

## PERSONAL NEWS

mining the role of oxygen and hydrogen in nuclear reactors under accident conditions. Under his prudent leadership the risk-prone chemical operation of removing the biofouling of the CIRUS nuclear reactor was successfully carried out in the sixties. He recognized very early the necessity of having stringent control of the chemical parameters of reactor water to minimize corrosion. Such foresight led to the establishment of the water and steam chemistry laboratory at Kalpakkam and the research groups in recoil and radiation chemistry made notable contributions of international standard. He was a champion of instrumentation in chemical research which is reflected in the development and transfer of know-how of the first indigenously designed gas chromatograph to industry.

He attended several international conferences including the first UN Conference on the Peaceful Uses of Atomic Energy held in 1955. He was a member of the editorial boards of

several Indian and international journals. In recognition of his outstanding contributions in chemical sciences he was elected fellow of the Indian National Science Academy (1969) and of the Indian Academy of Sciences (1975). Shankar was keenly involved in the activities of the Indian Chemical Society which he served in various capacities, ultimately as its president. He was elected president of the chemistry section of the Indian Science Congress Association in 1965.

About fifty students have received their doctorate degrees under his erudite guidance. He has more than 100 publications to his credit in reputed journals.

After retirement from BARC in 1972 Shankar actively continued his academic pursuits. He was an emeritus scientist and later adviser in the Department of Atomic Energy. During 1975 his services as Director of the Science Research Council were used by the University Grants Commission to streamline the

selection and funding of research schemes. He was also an advisor to the vice-chancellor of Kashmir University, Srinagar.

His admirers and students organized a national symposium on emerging frontiers in chemistry on his 75th birthday in November 1987 and the Indian National Science Academy brought out a special commemorative volume on this occasion.

Shankar ardently believed in observing discipline in scientific research and in life. He was always courteous and an immaculately dressed person. His death is a blow to the cause of chemistry in this country.

Shankar is survived by his wife and six illustrious sons.

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## BOOK REVIEWS

### Comprehensive radiobiology

**Biological Radiation Effects.** J. Kiefer. Springer Verlag, Berlin, 1990, 444 pp. Price: DM 98.00.

The book contains 24 chapters and two appendices and is a good attempt to give an overall view of the different aspects of radiobiology. The first four chapters are devoted to radiation physics, dealt with in a detailed manner usually not encountered in a book on radiobiology. The book starts with a chapter on the types of radiation, their sources of production, emission spectra of UV and ionizing radiations and the decay process of natural as well as artificially produced radionuclides. It then goes on to explain the processes of interaction of radiation with matter, which covers the next two chapters, the second of which only may interest

biologists as the first will fall into the field of a physicist.

Chapter 4 gives the energy transfer and microdosimetric consideration in energy deposition and distribution in biological targets. The relation between energy transfer and ionization track structure is described in detail, quoting values for different nuclides. This chapter also deals with the dosimetry of incorporated radionuclides and a short section on dosimetry of optical radiation.

The next two chapters are devoted to radiation chemistry; the first part of the fifth chapter dealing with photochemistry will fall more in the realm of a chemist, while the second part on radiation chemistry is of direct concern to a radiobiologist and is highly relevant to the radiation chemistry of DNA dealt with in the next chapter. Considering the importance DNA lesions have attained in radiation biology in recent years, the treatment of effect on DNA is rather brief. Though the topic continues to the next chapter, a major part of

chapter 7 is allotted to modern techniques like application of recombinant-DNA technique in studies of molecular changes.

Chapters 8 to 17 are devoted to cellular radiobiology. Cell survival curves and their relationship to biological complexity and cell population structure are described in chapter 8. Also included in this chapter is a note on dependence of cellular radiosensitivity on nuclear DNA content. Role of LET in influencing the survival curves is analysed in detail and the chapter ends with a brief account of the interaction of different types of radiation, which includes both UV and ionizing radiations.

The next chapter deals with chemical sensitization and protection, where the role of oxygen as a radiosensitizer is given a dominant place and is described in detail, while the topics of normal tissue protection by thiols and hypoxic cell sensitizers get a cursory glance.

Chapter 10 is on radiation effect on cell cycle phases. A brief outline of the

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effect on different phases of cell cycle, inhibition of DNA synthesis and division delay is given, without doing a deep study on any of the subjects. Unlike in many of the earlier books on radiation biology, chromosome aberrations and gene mutations are dealt with in separate chapters. This is quite appropriate in view of the great progress in mutation research in recent years. The molecular aspects of radiation mutagenesis described in chapter 12 can give the preparatory information for a researcher entering the field of molecular radiobiology. The chapter also gives a brief outline of *in vitro* neoplastic transformation studies.

The topic of repair and recovery is dealt with in better detail, with attention to the different types of repair processes. Examples of human hereditary diseases related to mutations and gene repair anomalies are cited. Modification of radiation effects by physical factors like dose modulations and temperature are touched upon in chapter 14. A short section on repair inhibitors is included.

Chapter 15 tries to give some insight into the hazardous effects of other types of radiations not usually incorporated in a book on radiation biology. Though not elaborate, this chapter is important because of the advent of ultrasound, microwaves and radiofrequency waves in human application as also the possibility of incorporation of radionuclides and radiomimetic chemicals into cells.

Chapter 16 deals in fair detail the different theoretical approaches to quantitate radiation action on cells. Starting from the original target theory it goes on to the two-hit model and theories based on microdosimetric considerations and repair models. The references at the end of the chapter should give enough reading material to those who have more than a casual interest in the subject.

Chapter 17 is a brief introduction to relating cellular effects to whole-body effects. *In vivo* cell survival parameters and cell renewal systems are introduced. This is followed by a description of whole-body effects, where acute radiation syndromes, lethality and therapy of radiation sickness are discussed.

The next three chapters, 19, 20 and 21, are important in the context of the present-day awareness of the harm to progeny and radiation carcinogenesis.

With recent reports on radiation-induced mental retardation in Japanese children and leukaemia incidence in the children of nuclear power plant workers, interest in the effect of *in utero* exposure is increasing. But this topic has received only a cursory examination in chapter 19, which could serve at the best as an introduction to the subject, while late somatic effects, especially radiation carcinogenesis, are dealt with in more detail in the next chapter.

Chapter 21 deals with environmental risks from radionuclides deposited in the body, which is very relevant in terms of environmental pollution. The dosimetric factors for emitters of different types of radiation given in the chapter will be useful in risk estimation from released radioactivity.

Radiation in the environment, though universally accepted as important, is not generally included in a book of radiation biology. Therefore it has been thoughtful of the author to devote some space for this area in chapter 22, on radioecology. It is also logical that this topic is followed immediately by a chapter on radiation protection regulations.

No book on modern radiation biology is complete without a discussion on the relevance of radiobiological studies in improving radiotherapy of cancer. This is made clear in the last chapter of the book, where the author discusses radiobiological experiences with experimental tumours and their role in understanding tumour response to radiotherapy. A brief review of the new modalities in radiation therapy is also included.

There are two appendices at the end. The first is on mathematical and physical relations. The mathematical equations may generally be ignored by a radiobiologist as too complicated. But a radiation physicist could find them useful. The second appendix, titled 'Biological background', deals with DNA, the genetic code and information processing. The notes on cell cycle and gene cloning at the end are too brief to be of much help to a beginner. The information given in appendix II could have been easily incorporated into the chapters 10 and 11.

In dealing with such a vast array of topics, it should be expected that all the subjects cannot be dealt with in equal depth and detail. Therefore a number of topics, some of them falling mainly in a biologist's realm, are only briefly dis-

cussed, while some others, e.g. cellular radiobiology, are discussed in more detail. The chapters on radiation physics and chemistry will attract both physical and biological scientists, though the elaborate mathematical treatment of some of the aspects can sometimes scare a pure biologist. In general the book will be useful to both physicists and biologists working with radiation.

In addition to UV and ionizing radiations, light photon interactions are given a not-so-insignificant place in this book. This probably reflects the author's interest in the currently up-coming field of cancer phototherapy. Biophysics has a dominating presence all through the different chapters of the book. This is not surprising considering that the author has a physics background and the book is built on his classroom lectures, as stated in the preface. This book is an updated English version of his original book in German *Biologische Strahlenwirkung*, published in 1981. The references at the end of each chapter are thoughtfully selected to give ample guidance for literature search to those who want to study the subject in more detail.

This seems to be the first time that somebody has attempted to combine so many diverse aspects of radiation biology in one book, though the main emphasis is on cellular radiobiology. The author is to be congratulated on his success in bringing out such a book. The effort put is clearly evident in the extensive literature cited and the illustrations included. This could be a good reference book for students of radiation biology and will be an asset to any library catering to research needs in the subject.

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### Brief reviews

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**Biotechnology in Agriculture — Reaching The Unreached, A Dialogue.** M. S. Swaminathan, ed. Macmillan. 371 pp. Rs. 320.

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The book is a record of the 'interdisciplinary dialogue' held in Madras in