

Radiochemistry

PROFESSOR
IGOR N. BECKMAN

RADIATION AND
NUCLEAR MEDICINE:
physical and chemical aspects



I.N.Beckman

**RADIATION AND NUCLEAR MEDICINE:
PHYSICAL AND CHEMICAL ASPECTS**

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A text-book series in Postgraduate Education

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Abstract

“Radiation and nuclear medicine: physical and chemical aspects” is the 7th volume in popular *“Radiochemistry”* text-book series, authored by prof. I. Beckman. This volume is dedicated to clinical applications of ionizing radiation and radionuclides. The author describes their usage in modern diagnostics, surgery and therapy and provides numerous practical examples to the reader. **Part I** describes the phenomenon of radioactivity, nuclear reactions, interactions of ionizing radiation with matter and biological effects of radiation. Current national and international radiation safety guidelines and sanitary standards are provided. **Part II** of the text-book is dedicated to methods of radiation diagnostics (planar X-ray imaging and CT scans) and therapy (X-ray-, γ -, and hadron therapy; radiosurgery, brachytherapy). **Part III** contains essential information on radionuclide diagnostics and therapy. The author describes the theoretical foundations, equipment and applications of scintigraphy, radioimmunoassays, single-photon emission computed tomography, positron emission tomography and kinetic methods. Methods and equipment for production of short-lived radioisotopes, as well as synthesis of radiopharmaceuticals are all outlined in the concluding chapters of present volume. The author reviews techniques which are currently employed in radiation and nuclear medicine as well as their applications in diagnostics and therapy of malignant tumors.

The volume has been written as an accompanying text-book for post-graduate students, taking advanced courses in chemistry and physics. However, it can be used a reference book by researchers working with radiation and by everyone who is interested in ionizing radiation, radioisotopes and their medical applications.

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Radiation is particularly associated with nuclear medicine and the use of nuclear energy, along with X-rays, is ionising radiation. Another valuable report, titled Low-level Radiation and its Implications for Fukushima Recovery, was published in June 2012 by the American Nuclear Society. In 2012 UNSCEAR reported to the UN General Assembly on radiation effects. The health effects of exposure both to radiation and to chemical cancer-inducing agents or toxins must be considered in relation to time. There is cause for concern not only about the effects on people presently living, but also about the cumulative effects that actions today might have over many generations. Nuclear medicine is a medical specialty involving the application of radioactive substances in the diagnosis and treatment of disease. Nuclear medicine imaging, in a sense, is "radiology done inside out" or "endoradiology" because it records radiation emitting from within the body rather than radiation that is generated by external sources like X-rays. In addition, nuclear medicine scans differ from radiology, as the emphasis is not on imaging anatomy, but on the function. For such reason, it is Nuclear Medicine Physics. Pages within Medical Physics. Medical Physics. Instrumentation & Clinical Engineering. The techniques are non-invasive, requiring in most instances no more than an intravenous injection. The radiation dose is similar to, and often far less than, that given in an equivalent radiological procedure. The Nuclear Medicine service for NHS Tayside is based at Ninewells Hospital, Dundee, with a satellite unit at Perth Royal Infirmary and conducts approximately 7000 investigations each year. The majority are imaging studies, where an image of the distribution of a radioactive pharmaceutical in the patient is obtained using a gamma camera.