

Dr. Christa Baumstark-Khan

Deutsches Zentrum für Luft- und Raumfahrt (DLR)

Institut für Luft- und Raumfahrtmedizin

- Strahlenbiologie -

E-Mail: christa.baumstark-khan@dlr.de

Tel. (02203) 601-3140

Fax (02203) 61970

Elective Course "RADIATION BIOLOGY BASICS"

Participants: MSc Biology (max. 16)

Lecturers: Dr. Christa Baumstark-Khan (Dipl. Biol.), Dr. Thomas Berger (Dipl. Ing. Phys.), Dr. Christine Hellweg (Vet. Med.)

Content:

The course RADIATION BIOLOGY BASICS will focus on the biological changes which follow the interaction of ionizing and non-ionizing radiation with living matter from molecular interactions to whole body responses. Particular emphasis will be placed on the role of ionizing radiation in the treatment of cancer, mechanisms of radiation-induced carcinogenesis, and changes in normal and tumor cells at the molecular, cellular and tissue level. The course includes the biological aspects of environmental radiation exposure. Major topics are:

- Natural and man-made sources of radiation; Types of ionizing radiation; The physics of radiation absorption; Radiation dosimetry and dosimeters.
- Interactions of radiation with matter: The chemistry of radiation absorption in solutions and in living systems. Radiation protectors: Chemistry of radiation scavenging and protection.
- DNA damage: DNA as the principle target of radiation killing; Single and double-strand DNA breaks; Mechanisms of DNA repair; Chromosomal aberrations and their use as 'radiation dosimeters'
- The cytosol and radiation response: Mechanisms of signal transduction from the cytosol to the nucleus, or vice versa, factors influencing radiation response of mammalian cells; Important gene products
- Characteristics of cell survival curves - interpretive models based on target theory or repair theory; Radio sensitivity of various tissues. The role of oxygen in modifying the chemistry of radiation damage and cellular radio sensitivity; Mammalian cell radio sensitivity: Interphase, reproductive and apoptotic cell death; Cellular factors that modify radiation response: The role of the cell cycle in influencing radiation response.
- Use of radiation for cancer therapy: Deficient vascularisation, high interstitial pressure and hypoxia in solid tumours; Significance of tumour physiology for radiation treatment; Tumour regrowth and tumour cure assays.
- Low dose effects on humans: The mechanisms of radiation-induced mutagenesis and carcinogenesis; Oncogenes and suppressor genes; Susceptibility of various organs; Risks of developing cancers from present-day sources; The hereditary effects of radiation; Effects on the embryo and foetus.

- Whole body irradiation - acute effects of high doses: Prodromal syndromes; Cerebro-vascular, gastro-intestinal and haematopoietic syndromes; Mean lethal doses; Treatments for whole body exposure.
- Lessons from Hiroshima, Nagasaki and Chernobyl: Acute and chronic health effects on those exposed; Assessment of exposure doses; Assessment of present day risks, and radiation protection standards.

Dates and Scope:

Summer Semester 2011: March 21st – July 17th

Prerequisites:

BSc awarded

Mode of Delivery:

The course is delivered by formal lectures (15 hours), seminars (15 hours), and a laboratory course (15 hours), including at least 1 excursion

Assessment:

Each student will give a seminar talk on a special topic.
Protocols of the laboratory experiments will be required.
A written test will be performed at the end of the course.