BOOK REVIEWS

NUCLEAR MEDICINE ANNUAL 1982. L. M. Freeman, H. S. Weissmann. New York, Raven Press, 1982, 420 pp, $49.00

This third volume of "current status" reviews offers a wide variety of interesting topics ranging from such well-established procedures as blood-pool scintigraphy to ongoing investigations with radiolabeled leukocytes and to the past, present, and future role of the cyclotron. The chapters on bone scanning of trauma and benign conditions, radioiodine treatment of hyperthyroidism, and efficacy of bone and liver scanning in malignancies are exceptionally well-written and provide much useful information gleaned from the literature and the authors' personal experiences. Other chapters on liver scintigraphy for space-occupying disease, correlative radionuclide and ultrasound imaging in abdominal disorders, and radioimmunoassay and related methods are valuable reviews pertinent to daily practice. The chapters on radiolabeled platelets and radiolabeled leukocytes provide much information and excellent references for the reader who wishes to delve deeper into these areas. The section dealing with the role of the cyclotron and functional imaging of the brain with PET are comprehensive and extensively referenced, and it requires considerable concentration. Blood-pool scintigraphy of the heart details first-pass and equilibrium methodology, compares the two techniques, and contrasts them to two-dimensional echocardiography similar to other recently published reviews.

The illustrations are nicely reproduced, but in several instances the separation of many pages between the text reference and the illustration may prove disruptive to the reader. To the editors' credit, missing arrows, mistyping of tables, and the like are held to a minimum. This volume will be a valuable addition to the library of any practicing nuclear physician and should be required reading for residents and specialty examination candidates.

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ADVANCES IN RADIATION BIOLOGY. J. T. Lett, H. Adler, Eds. Academic Press, New York, 1981, Vol. 9, 473 pp, $55.00

This volume covers a wide variety of subjects from radiation effects on molecules to those on tissues, and the authors and editors have maintained the level of excellence extant in the previous volumes. It is a valuable book not only for this reason but also because it is now the only publication dedicated to reviews on the action of ionizing radiation on biological systems.

The specific topics are revealed by the chapter titles: 1. "The role of radiation and chemicals in the induction of mutations and epigenetic changes during carcinogenesis;" 2."Radiation-induced vascular injury and its reaction to late effects in normal tissues;" 3."Evaluation of nitroheterocyclic radiosensitizers using spheroids;" 4."Radiation-induced strand breaks in DNA: chemical and enzymatic analysis of end groups and mechanistic aspects;" 5."Radiation-induced events and their time scale in mammalian cells;" 6."Solid-state radiation chemistry of DNA: the bases;" 7."Intrinsic radiosensitivity of proliferating mammalian cells;" 8."Factors governing the use of microwave/radiofrequency energies in cancer therapy."

The vigor of the research in radiation biology exemplified by these chapters puts them in sharp contrast to the final and unusual chapter by K. G. Zimmer, "That Was the Basic Radiobiology That Was: A Selected Bibliography and Some Comments," in which he gives a provocative and timely discussion of the decline in support for basic radiation biology on an international scale. This discussion will interest anyone concerned with radiation effects. To support its theme a list of "important textbooks, monographs, and review volumes with their tables of contents" published since World War II is included. Among other points, Zimmer notes that recent textbooks are directed primarily toward students of medical (applied) rather than toward those of basic science.

With the premise that sound basic research must precede practical applications, Zimmer offers a concise rationale for the current emphasis on "mission oriented" research. After reviewing the prominent conceptual and theoretical models of radiation action that have been proposed, beginning with the "point heat" theory Dessauer put forth 60 yr ago, he notes the failure of the models to yield a general law or rule for the biological action of radiation. One main reason for this is that a unique target has not been established in the nonhomogeneous molecular system that is the cell. Although DNA has been shown to be an important site of action, primary damage to other types of molecules cannot yet be unequivocally ruled out.

Zimmer proposes that the failure of basic research to provide information that would lead to an effective "drug" against injury from military and industrial radiation and to an effective regimen of radiation therapy for tumors has contributed to an accelerated pursuit of practical research for radiation protection and radiation therapy. This view seems simplistic, but it contains enough truth to prod us to persist in seeking fruitful research directed toward the fundamental problems. Zimmer is not pessimistic but rather points out questions that beg answers and takes the position, held by many, that the most promising approach is the molecular-biochemical study of the cell's response to radiation. Other chapters in Volume 9 of *Advances in Radiation Biology* report the significant progress that is being made with this approach.

A monograph that deserves attention and was not available when the volume went to press is *The Molecular Theory of Radiation Biology* by K. H. Chadwick and H. P. Leenhouts (Springer-Verlag, N.Y., 1981).

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CRC HANDBOOK OF MEDICAL PHYSICS VOLUME I. R. G. Waggener, J. G. Kereiakes, R. J. Shalek. Boca Raton, FL, CRC Press, Inc., 1982, 327 pp, U.S. $64.00, outside U.S. $74.00

The charge given the authors of this Handbook was that they should write about a topic as if to give a good friend a "quick knowledge of that particular subject." I contend that this approach leads to a set of chapters for the nonspecialist, which is not what a handbook should be. Be that as it may, I shall review the chapters for their breadth.

The *Handbook of Medical Physics*, Vol. I, contains twelve chapters, ten of which are oriented toward radiation therapy and may be helpful in that area. (The therapy-oriented chapters will

doubtless be reviewed in therapy-oriented journals.) The other two chapters are on the assay of β^- and γ sources and statistics and error analysis. The authors have been poorly served by the editors, the typesetters, and the proofreaders. The references include none more recent than October 1975. Chapters are given in the Table of Contents by name and authors only, and subheadings are not given in outline form so the reader can determine what the chapter covers or where to find a particular subject. I shall comment specifically about the two chapters mentioned above.

The chapter on assay of sources begins with standards and a list of available NBS standards (several of the chemical elements are given incorrect symbols). There is no reference to the chapter on statistics and vice versa, but each rather develops solutions to the same topics. The chapter is thoroughly illustrated although two illustrations are reversed, and the caption for Figure 2 misquotes the source of the figure. The third section deals with beta counting, and a bit more space is devoted to liquid scintillation counting than to gaseous detection. For each, an outline of the setup, use, and quality control of a typical system is given. The names of the scintillators, POPOP and PPO, are not given correctly. The next section covers the assay of gamma sources by ionization chamber, by NaI(Tl) crystal, and by semiconductor detectors. The dose calibrator discussion is adequate. The section dealing with the NaI(Tl) detector describes different kinds of samples and different counter geometries in a somewhat disorganized manner. No mention is made of counter drift as a source of difficulty, and a typical block diagram is not given for either the NaI(Tl) or semiconductor detector systems, although there is a thorough set of diagrams in previous sections. No information is given concerning shielding these systems. The chapter's appendix gives formulae for the calculations of "spillup" and "spilldown" in dual nuclide counting (called dual "isotope" counting). A linear correction is used with a caveat that samples should have adequate count rates to avoid error propagation, but there is no mention of any further complications. The term "adequate count rates" is not defined even by reference to the statistics chapter. In summary, this chapter should be better organized and more explanation provided, and there are a few omissions.

The chapter on statistics begins with what I believe to be an inaccurate description of radioactive decay as being a random process. The randomness is in the nature of the decay process, not in our inability to measure the same result every time. The chapter was pleasantly thorough but, once again, lacked the attention of an editor and a proofreader. The link between the Poisson and the Gaussian distributions was omitted, leaving the reader to wonder from whence the Gaussian arrived. After the authors have developed their theme from the binomial through the Poisson to the Gaussian description using the same example, they note that the distributions can be compared. At the end of the Chapter, Figure 1 appears with no legend to indicate that it illustrates the sought-for comparison and the text does not refer the reader to the figure.

Propagation of error is nicely treated with examples. Hypothesis testing is discussed with the aid of some figures, which unfortunately do not match the text. An extra table was added and consequently all the text references to the tables are incorrect. Tests of randomness are next described. The editor should have organized the section with the relevant parts of the example appearing on the same page, so that sums were not "orphaned." In addition, an extra number has been inserted in the example between the text description of the problem and its solution. These difficulties and others, such as incorrect subscripting and superscripting, confuse the reader. The Poisson distribution discussion would have been more valuable had it been cross referenced to the previous chapter, and the paired source method could have been jointly described and given the same name in both chapters.

I hesitate to recommend this book as a reference on the topics I have discussed. Chase and Rabinowitz is an old standby and will have to continue to be so although certainly its treatment leaves a great deal to be desired.

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RADIATION DAMAGE TO THE NERVOUS SYSTEM: A DELAYED THERAPEUTIC HAZARD. H. A. Gilbert, A. R. Kagan, Eds. New York, Raven Press, 1980, pp 225, $30.00

This volume represents a good overview of an important issue—late effects of radiation on the nervous system, a topic of interest to everybody who deals with neurooncologic problems. The book is well edited and includes almost all relevant subjects ranging from diagnostic and dosimetric considerations to treatment of radiation brain necrosis.

The first two chapters are devoted to the experimental observations of delayed necrosis in normal animal brain and a review of clinical experience on irradiation injury of the human brain. W. F. Caveness has demonstrated that a dose of 8,000 rad in eight weeks to the monkey brain causes irreversible damage, which was not seen with 6,000 rad in six weeks. M. M. Mikhael correlated the CT findings of brain necrosis with the tumor dose based on isodose reconstruction maps in his chapter, "Dosimetric Consideration in the Diagnosis of Radiation Necrosis of the Brain." In "Imaging Techniques in Diagnosis" M. D. F. Deck presented eight case reports to show the variable appearances of brain lesions on CT scans as a result of delayed radiation injury to the brain. He has also observed various patterns of evaluation of delayed radiation changes; i.e., some lesions resolved either spontaneously or by steroid medication whereas others progressed to fatal radiation necrosis within or outside the brain lesion.

D. R. Groothuis and N. A. Vick ("Radionecrosis of the Central Nervous System") presented several key issues along with four case reports dealing with radiation damage to the central nervous system. They also reviewed the neuropathological changes of radionecrosis of the brain and found that the characteristic vascular abnormalities correlated poorly with the demyelination and necrosis but that coagulation necrosis was the most extensive and irreversible type of damage. M. S. Edwards and C. B. Wilson suggested a new direction in the treatment of radiation necrosis in their chapter "Treatment of Radiation Necrosis." They discussed the efficacy of surgical and/or medical treatments of radiation necrosis, and surgery appeared to be a life-saving measure. In the future this approach should be ideal in many patients. T. J. Kinsella et al. have discussed uncommon problems of radiation damage to the cranial and peripheral nerves. The dose-fractionation schedule and volume irradiated are considered to be the major determinants of damage, often caused by poor radiation technique and unacceptable dose inhomogeneity.

Based on survivors of childhood leukemia, M. A. Bleyer and T. W. Griffin have examined adverse late effects of disease and its treatment. The apparent late sequelae following chemo-radiotherapy were: (1) decreased intellectual function; (2) necrotizing leukoencephalopathy; and (3) mineralizing microangiopathy with dystrophic calcification. They found that the risk and severity of delayed neurotoxicity are directly proportional to the number of therapeutic modalities used; e.g., intrathecal (IT) methrotrexate (MTX), high-dose intravenous MTX, and radiotherapy. Correlation between the risk of leukoencephalopathy and cumulative dose of IT MTX were discussed, i.e., chemotherapy given with radiation intensified damage to normal tissue. "Effects of Irradiation on the Hypothalamic and Pituitary Regions" by G. E. Richards is an important but controversial and complex topic. Well-designed, prospective, and careful studies will be needed in the future to correlate various factors such as age at treatment,