

## BOOK REVIEWS

**IMAGING WITH IONIZING RADIATIONS (VOLUME I).** K. Kouris, N. M. Spyrou, and D. F. Jackson. Glasgow and London, Surrey University Press, 1982, 204 pp, £29.75

This monograph is the first in a series entitled *Progress in Medical and Environmental Physics. Imaging With Ionizing Radiations* is intended to describe new developments in the applications of physical techniques in medicine. The book is proposed for graduate scientists and engineers or as a critical review for experienced workers in the fields. The first three chapters, which are rather general, are relevant to subsequent volumes in addition to the purpose of this first volume. The remaining four chapters deal with x-ray, charged particle, radionuclide, and positron imaging, respectively. Finally, there is a four-part appendix.

The first chapter introduces the concepts and definitions in imaging and traces the historical development of emission and transmission imaging but includes some discussion of other imaging modalities.

Chapter Two introduces information theory and linear systems. In the attempt to describe these topics in general terms without being specific to a particular imaging technique, the results become vague and difficult to relate to application. Parameters for defining image quality are described and sampling and ROC analysis covered.

Chapter Three discusses the theory of reconstruction from projections. From a generalized development of a continuous projection approach, the discrete case is developed, and classification of reconstruction methods is divided between transform and series expansion methods. For transform methods, the convolution back-projection technique is described for both parallel and fan beam geometries. Implementation in Fourier space is also presented as is a discussion of convolving functions. Series expansion methods concentrate on the algebraic reconstruction techniques. This chapter concludes with brief discussions of optimization criteria, 3-D imaging reconstruction, computer simulation programs, and noise.

In Chapter Four more specific discussions are given, beginning with x-ray radiography and transmission tomography. From the chapter title one would anticipate some discussion of conventional radiography, but the chapter is devoted almost exclusively to x-ray CT. There is an extensive discourse on the limitations of quantitative computed tomography and the different approaches that have been tried to solve this problem. The sequence of topics in this chapter is confusing.

Chapter Five, on charged particle radiography and tomography, adequately describes the physical principles underlying energy loss mechanisms of charged particles and charged particle scattering. A discussion of the different methods of radiography and tomography by charged particles is clear and concise and the advantage of charged particles over x-rays is emphasized and clearly explained. Considering the stage of development and extent of application of this technique, to devote a whole chapter, however, seems to be an overemphasis when compared with the other imaging methods using ionizing radiation.

Chapter Six, "Radionuclide Imaging and Gamma Ray Emission Tomography," includes a very good description of gamma ray imaging from both the general sense and the specifics of detection efficiency and energy resolution. The section on scattering is

particularly good, with emphasis on the magnitude of this problem in gamma ray imaging. The discussion of nonlinearity and nonuniformities of scintillation cameras is up-to-date. The second half of the chapter on gamma ray tomography, however, suffers from some confusion because of the order of presentation. A general formulation for emission tomography given in the middle of this section would have been more appropriately presented at the beginning of the tomographic discussion. Most gamma ray tomography today is performed with rotating scintillation cameras, but little discussion is provided on this topic. Most of the emission tomography systems described are limited angle tomography, such as multiple pinhole or coded aperture.

The last chapter on positron emission tomography is covered very well, presenting an overview of positron interactions and annihilation and continuing in a logical fashion through other topics unique and relevant to this imaging technique. The attenuation problem in emission tomography and its simpler solution with positron tomography is explained, and discussions of spatial sampling, instruments, and time-of-flight techniques are included. At the end of the chapter several clinical applications are provided.

The appendix is an unusual mixture of four subjects: (a) mathematical background including a discussion of the Dirac delta function and Fourier transforms; (b) probability theory including axioms, random variables, and stochastic processes; (c) compartmental analysis describing cerebral blood flow and oxygen metabolism, distribution of red cells, and cerebral glucose metabolism; and (d) detectors for imaging devices and the parameters for detector performance evaluation.

Although this monograph is relatively small, it cannot be assimilated in one reading. The descriptions for the most part are mathematical, but sometimes the logic of the sequence of subject presentation is unclear. I feel, however, that it is a useful reference text for the scientist-engineer with previous experience in medical imaging.

PAUL H. MURPHY  
Baylor College of Medicine  
Houston, Texas

**ATLAS OF RADIONUCLIDE HEPATOBILIARY IMAGING.** C. C. Kuni, W. C. Klingensmith, III. Boston, G. K. Hall Medical Publishers, 1983, 222 pp, \$39.95

The maturing of a field is often marked by the appearance of a "field guide" or "atlas." We are particularly reminded of the series of volumes entitled *Atlas of Nuclear Medicine* produced by DeLand, Wagner, and Dibos during the period 1969-1978. Hepatobiliary imaging has progressed to the point where an atlas is indicated for the practitioner of nuclear medicine; based upon their experience, Kuni and Klingensmith have produced such a work, presenting an account of Tc-99m iminodiacetic acid hepatobiliary agents and their clinical utilization. Chapter 1 gives a brief history of I-131 rose bengal and a comparison with Tc-99m labeled compounds. The chemical structure of iminodiacetic acid is not given, however, and the effects of additions to the ring on lipid solubility and partitioning are not clearly developed. Hepatic