

Advancing Clinical Management of Cancer Through Radiobiology

Lecturers: Bill McBride, Jacqueline Williams, Bill Morgan

1. Introduction to Radiobiology
 - The concept of Biological Dose vs Physical Dose
 - Interaction of Ionizing Radiation with Biological Matter
 - Role of free radicals
 - Direct and Indirect Action of Radiation
 - What is the Lethal Lesion?
 - Oxygen effect
 - LET and RBE

2. DNA Damage and Repair and its Relevance in the Clinic
 - Chromosome Damage and its Consequences
 - Types of DNA Repair
 - Significance of DNA Repair for Dose Fractionation and Brachytherapy
 - The DNA Damage Response and Molecular Signaling
 - Molecular Signaling and Cancer
 - The Meaning of Intrinsic Cellular Radioresistance

3. Manipulating Cell Proliferation and Cell Death
 - The Cell Cycle and the Effects of Irradiation
 - The Influence of Cell Cycle on Radiation Responses
 - Cell Death Pathways
 - Significance of Cell Death in Radiation Responses
 - Growth Kinetics of Normal and Cancerous Tissues
 - Accelerated Repopulation
 - Relevance to Clinical Tumor Regression

4. Clinically Relevant Normal Tissue Responses
 - Acute and Late Normal Tissue Responses to Radiation
 - Latency
 - Functional Subunits and Tissue Responses
 - Volume Effects
 - Regeneration in Normal Tissues and its Clinical Relevance
 - Remembered Dose
 - Dose-Volume Histograms
 - Effects of Total Body Irradiation
 - LENT and SOMA

5. The Tumor Microenvironment and Outcome of Radiation Therapy
 - Tumor Vasculature
 - Angiogenesis
 - Intermittent and Chronic Hypoxia
 - Hypoxia and Tumor Progression
 - Reoxygenation in Radiation Therapy
 - What is a Tumor?

6. Radiobiological Modeling of Clinical Fractionation Protocols
 - The 4Rs of Radiobiology and Dose Fractionation
 - Time Dose Fractionation Concepts
 - Changing Dose Fraction Size
 - Altered Fractionation Schedules
 - Dose Heterogeneity
 - Therapeutic Ratio

7. Chemotherapy and Radiation Therapy
 - Classes of Agents
 - Oxygen Effects for Chemotherapy
 - Multiple Drug Resistance
 - Interactions of Chemotherapy Agents with Radiation Therapy
 - Normal Tissue Consequences of Combined Therapy

8. Modifying Tumor and Normal Tissue Responses for Increased Therapeutic Benefit
 - Radiosensitizers
 - Bioreductive Drugs
 - Radioprotectors
 - Biological Targeting

9. Low Dose Radiation Effects and Radioprotection
 - Radiation Carcinogenesis
 - Heritable effects of Radiation
 - Radiation Effects on Developing Embryo
 - Radiation Protection