate Tectonics Theory. x, 435 pp., illus. $50. Vol. 2, Alternative Theories. viii, 444 pp., illus. $50.

Critical Perspectives on Nonacademic Science and Engineering. Paul T. Durbin, Ed. Lehigh University Press, Bethleham, PA, 1991 (distributor, Associated University Presses, Cranbury, NJ). 299 pp., illus. $45. Research in Technology Studies, vol. 4.

The Design of Analgesic Clinical Trials. Mitchell B. Max, Russell K. Portenoy, and Eugene M. Laska, Eds. Raven, New York, 1991. xxii, 729 pp., illus. $122. Advances in Pain Research and Therapy, vol. 18.

The Diabetic Heart. Makoto Nagano and Naranjan S. Dhalla, Eds. Raven, New York, 1991. xxvi, 533 pp., illus. $99. From a symposium, Tokyo, Oct. 1989.

Earthquake Engineering for Concrete Dams. Design, Performance, and Research Needs. Panel on Earthquake Engineering for Concrete Dams, National Research Council. National Academy Press, Washington, DC, 1990. x, 143 pp., illus. Paper, $15.

Ecology, Community and Lifestyle. Outline of an Ecosophy. Arne Naess. Cambridge University Press, New York, 1991. xiv, 223 pp., illus. $49.50; paper, $17.95. Translated from the Norwegian edition (1976) with revisions by David Rothenberg. Reprint, 1989 ed.

Electroslag Technology. B. I. Medovar and G. A. Boyko, Eds. Springer-Verlag, New York, 1991. xxii, 270 pp., illus. $79. Materials Research and Engineering. Translated from the Russian edition by Olga Gavrilovic.

Elementary Topology. Michael C. Gemignani. Dover, New York, 1990. xii, 270 pp., illus. Paper, $6.95. Reprint, 1972 ed.

The Emergence of Modern Humans. An Archaeological Perspective. Paul Mellars, Ed. Cornell University Press, Ithaca, NY, 1991. xii, 555 pp., illus. $65.