POSITRON EMISSION TOMOGRAPHY.
Martin Reivich, Abass Alavi, Eds., New York, Alan R. Liss, Inc., 1985, 478 pp, $79.50

This book which has 54 contributors surveys the present state of theoretical and technical development of this technique emphasizing areas of application in neuroscience. The basic theoretical principles of quantitative autoradiography to the measurement of biochemical processes in vivo are described first by Louis Sokoloff. Progress and trends in the technology of PET are reviewed, covering instrumentation, accelerator-produced and radionuclide precusor labeled compounds, and positron emitter generators. Reconstruction algorithms for processing scanning data are examined, as are methods for three-dimensional analysis and display of these images. Theory and methods for the clinical measurement of local cerebral blood flow, glucose consumption, oxygen consumption, protein synthesis, and pH are presented, and the assumptions and limitations of these methods are critically reviewed. Both dynamic and steady state methods for the measurement of local cerebral blood flow and oxygen consumption are described. Single photon emission tomography is also described and compared with PET. Its principles, instrumentation, and methodology are examined and its use in various brain disorders is reviewed.

Applications of PET measurements for the study of stroke, epilepsy, aging and dementia, psychiatric disorders and brain tumors, as well as for studies of the heart, lungs, and systemic tumors are discussed. The use of PET in studying the processing of sensory and cognitive stimuli is explored, and the hypothesized close couple among cerebral blood flow, oxygen consumption, and glucose utilization is examined. Pharmacokinetic studies of patterns of concentration, distribution, and retention of radiolabeled pharmaceuticals in the brain are described. The relationship between nutritional blood flow and metabolic processes is considered as a means of identifying qualitative and quantitative differences between normal and neoplastic tissues.

This book will be of interest to radiologists, neurologists and cardiologists, clinical physiologists, research scientists and clinicians involved with PET in the fields of nuclear medicine, biophysics, biochemistry, oncology, and computer science. The educational level of this book is advanced and it is probably more appropriate as a library resource, although researchers in the field might want to have it as a personal reference. The text and illustrations are of very high quality and each chapter is well referenced.

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AN INTRODUCTION TO EMISSION COMPUTED TOMOGRAPHY, (Report #44).
E.D. Williams, Ed., London, The Institute of Physical Sciences in Medicine, 1985, 65 pp, £9.50

This small paperback was published by the publishing arm of the Hospital Physicists' Association with the stated aim of " . . . presenting information which should be available to someone who is using or introducing tomography, selecting equipment for it, or wishing to develop a clinical application . . . " For the most part the book fulfills its objective. However, the terseness forced upon the authors by the constraint of covering single photon, seven pinhole, rotating collimator and positron tomography in 65 pages sometimes interferes with the readability of the material. Outside of the discussion of the basic theory of filtered-back projection which contains a strange admixture of "simple concepts" and esoteric mathematical expressions, the level of discussion is appropriate to an overview. The writing style is very consistent throughout the book, a characteristic that is difficult to attain in any multi-author text, and one for which the editor is to be commended.

The text does cover an extremely broad range of topics and generally does it very well. Both basic concepts and some very practical considerations for the use of the technology are provided. The clinical application section is pretty much limited to a short literature review (with 39 references) and is divided into the various organ systems.

If one was going to pick at nits the complaint could be made that the book is too short. There are a number of instances in which an additional paragraph might have clarified a concept or an application. Having read the whole book it is still not clear what a 'partial volume effect' is or what an 'impedance estimator' does.

Although the briefness of the discussions might be more confusing than educational to the completely uninitiated, this little book is a very excellent overview and would serve as a fine precis for those with at least a nodding familiarity with the broad concepts of tomography. On a page per dollar scale the book might be considered expensive but it is a high quality publication and would be an excellent addition to the library of anyone interested in the field, particularly those involved in the often frustrating task of teaching others about this complex technology. The extensive references (158 references and an 11-item bibliography) alone would provide a good start to an in-depth training course.

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NCRP REPORT No. 83, THE EXPERIMENTAL BASIS FOR ABSORBED-DOSE CALCULATIONS IN MEDICAL USES OF RADIONUCLIDES.
National Council on Radiation Protection and Measurements, Bethesda, NCRP Publications, 1985, 109 pp, $13.00

What is the liver dose for an adult undergoing a SPECT liver/spleen imaging study? What dose would an embryo receive if the mother undergoes a gallium study? Are there important dosimetric differences between ^{201}Tl and ^{82}Rb when used for myocardial perfusion studies? My initial reaction to these types of questions is to whip out my MIRD pamphlets and make some calculations. NCRP Report No. 83 reminds us that there are three fundamental ways to answer those questions: (1) measure the desired doses directly in humans; (2) extrapolate from animal or phantom data; and (3) calculate using a mathematical model. The Report then discusses the advantages and shortcomings of each of these, concluding that calculational methods will continue to be more workable than the others. Mathematical models are expected to become more and more realistic as computing power increases and computing costs and time decrease. However, a mathematical model will never be an exact description of any given individual, and any assumed "Reference Man" biokinetics data will similarly not be an exact description of that individual. Thus, calculational methods will get better for a "representative" person, but we should never expect them to be exact for you or me as individuals, especially in the presence of altered physiology due to disease.

NCRP Reports 83 and 84, taken with Reports 70 and 73, constitute current NCRP thinking about radiation dosimetry in nuclear medicine. Report No. 83 will be of interest primarily to researchers working on internal dosimetry calculations and measurements. Health physicists and medical physicists who teach internal dosimetry may find it useful as a conceptual base for modern internal dosimetry techniques. Clinicians and technologists are not likely to find it of much value to them.

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NCRP REPORT No. 84, GENERAL CONCEPTS FOR THE DOSIMETRY OF INTERNALLY DEPOSITED RADIONUCLIDES.
National Council on Radiation Protection and Measurements, Bethesda, NCRP Publications, 1985, 109 pp, $12.00

Current USNRC regulations regarding internally deposited radionuclides are based on NCRP Report No. 22, "Maximum Permissible Body Burden and Maximum Permissible Concentrations of Radionuclides in Air and Water for Occupational Exposure," published in 1959. In recognition of many of the conceptual advantages of the most recent guidance of ICRP Publications 26 and 30, both EPA and NRC have announced plans to adopt the ICRP formulations in preference to the older NCRP scheme. the ICRP formulation is different from the NCRP approach in many philosophical as well as technical ways. It is understandable, therefore, that there has been a vigorous debate within the health physics and nuclear medicine communities in regard to the advisability of adopting the ICRP scheme in toto or only in part. NCRP Report No. 84 presents NCRP evaluations of ICRP methods and recommendations and expresses reservations about their use for radiation protection policy-making and for evaluation of exposures to individuals.

Chapters 1 and 2 describe current NCRP work related to this Report and the scope of the Report. Chapter 3 discusses the major concepts of ICRP Publication 26 *vis à vis* NCRP Report 22 and, in general, concludes that the ICRP Publication 26 scheme is an improvement. The ICRU Report 33 definition of dose equivalent, which had been tacitly adopted in a slightly different format in NCRP Report 39, was formally adopted, and the position is taken that "hot spot" distributions of radioactive material in an organ should nevertheless be treated as a uniform distribution for calculation of organ doses. The specific effective energy methodology for calculating organ doses was adopted; this is essentially the same as the MIRD method with changes in nomenclature. MPC's were based on continuous intake throughout the year, while annual limits to intake (ALI's) are based on a single intake per year. The calculational differences are minimal and have virtually no effect on long-term doses, although short-term doses may be significantly different. The committed dose equivalent is the integrated dose equivalent to an organ during the 50 years following intake. While agreeing that there are some valuable uses of the committed dose equivalent for planning purposes and for evaluating compliance, NCRP cautions against its blind use for calculating doses in individuals since actual organ dose equivalents will be of greater concern. NCRP prefers the concept of effective dose equivalent over the use of a critical organ in developing radiation protection standards, but it endorses the continued implicit use of the critical organ concept to derive maximum doses for organs having low susceptibility to stochastic effects.

Derived limits are discussed in Chapter 4. The annual limit on intake (ALI) is considered to be valid and to be useful for calculation of derived air concentration (DAC), but the ALI is deemed to be difficult to use in practice. The DAC concept is approved unconditionally. NCRP feels that derived organ and body burdens are necessary for the operational health physicist and expressed its dismay that ICRP did not present them; future NCRP reports will remedy this shortcoming.

Chapter 5 deals briefly with the mathematical models used by ICRP. Chapter 6 sets forth research needs that NCRP identified during preparation of the report, and Chapter 7 is entitled "Summary Statement of NCRP Position on Control of Internal Dose (with special reference to ICRP Publications 26 and 30)." Various appendices treat in more detail the mathematical models used in ICRP Publications 26 and 30.

NCRP Report No. 84 is a philosophical document which will be of value to those of us who are struggling with the proposed revision to 10CFR20, which is the regulatory embodiment of the new ICRP scheme. It is not a practical guide to the scheme, nor does it attempt to explain the scheme in detail. This Report belongs to the bookshelf of all health physicists and any nuclear medicine personnel concerned with the theoretical underpinnings of our national radiation protection policy.

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Books Received

Brigham and Women's Hospital Handbook of Diagnostic Imaging. *B.J. McNeil, H.I. Abrams, Eds. Boston, Little, Brown, and Co., 1985, 450 pp, $18.00*