BOOK REVIEWS

RADIOPHARMACEUTICALS STRUCTURE-ACTIVITY RELATIONSHIPS. R. P. Spencer, Ed. New York, Grune & Stratton, 1981, 843 pp, illustrated, $45.00

Structure-activity relationships have proven to be invaluable tools both for improving the effectiveness of pharmaceuticals and in understanding their mode of action. The same tools are being applied, for the same reasons, to the design of radiopharmaceuticals. This book comprises the proceedings of a recent meeting on structure-activity relationships applied to radiopharmaceuticals.

With conventional structure-activity studies, compounds of known and well-defined structures are used, but the activity is frequently difficult to measure. However, in radiopharmaceuticals the activity, as defined by specific organ uptake, is easy to measure but the exact structures of the administered compounds are frequently unknown and may not be known if there is more than one compound present in the administered solution. This observation is reflected in the different contributions to the book where the "organic" compounds, i.e., those compounds containing nonmetallic radionuclides and thus of well-defined structure, fit most satisfactorily into the classic structure-activity relationships. Thus, the chapter on receptor-binding estrogenic compounds is an elegant description both of the binding characteristics necessary in a compound to measure receptor concentration and of the structural requirements of the compound to meet these characteristics. Other chapters concerning organic compounds follow this theme and contain much valuable data and important theoretical considerations.

As soon as metals become involved, however, the pathway between the data and the explanations becomes obscured by the intervening uncertainties of structure, "in vivo" ion transfer, charge, and solvation. The myocardial cation transport system consistently discriminates between sodium and potassium cations, but the potassium side of the system can incorporate other cations as dissimilar as quaternary ammonium salts and monovalent thallium. When the quantitative dynamics are studied, the mystery deepens as each cation follows its own path with little regard for either its closest or distant neighbors.

With the technetium-HIDA derivatives, the hepatobiliary excretion follows consistent pathways as the lipophilicity and metal-binding characteristics of the ligand are changed. Yet there is still the "magic" methylene, unnecessary for coordination, uninvolved in solubility, with no effect on the presumed gross structure or charge of the complex, but it cannot be touched without completely changing the "in vivo" characteristics of the compound.

The application of structure-activity relationships to radiopharmaceuticals is a subject in its infancy, and this book reflects that fact. Where the classical tools are applicable, they are applied with skill and precision. Where the established methods fail, there are false starts and perilously balanced logic. The correct paths will be found and this book represents the beginning of the search.

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RADIATION PROTECTION: A GUIDE FOR SCIENTISTS AND PHYSICIANS. 2nd Ed. J. Shapiro. Cambridge, Harvard University Press, 1981, 480 pp, $25.00

Radiation Protection is a welcome addition to the library of concerned scientists who deal with radiation in their professional life and are therefore continuously approached as a resource person when questions of radiation safety arise in our increasingly radiation-conscious society. This second edition is an extensive revision of the first, including an explanation of SI units (without actually making the transition in the text), a reworking of the internal dosimetry sections based on the MIRD documents, and additional material on radiation detectors, regulations, and topics of public interest regarding nuclear power and weapons.

This book is easy to understand for the broad spectrum of scientists and in large part by the concerned and knowledgable lay public. The professional radiation scientist can obtain most of the technical information presented in this book from other more detailed sources, but the intended audience of intentional or unwitting radiation users will find here an enormous span of useful information, well written and concise, to suit their laboratory and humanistic needs. I include in this population the biochemist who routinely manipulates radioactive isotopes in the laboratory, the physician who must be made aware of the serious consequences of our present day radiographic inflation, the reporter faced with a cloud of confusion at every radiation-related story, politicians who must eventually deal with the real costs of nuclear weapons production, and the energy consumer whose confusion is understandable given the confusion evidenced by the experts. For these very important readers Part VI, "Ionizing Radiation and Public Health," provides easily accessible details on protection standards, sources and risks of population exposure, fallout, nuclear power, radiation accidents from Gabon to Three Mile Island, and the gruesome effects of nuclear war. These final one hundred pages can be read without reference to the rest of the book. They provide very interesting reading for lay persons and well-documented fodder for public lectures or cocktail talk on radiation and public health.

The book opens, Stanley Kubrick style, with the origins of terrestrial radiations at time zero, when the temperature of the universe was some 10^{33} degrees and matter had not yet condensed, a delightful introduction to the radiation environment we find ourselves in now. After a very brief description of the composition of atoms, the reader is introduced directly to the characteristics of charged particles and photons, beginning with a brief discussion of radiation injury and containing most of the standard, albeit nonmathematical, details of directly and indirectly ionizing radiations. The material is very tightly controlled, containing little that is extraneous to the needs of the radiation user and yet reasonably complete and clear in its coverage of a wide range of basic radiation science.

Perhaps because of the large scope of this book and the lack of mathematics there are errors of omission. Absorbed dose is never really defined, though mean absorbed dose is discussed. A nicely detailed figure illustrating various ionization patterns produced by common radiations would lead easily into some mention of specific energy and the limitations of the concept of absorbed dose, but does not. This then leads to errors such as the statement that "The higher the LET, the greater the injury produced for a given

absorbed dose." The concept of exposure is covered almost as an afterthought, with little more than a definition, a welcome deemphasis; but the absence of any discussion of factors or absorption coefficients and the basic interactions that control these factors is a weakness that limits the usefulness of the book even as an introductory text for radiation science students. Several of these basic concepts missing from the section on principles of radiation protection are used and defined briefly as needed for later chapters on specific applications. For example, the absorption coefficient is used in an example to show the origins of the dose rate constant, but its properties are not discussed. A great deal of confusion then arises between exposure rate constant and dose rate constant; for example, the symbol R is used for both rads and roentgens. A footnote states that for radiation protection purposes dose equals exposure. One hopes, therefore, that this book will not be used to train radiation safety officers in the intricacies of radiation interactions. Microdosimetry is mentioned only as it relates to the anatomic distribution of I-125 absorbed dose in thyroid tissues, and the Compton effect is briefly mentioned in a figure caption describing a scintillation counter spectrum. These concepts are fundamental to an understanding of radiation dosimetry and shielding.

I realize that I take some risk in criticizing the lack of rigor in a book intended for the occasional radiation user and the lay public, but there is also a risk that this very attractive book will be used for introductory courses in radiation safety programs where a more rigorous development of basic principles is imperative. This danger arises in fact because the book is not only well written, but because it covers some subjects with a clarity and breadth not found in other available textbooks for the beginning radiation scientist.

The author is careful to refer to the book in the preface as a manual for individuals to become qualified in radiation protection as an adjunct to working with sources of radiation in medicine. The book deals more extensively with radionuclide use than with the use of radiation-producing machines, whose users are more likely to be trained in radiation physics. In general, this approach is quite successful, with many examples worked out in the text for specific radionuclides, both in shielding and dosimetry. The material on survey procedures, however, is not covered as clearly. Many detector systems are described in the section on radiation measurement, but as a manual for radiation users it would be helpful to include an indexed section on survey and emergency procedures for specific radionuclides. This material, which could be added after the discussion of detectors, would also help the reader to understand better the differences in performance of different detector types.

When viewed as a reference book for users of radionuclides, the reservations expressed above are cancelled and one sees the advantages of introducing certain concepts only as they are needed, staying close to relevant topics instead of following the custom of filling the first half of such books with material that to many is dry, basic physics. It indeed addresses the expanding, untrained army of radioisotope users in a format that is likely to be well received. As the author indicates in a series of interesting quotations, the education of the lay public is our best chance for making profound changes in the uses of radiation in our society.

Finally, this is a very human book. From its cosmic opening to the personal statement at the end, one is aware that there is a great deal of concern for the reader both as a radiation user and as a member of the larger worlds of human interests. Dr. Shapiro has seized the opportunity to raise the consciousness of a very select and influential segment of our society regarding the real and perceived hazards of radiation. I enjoyed the book immensely and recommend it to anyone interested in a good reference book and some stimulating reading about the role of radiation in medicine and society.

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ADVANCES IN DIGITAL IMAGE PROCESSING: THEORY, APPLICATION, IMPLEMENTATION. IBM RESEARCH SYMPOSIA SERIES. P. Stucki, Ed. New York, Plenum Press, 1979, 332 pp, $37.50

This book contains the proceedings of an international symposium on advances in digital image processing, sponsored by IBM, Germany, and held at Bad Neuenahr, Federal Republic of Germany, on September 26-28, 1978. The proceedings are unusual in that such a broad range of topics are considered, including digital signal processing theory, digital television, satellite imagery, industrial automation, and biomedical image processing. For readers in the USA, the volume is valuable in presenting English language reports of work by European and especially by German authors. The book is divided into 15 chapters, each written by one author, and each covering a single topic. The level of the presentations is highly variable, as might be expected with so many authors. Some prior knowledge of digital signal and image processing is needed to understand the material, although it appears that the book was intended as a general subject review and little information is presented that has not already been published elsewhere.

The major value of this book to medical readers is to introduce the variety of image-processing applications used outside the area of medicine, especially from a European perspective.

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IMAGE RECONSTRUCTION FROM PROJECTIONS, THE FUNDAMENTALS OF COMPUTERIZED TOMOGRAPHY. G. T. Herman. New York, Academic Press, 1980, 316 pp, $29.50

This book introduces image reconstruction from projections, the mathematical basis of computed tomography. It was originally developed for a two-semester graduate course in computer science taught by the author when he was at the State University of New York at Buffalo. It is definitely not a dry analytical text reporting one author's overview of work largely done by others. Instead, the reader will find that this book is a practical account of many years of development by a well-known researcher and teacher whose insights are presented in a remarkably clear form. The chapter on algebraic reconstruction techniques (ART) is a good example. The chapter is divided into five subsections: (1) What is ART?, (2) Relaxation Methods, (3) Additive ART, (4) Tricks, and (5) Efficacy of ART. The amount of essential practical information included in the text is an important feature. Since the author and his associates played a significant role in the development of mathematical techniques for reconstruction from projections, they have a great deal of practical experience in putting the formulas to work. The style of the text emphasizes the practical rather than the theoretical implications of these methods. A particularly attractive feature of this book is the inclusion of a section entitled "Notes and References" at the end of each chapter. It is here that the author reviews the literature and puts the methods being considered into perspective. I found these sections to be particularly illuminating and interesting. The text is accompanied with appropriate references, and both subject and author indexes are provided.

There are some drawbacks to the text for workers in nuclear medicine, however. This book is based on x-ray computed tomography, especially transaxial. The large variety of nuclear medicine tomography systems, including positron emission,