

- **$\alpha$ -particles**

- Two protons plus two neutrons
- Helium (He) nuclei
- Charged particles (2+)



High ionization density

- **$\beta$ -particles**

- Electrons (or positrons)
- Charged particles (- or +)



Low ionization density

- **$\gamma$ -rays and X-rays**

- Electromagnetic waves (photons)



Low ionization density/high  
penetrating power

- **Neutron beams**

- Neutrons
- Uncharged particles



High ionization density

When the ionization number is the same, the higher the ionization density is, the larger the biological effects are.

# Biological Radiation Effects

**RJ Alexander**



## **Biological Radiation Effects:**

**Biological Effects of Radiations** Daniel Grosch, 2012-12-02 Biological Effects of Radiation Second Edition aims to present an organized survey of the various experiments wherein living materials have been exposed to ionizing and exciting types of radiations. However, this book focuses on the effects of radiation on lower organisms as these have received less attention. It tells how small amount of energy can damage submicroscopic structure and ultimately alter the appearance and abilities of such organisms. Divided into five parts, this book starts off with two introductory chapters in the first part. It explains the effects of radiation. Then other parts of the book focus on the impact of radiation from cellular to organ level. How the lower organisms response is then discussed. Lastly, the book explains the interrelations between organisms in contaminated areas. Same with the first edition, emphasis is given on the consequences of mutations as a whole chapter is devoted to this topic. Furthermore, this book covers discoveries from experiments with cultured cells. This book is a good text reference for students and professionals. Also, it can be of great help to scientists, researchers, and specialists involved in the biological response to radiation. *Biological Effects of Radiation* J. E. Coggle, 1983

**Biological Radiation Effects** Jürgen Kiefer, 2012-12-06 The biological action of radiation undoubtedly constitutes an issue of actual concern particularly after incidences like those in Harrisburg or Chernobyl. These considerations, however, were not the reason for writing this book, although it is hoped that it will also be helpful in this respect. The interaction of radiation with biological systems is such an interesting research objective that to my mind no special justification is needed to pursue these problems. The combination of physics, chemistry, and biology presents on one hand a fascinating challenge to the student; on the other, it may lead to insights which are not possible if the different subjects remain clearly separated. Special problems of radiation biology have quite often led to new approaches in physics or vice versa. A recent example is microdosimetry. Chapter 4 Biological radiation action comprises all levels of biological organization. It starts with the absorption in essential atoms and molecules and ends with the development of cancer and genetic hazards to future generations. The structure of the book reflects this. Beginning with physical and chemical fundamentals, it then turns to a description of chemical and subcellular systems. Cellular effects form a large part since they are the basis for understanding all further responses. Reactions of the whole organism, concentrating on mammals and especially humans, are subsequently treated. The book concludes with a short discussion of problems in radiation protection and the application of radiation in medical therapy. These last points are necessarily short and somewhat superficial.

**Federal Research on the Biological and Health Effects of Ionizing Radiation** National Research Council (U.S.). Committee on Federal Research on the Biological and Health Effects of Ionizing Radiation, Assembly of Life Sciences (U.S.). Committee on Federal Research on the Biological and Health Effects of Ionizing Radiation, 1981

*The Effects of Radiation and Radioisotopes on the Life Processes: Radiation effects on molecules of biological interest.* Zoology, 1963

**Biological Effects of Radiation**, 1958

**Biological Effects of Radiations** Daniel S. Grosch, 1965

Although written for the author's use in the classroom this book will interest all who have been seeking an organized survey of the complex field of biological response to potent radiation

**Introduction to Biological Radiation Effects** U. L. Prenn, 1994     *A Primer on Low-level Ionizing Radiation and Its Biological Effects* Edward W. Webster, American Association of Physicists in Medicine. Biological Effects Committee, 1988

**Biological Risks of Medical Irradiation** American Association of Physicists in Medicine. Summer School, American Association of Physicists in Medicine, 1980

**The Early Effects of Radiation on DNA** E.M. Fielden, Peter O'Neill, 1991-06-28

Interest in the biological effects of ionising radiation closely followed the identification of such radiation. The realisation that DNA is the site of genetic information in cells subsequently focussed attention on DNA as an important target in the lethal and mutagenic effects of ionising radiation. Thus radiation effects upon DNA became an important area for fundamental scientific studies by radiation biologists, chemists and physicists. To a first approximation the concerns of the three disciplines can be divided by time scales: the physical process of energy deposition from photon or charged particle and subsequent relaxation 10<sup>-16</sup> to 10<sup>-12</sup> secs followed by chemical reactions 10<sup>-12</sup> to 10<sup>-10</sup> secs and finally the expression of biological effect minutes to years. Thus the concept of early processes conveys different ideas to different scientists although they are all interrelated. To attempt to describe in any detail all these processes is a mammoth task which is not made easier by the different conventions and experimental approaches of the three disciplines. However the recent advances in all these scientific areas seemed to the organisers at least to offer the opportunity to stimulate more active interaction between physicists, chemists and biologists. With this in mind a multi-disciplinary workshop was organised which brought together some fifty scientists to present their own specialist interests and through extensive discussion explore which problems are of high priority and require input from the different disciplines to resolve them.

**Nuclear Science Abstracts**, 1976     Inventory of Federal Energy-related Environment and Safety Research for FY 1978, 1979     *The Biological Effects of Atomic Radiation* National Academy of Sciences (U.S.), 1960

Inventory of Federal Energy-related Environment and Safety Research for FY 1978: Project listings and indexes, 1979

Biological Effects of Ionizing Radiation, 1979     **Inventory of Federal Energy-related Environment and Safety Research for ...**, 1979     Effects of Low Dose and Low Dose Rate Radiation Oddvar F. Nygaard, Warren K. Sinclair, John T. Lett, 2013-10-22

Advances in Radiation Biology Volume 6. *Effects of Low Dose and Low Dose Rate Radiation* examines the biological effects of low dose and low dose rate ionizing radiation on a broad scale covering various articles from microdosimetry to analyses of human responses. Estimates of the effects on humans from low doses or from sustained exposures to low dose rates of ionizing radiations are of critical importance for the assessment of radiation risks under occupational and environmental conditions. This book consists of such knowledge that is essential for radiation protection and governmental regulatory activities pertaining to radiation exposure. This volume is intended for radiobiologists, radiation epidemiologists, radiation physicists, radiation safety personnel, health officials and individuals involved in regulatory activities.

Biological Effects of Ionizing Radiation United States. Committee on Federal Research into the Biological Effects of Ionizing Radiation, 1979      *Energy Research Abstracts* ,1979

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