BOOK REVIEWS

CRC ATLAS OF SCINTIMAGING FOR CLINICAL NUCLEAR MEDICINE. Henry N. Wellman, ed. West Palm Beach, Florida, CRC Press, Inc. Section I: $195, Section II: $100, Section III: $900.

The editor, contributors, and publisher are to be congratulated on a monumental work, one that is superbly directed to the practitioner of nuclear medicine. In addition to presenting a wide variety of well-illustrated cases, they have provided basic science information in an easily assimilated form that will be welcomed by physicians.

The format of the atlas is unusual; it is composed of three sections. The first section along with either Section II or Section III (or preferably both) form companion units. The first section includes three chapters of basic science information and the remainder is devoted to the presentation and interpretation of cases, accompanied by appropriate schematic drawings of the scintimages for assistance in interpretation. Section II contains the printed scintimages and Section III the same scintimages in transparencies. The entire work is in large, loose-leaf form with four binders for Section I, and two binders each for Sections II and III. The advantages of this form of presentation are that it can be easily updated, subsequent additions can be made, and pages can be removed for educational purposes.

Chapters 1 through 3 of Section I—Methodology and Interpretation—cover instrumentation for scintimaging, practical guidelines for radiopharmaceutical preparation, and radiation safety. The lucid, understandable approach to these basic science topics with minimal mathematics offers the clinician the opportunity to grasp important fundamentals with confidence. Another unique feature is the presentation of extensive tables on collimator characteristics for rectilinear scanners and gamma cameras, gamma camera specifications, characteristics of generator systems, commercially available radiopharmaceutical kits, half-value layers for absorbers, and numerous other tables in each area of the basic sciences. Decay schemes are presented for 14 radionuclides.

Chapters 4 through 12 are devoted to examples of scintimaging for the different organ systems with sections on pediatric studies and on imaging with oncophilic radiopharmaceuticals. Each clinical chapter is introduced with information specific for the area in question, and includes such topics as patient preparation, radiopharmaceuticals, instrumentation, dynamic and static imaging, pathology, and scintimaging findings. Each case is presented in history format with an explanation of the images and correlation with the schematic drawings of the images. A very wide variety of lesions are represented for each organ system, a total of nearly 500 cases. The chapters contain excellent reference sources. The scintimages, both in the printed and transparency format, are consistently well reproduced. Several of the accompanying radiographs are not of the same high quality.

This publication is a *highly* desirable addition to both academic and nonacademic departments of nuclear medicine and can be used advantageously for self-learning, as an aid in diagnosis, and for teaching.

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THE PHYSICAL PRINCIPLES OF DIAGNOSTIC RADIOLOGY. Perry Sprawls. Baltimore, University Park Press, 1977, 365 pp, $24.50.

"Not *another* book on radiological physics!" I hear you cry. Yes, another book on radiological physics. Why, when there are so many already that just devising an original title for a new one is no mean feat of ingenuity, why do we need another? Since the author is already a full professor, the usual reason obviously does not apply. No—there must be a *good* reason. To find it we need go no further than the author's own words in the Preface: "Training in—radiological physics—is undergoing a significant change in many institutions. For many years most radiologists trained in both the diagnostic and therapeutic applications of radiation. Traditionally, the physics training was heavily oriented toward the therapeutic applications. However, in recent years there has been a major emphasis placed on the physics of diagnostic radiology because most radiologists are entering that field and also because the diagnostic x-ray systems are increasingly sophisticated. It is these changes that have produced a need for a book of this type."

Professor Sprawls' own words make it clear that he intended his text for residents in diagnostic radiology training programs and not, as stated on the fly-leaf, "as a primary text for training x-ray technologists." As a result of long experience teaching radiological physics to radiology residents the author says ruefully: "The book assumes that the reader has no background in physics." While some residents will be maligned by this assumption, the majority will welcome it.

The text is a paragon of lucid prose. Basic concepts are explained in simple, sometimes graphic language: "X-ray photons impinging on a surface, like raindrops, will do so in a random pattern." The approach is largely qualitative with mathematics kept to a minimum. (For those with little grounding in mathematics there is an appendix that explains the mathematical relationships used in radiology in terms even the least mathematically inclined resident should be able to understand.)

Equations are stated rather than derived but in several sections the use of nonstandard notation may be confusing to some readers. For example, the familiar $I/I_0 = e^{-\mu x}$ equation that describes the attenuation of x-rays by an absorber is replaced by $p = e^{-\mu t}$, where p is the "penetration factor." This factor is expressed in units of cm^{-1} and hence is normalized for the x (thickness) dimension of the more familiar equation. Although the concept of penetration factor has some advantages in a discussion of x-ray imaging, its use destroys the analogy with the radioactive decay equation $N/N_0 = e^{-\lambda t}$ and is therefore probably a retrograde step.

The text begins conventionally with the fundamental physics of energy and of the structure of matter. The latter is dealt with purely at the atomic level. Nuclear phenomena are not considered. (What have nuclear phenomena to do with diagnostic radiology? More on that later.) Radiation quantities and units are introduced, including a section on light quantities and units which is so confusing it should be rewritten. The production of x-rays and the principles of x-ray tube operation and control are, on the other hand, described very clearly. Chapters on image contrast and resolution and image noise are outstanding and are recommended reading for all radiology residents. As befitting a text published in 1977, rare earth screens receive due consideration and sections on image intensification radiography and fluorography are well written.

The physics of CT and ultrasound have been included and in this respect this book is unique among radiology physics texts, most of which were written when these new offspring of medical imaging were mere embryos. Unfortunately, the treatment of CT physics is superficial. Important concepts such as the "partial volume effect" are not discussed, and the only reconstruction method mentioned is (unfiltered) back projection. Nonstandard notation is again used—e.g., "the CT number, N_m" instead of H (for Hounsfield units). The equation for calculation of CT number is given as $N_m = C\ (\mu_m\text{-}\mu_{water})$, rather than the standard

$$H = C\ \frac{\mu_m\text{-}\mu_{water}}{\mu_{water}}.$$

The difference lies in Sprawls' constant, which includes the second μ_{water} term, but the effect will be to confuse rather than edify.

The physics of ultrasound is covered in much greater depth than that of CT and is accordingly devoted three times the space. Real-time ultrasound, however, is barely mentioned.

While the writing is generally of a high standard, the "design" and quality control of the book leave something to be desired. The text presents a bland, uniform appearance which makes it difficult to pick out important statements. More use could be made of heavy type or italics. A summary of pertinent points at the end of each chapter would also be helpful. The diagnostic radiology resident studying for his written Board examination would also be assisted by a series of questions of the type used in the physics section of the Board examination. Some of the figures are little short of absurd: a figure entitled "Conceptual relationship of biological impact to absorbed dose" shows a box labeled "living tissue", with an arrow labeled "dose" entering it and a second arrow labeled "biological impact" leaving it. The proofreading is poor with many typographical and some factual errors (e.g., "contrast is directly related to the value of the scatter factor"—instead of inversely related.) The English is above average, but some phrases such as "more predominant than" and "minimized as much as possible" win the Redundancy Award for 1977. The curved lines on graphs have been drawn by a rather unsteady hand with a result that is unworthy of a professionally produced publication. There is a total of only eight references, most of them on radiation protection. One is left with a slightly uneasy feeling as to how well the material in the book was researched and, of course, further reading is made so much more difficult.

With the recent separation of diagnostic and therapeutic radiology training in the USA has come an increased emphasis on broad training in "Imaging" in diagnostic programs. Residents receive instruction in diagnostic roentgenology, CT scanning, ultrasound, and nuclear radiology. It would be not unreasonable therefore to expect that a physics text for residents that is described (on the fly-leaf) as "the only comprehensive textbook on the physics of diagnostic radiology" include a section on the physics of radionuclides. Surprisingly, while the physics of CT and ultrasound are well represented, the physics of radionuclides is conspicuously absent.

Finally, this seems an opportune occasion to raise again the question asked by Marvin Daves (*1*) (and no doubt by thousands of residents through the ages): "How important is detailed knowledge of radiation physics to the clinical radiologist?" Dr. Daves' answer is that it is "strictly for the Boards." The pun makes this answer a useful addition to the radiological literature, but most would agree that it represents an oversimplification. Few radiologists have, like Marvin Daves, a Bill Hendee to lean on. In fact, fewer than half the practicing radiologists in this country work in an institution large enough to support a radiation physicist. Maintaining adequate quality control and handling technical problems that arise during everyday practice, buying new equipment, answering patient's questions about radiation doses and effects, and adopting and overseeing personnel protection devices and practices all require active involvement of the radiologist when a radiation physicist is not available; and, to some extent, even when one *is* available. Accordingly, the radiologist *must* have a working knowledge of radiological physics and for this reason books like *The Physical Aspects of Diagnostic Radiology* will always perform a valuable service.

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REFERENCE

1. DAVES ML in *Medical Radiation Physics*, HENDEE WH. Chicago, Year Book Medical Publishers, 1972, pp 7–8

ISOTOPE EFFECTS ON ENZYME-CATALYZED REACTIONS. W. Wallace Cleland, Marion H. O'Leary, and Dexter B. Northrop. University Park Press, Baltimore, 1977, 303 pp, $39.50.

The study of reaction mechanisms using isotope effects on reaction kinetics began in the 1930's and has now become an important basic tool in organic chemistry. The publication of this book moves this powerful scientific tool one significant step closer towards its application to the diagnosis and understanding of human disease.

This text is a collection of the papers given at a symposium held in 1976 which brought together individuals who have been making isotope effect measurements and those who have been studying enzymatic reactions. The papers presented and discussed at the conference form a basic reference. The mathematics of both primary and secondary kinetic isotope effects are derived for the reader. Examples cited from the literature illustrate how the technique can be used to study enzyme-catalyzed reactions. Also extensive bibliographies are presented.

Chapter topics are: computation of isotope effects on equilibria and rates; magnitude of primary hydrogen isotope effects; solvent isotope effects on enzymatic reactions; secondary kinetic isotope effects; determining the absolute magnitude of hydrogen isotope effects; measurements of isotope effects by the equilibrium perturbation method; isotope effects in hydride transfer reactions; hydrogen isotope effects in proton transfer to and from carbon; studies of enzyme reaction mechanisms by means of heavy-atom isotope effects; and derivation of an isotope effect from the proline racemase overshoot in D_2O. The four appendices further enhance the reference value of this book to those who use the technique.

Although this is an excellent book, it contains little of practical value for most of us in nuclear medicine, and thus it is directed primarily toward those who are exploring new techniques. It is also recommended, however, for those