THE BASIC PHYSICS of RADIATION THERAPY

By

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Preface

PHYSICS has played a dominant role not only in the birth and development of Therapeutic Radiology, but also in the charting of its future course. Every major advance in the technical aspects of radiation therapy has been predicated on new information in physics and engineering. This is evidenced particularly by the advent and popularization of supervoltage therapy and medical radioisotopes.

To the resident in radiology, physics often looms as a major obstacle in a varied and intensive program. So often, the newcomer to radiology is keenly aware of his deficient background in the physical sciences, making his task even more difficult. Yet, a secure foundation in radiologic physics is necessary both as a part of any successful training program and as a basis upon which to build future knowledge. The chore of keeping abreast of new developments in therapy methods and apparatus, and of appraising their value, is facilitated when the radiologist is adequately trained in physics. However, there is no consensus among teachers of radiology as to the amount of time that should be devoted to physics in the average residency training program. While some believe that there is already too much emphasis on the physical basis of radiotherapy, others are of the opinion that in many cases this is being grossly neglected. Despite this difference of opinion, there can be no question that the better the radiologist's training in physics, the more intelligently he can plan his therapy and the more satisfactory will be his relationship with his consulting physicist.

The purpose of this book is to explain the fundamental physical principles underlying radiation therapy in as comprehensive and comprehensible a manner as possible, without sacrificing accuracy for simplicity. Wherever possible, the material is presented from the standpoint of the radiologist who, from his own experience, is aware of the problems confronting the resident in radiology. It is hoped that such a presentation will be of benefit not only to the resident but also as a refresher course for the practicing radiologist. Furthermore, in view of the present trend toward two-year courses in schools of x-ray technology, this book may serve to direct more attention to the physics of radiation therapy in the x-ray technician's training program. To facilitate adaptation to various curricula, the chapters and sections are so arranged that certain material can be excluded without jeopardizing the continuity of the text. For this reason, a minimum of cross references has been used; each section has been made as complete as possible in its own right.

Since experienced teachers are well aware of the shortcomings of most neophytes where mathematics is concerned, the first chapter is devoted to the mathematical concepts pertinent to Therapeutic Radiology. Matter, energy, and radiations are then covered in survey fashion in order to acquaint the student with modern "pure" physics in preparation for the more specific aspects of radiation therapy physics. The production and properties of orthovoltage x-rays are reviewed briefly, since most students will have had a certain amount of instruction along these lines. The greatest emphasis is placed on the interactions of radiation with matter, radiation dosage and quality, therapy planning, supervoltage and telecurietherapy, radioactivity and nuclear physics, and radium and radioisotope therapy. Finally, detailed consideration is given to radiobiology and health physics since these are assuming a position of ever-increasing importance not only in medicine, but in the world at large.

The Bibliography has been assembled at the end of the book in order to facilitate the location of references. A supplementary list of textbooks and other books for collateral reading has been added to broaden the scope of the student's background.

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