



# RADIATION RESEARCH IN ONCOLOGY

## HIRO and OncoRay Lecture Series 2023 – 25

### Part 1: Nov. 2023 – June 2024

#### OBJECTIVES OF THE LECTURE SERIES

Radiation research and radiotherapy in oncology are highly interdisciplinary fields: physicians, scientists like biologists and physicists as well as engineers and computer experts are closely collaborating within the Heidelberg Institute of Radiation Oncology (HIRO) and OncoRay in Dresden.

The established cooperation of HIRO and OncoRay was awarded by BMBF as the National Center for Radiation Research in Oncology (NCRO).

To train young scientists in interdisciplinary research work is a special responsibility of HIRO, DKFZ and OncoRay. An important condition for a fruitful scientific collaboration is an active communication between researchers and consequently a common knowledge of the fundamentals of the whole field. This will be supported by this series of 18 lectures in 2 years.

The lectures cover a wide spectrum of topics from medicine, biology, chemistry, physics and technology being relevant for the research at HIRO Heidelberg and OncoRay Dresden. Each lecture will give a commonly understandable overview on a particular topic.

Therefore, all PhD students of the DKFZ, the Heidelberg university hospital and OncoRay as well as collaborating institutions and all other interested persons are cordially invited to join the lectures!

#### TOPICS AND DATES

##### 1. Interaction of radiation with matter (Prof. Dr. Christian Richter)

*Thursday, 02.11.2023, 5 – 6.30pm*

Each diagnostic or therapeutic application of ionizing radiation exploits physical effects which occur during the interaction between radiation and matter. In this lecture, an overview on those mechanisms of interaction between ionizing radiation (photons, electrons, ions, neutrons) and matter, which are relevant for medical applications, will be given.

## **2. Radiation and its generation (Prof. Dr. Oliver Jäkel)**

*Thursday, 30.11.2023, 5 – 6.30pm*

Radiation is the fundamental basis of radiation research and radiation application in oncology. This lecture provides an introduction to different types of radiation used in radiation oncology like Co-60 sources, neutrons, Megavoltage X-rays and heavy charged particles like protons and ions. Some of the principles of generation of radiation will be explained, like the electron linear accelerators and particle accelerators. The lecture will also highlight some historic and future developments.

## **3. Fundamentals of oncology (Dr. Thomas Held)**

*Thursday, 14.12.2023, 5 – 6.30pm*

This lecture gives an introduction on the importance of cancer and the main treatment methods. Risk factors, curative and palliative treatment options and the increasing role of interdisciplinary oncology are discussed.

## **4. Clinical radiation oncology (Prof. Dr. Mechthild Krause)**

*Thursday, 01.02.2024, 5 – 6.30pm*

Understanding of tumor radiation biology is a basis for effective clinical application of radiotherapy. This lecture gives an overview on the clinical importance of radiobiological factors and on their integration into clinical radiotherapy protocols.

## **5. Tumor Pathophysiology (Prof. Dr. Leoni Kunz-Schughart)**

*Thursday, 22.02.2024, 5 – 6.30pm*

Growth and progression of solid tumors are accompanied by numerous physiological alterations as compared to normal tissues. In this lecture, an overview about the different aspects of tumor pathophysiology will be given and causes and consequences of tumor pathophysiological resistance factors in radiotherapy (e.g. chronic vs. acute hypoxia) will be discussed.

## **6. Technology of Radiotherapy (Prof. Dr. Oliver Jäkel)**

*Thursday, 21.03.2024, 5 – 6.30pm*

The lecture reviews the state-of-the-art technology for radiotherapy. This includes: linear electron accelerators, novel robotic and tomographic methods of dose delivery, proton and ion accelerators. Furthermore, new sophisticated techniques like image guidance and motion compensation will be introduced.

## **7. Molecular and cellular radiobiology (Prof. Dr. Nils Cordes)**

*Thursday, 25.04.2024, 5 – 6.30pm*

Exposure to ionizing radiation induces myriads of molecular and biological reactions in a cell. Fundamental concepts of cellular radiobiology including modes of cell death, proliferation and cellular targets will be introduced. While some reactions differ between normal and tumor cells, the majority shows to function in a uniform manner. Particularly, mechanisms that govern cell survival, proliferation and DNA repair will be reviewed and discussed within the context of testing novel therapeutic approaches against cancer.

## **8. Radiopharmaceuticals – in times of (Radionuclide) Theranostics (Prof. Dr. Klaus Kopka)**

*Thursday, 06.06.2024, 5 – 6.30pm*

Radiolabelled compounds got a key role in elucidation of metabolic pathways already in the early 50th of the last century. To date there is an ongoing application of such methods for the characterization of biochemical functional behavior of cells and tissues by techniques of nuclear medicine and for the exploitation of similar methods for therapeutic purposes. This lecture will give an insight to the radiochemical and radiopharmacological background and will discuss current problems and applications.

## **9. Translational Radiooncology (Prof. Dr. Dr. Amir Abdollahi)**

*Thursday, 27.06.2024, 5 – 6.30pm*

In this HIRO research focus high precision radiation oncology is integrated into curative multimodal therapy concepts. In field of precision radiotherapy, the radiobiological impact of novel particle therapy qualities i.e. proton, helium, carbon to oxygen ions developed at HIT are investigated. This unique beam parameter space is utilized to identify strategies to eradicate resistant tumor subpopulations such as hypoxic and stem-cell like cells and to explore their impact on tumor-immune microenvironment communication. Towards broadening the therapeutic window, investigation of normal tissue tolerance to multimodal therapies and their effect on inflammatory response, organ dysfunction and ultimately development of fibrosis are also of utmost significance. Inevitably, precision therapy requires precision diagnostic to stratify or even personalize treatment. With a reverse translation approach, compendium imaging and molecular diagnostics are developed to select patients most benefiting from designed multimodal therapy strategies within a program. Overall, the mission of this research area is to develop the next generation radiation oncology by integrating the rapidly evolving field of cellular- and molecular biology into a multidisciplinary adaptive radiotherapy.

**Summer Break 2024**

**Part 2 will start in Oct. 2024!**