SECOND EDITION

THE PHYSICS OF RADIOLOGY

By

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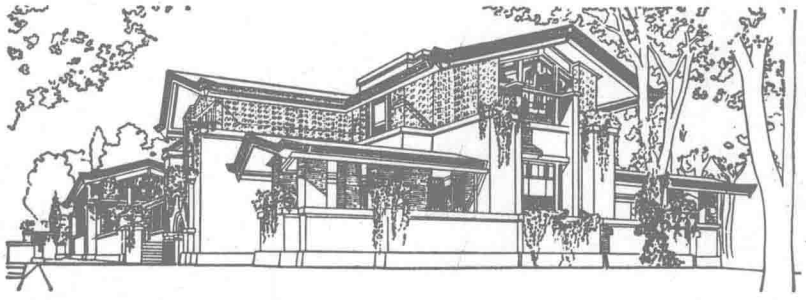

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PREFACE

This second edition of the book *The Physics of Radiation Therapy,* published in 1953, has been expanded to include discussions on diagnostic radiology and the diagnostic uses of isotopes. The title has therefore been changed to *The Physics of Radiology.* It is written with the object of supplying students of Radiology and Physics, as well as physicians, with the fundamental physical principles basic to an understanding of radiology. It contains information and ideas which should be of value to radiation physicists.

There is no detailed discussion of elementary electricity and mechanics since this may be found in any number of physics text books. Throughout, the concept of the energy of a photon of radiation rather than its wavelength, has been emphasized. A detailed discussion of the methods by which an x-ray beam can transfer its energy to tissue has been included. Emphasis has been placed on the concept of energy absorption in tissue.

Throughout the book new concepts of energy absorption, using the rad, have been emphasized and every effort has been made to distinguish between the roentgen and the rad. Detailed calculations have been included to show how absorbed dose in rads may be obtained from exposure dose in roentgens. All statements of dose for x-rays, radium and isotope therapy have been based on the rad.

Because of the present widespread use of supervoltage and teletherapy machines, detailed discussions of these high energy machines have been included. Emphasis has been placed on radiations in the 1-3 Mev range rather than in the 200 kv range because these latter radiations will be replaced in large measure by high energy radiations. A complete chapter on the combination of radiation fields for clinical use has been included. This contains many illustrations using cobalt 60, caesium 137 and other high energy radiation. A complete chapter on rotation therapy will also be found.

Present day emphasis on high energy radiations has necessitated a detailed discussion of the difficulties of measuring such radiation. Various types of dose meters have been described in detail. This should prove of value to the radiation physicist.

The description of radium dosage has followed closely the Manchester system with slight alterations to enable the dose to be expressed in rads.

The widespread interest in radiation hazards has required a detailed discussion on Radiation Protection. The growing field of radiobiology has been dealt with in one chapter and emphasis has been placed on recent advances in the understanding of radiobiology at the cellular level.

To increase the practical application of this book, an extensive appendix has been included. Section A contains data on absorption coefficients and related topics useful to the radiation physicist. Section B contains much depth dose data for circular and rectangular fields for a great variety of radiations and focal skin distances. A few isodose curves for 200 kv radiation, caesium 137, cobalt 60 have been included.

Throughout the book numerous examples have been introduced to clarify the concepts. At the end of most chapters are problems which the student should attempt. The answers are at the end of the book.

A book of this type cannot be written without discussions with many people. To all these people I wish to acknowledge my appreciation and indebtedness. Dr. Jan Cederlund, who has been at the Ontario Cancer Institute on loan from the Radiofysiska Institutionen, Lund, Sweden, has been of inestimable help to me. He has read each chapter carefully, offered many constructive suggestions and has interpreted to me the European approach to this subject. Professor J. E. Till of the Department of Medical Biophysics, University of Toronto, prepared much of the material for the chapter on Radiobiology. In the chapters containing clinical applications, Dr. C. L. Ash, Director of the Ontario Cancer Institute, Dr. W. D. Rider and Dr. W. E. C. Allt, Senior Radiotherapists at the Ontario Cancer Institute, read the script carefully and made many suggestions. Helpful discussions with Professors A. W. Ham, G. F. Whitmore and J. W. Hunt of the Department of Medical Biophysics, Professor K. G. McNeill of the Department of Physics, Dr. D. J. Wright, Dr. J. R. Cunningham and R. S. Bush of the Physics Division, Ontario Cancer Institute, Professor A. C. Singleton, Head of the Department of Radiology, Dr. H. O. R. Stolberg, resident in Diagnostic Radiology, and Dr. R. M. Taylor of the National Cancer Institute of Canada, are gratefully acknowledged.

I am grateful to Dr. F. W. Spiers for permission to include some of his basic work on the absorption of energy in a heterogeneous medium, to Dr. W. J. Meredith for his excellent tables on the use of radium, and to the originators of the Manchester system of radium dosage. In addition, I wish to thank the many other persons who have given me permission to use their work.

It gives me great pleasure to acknowledge the assistance of Dr. Milton Friedman, Editor of the Radiation Therapy Series of the American Lecture Series. He read the script very carefully and made many helpful suggestions concerning the material to be included in this book.

Mr. T. J. D. West, the Chief Mould Room Technician at the Ontario Cancer Institute, prepared all the casts and moulds used in the illustrations and Mr. R. S. Gilder, of the Photographic Department of the Institute, made the diagrams for the illustrations in the book. Mrs. Hilda Crawley, Librarian

at the Ontario Cancer Institute, checked many of the references in the book. My secretary, Miss Elizabeth Westbrook, typed the script and checked many of the references with the assistance of Miss Ruth Mills and Miss Florence Armstrong. For all this technical assistance, I am grateful.

Without the continuous encouragement of my wife and family, this book could not have been completed.

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