University of Maryland Resident Radiation Biology Education Curriculum

Year 1 Curriculum Topics
Lecture Title
Radiation and Cancer Biology Course Overview
History of Radiation Therapy: 1895 to present
Interaction of Radiation with Matter (radiochemistry)
Topic 1: Molecular and Cellular Damage and Repair
Molecular mechanisms of DNA damage and repair
Chromosome and chromatin damage, cell cycle regulation, and radiation effects
Question and Answers Review Session
Topic 2: Cellular Responses to Radiation
Mechanisms of cell death and modes of cell survival - Part 1
Mechanisms of cell death and modes of cell survival- Part 2
Cell and tissue survival assays: measurement of response - Part 1
Cell and tissue survival assays: measurement of response - Part 2
Question and Answers Review Session
Topic 3: Dose Rate and Fractionation
History of dose fractionation
Time, dose, and fractionation in radiotherapy
Linear Quadratic Isoeffect Model – α/β Part 1
Linear Quadratic Isoeffect Model – α/β Part 2
Sublethal damage repair and dose rate effect
Question and Answers Review Session
Topic 4: Linear Energy Transfer and Oxygen Effect
The history of the oxygen effect
LET and RBE
The Five R's of Radiation Therapy
The Five R's of Radiation Therapy
Question and Answers Review Session
Topic 5: Cancer Biology
Cell and tissue kinetics
Molecular signaling
Mechanisms of cancer development
Question and Answers Review Session
Topic 6: Tumor Biology and Microenvironment
Model tumor systems
Molecular aspects of tumor hypoxia
Metastasis and tumor microenvironment
Radiosensitizers, bioreductive drugs, and radioprotectors
Question and Answers Review Session

Year 2 Curriculum
Lecture Title
Radiation and Cancer Biology Course Overview
Topic 1: Radiobiology of Normal Tissues
Clinically relevant normal tissue responses to radiation
Mechanisms of normal tissue responses to radiation
Total body Irradiation
Question and Answers Review Session
Topic 2: Dose Delivery
Therapeutic ratio
Time, dose, and fractionation
Brachytherapy
Radiobiological aspects of different radiation modalities
Question and Answers Review Session
Topic 3: Combined Modality Therapy
Chemotherapeutic agents and radiation therapy: Mechanisms of chemotherapy
Chemotherapeutic agents and radiation therapy: Classes of chemotherapeutics
Chemotherapeutic agents and radiation therapy: Drug resistance
Chemopotentiators/Radiosensitizers
Hyperthermia
Topic 4: Immune Therapeutics
Basics of Immunology
Immune Therapeutics
Combination of immune therapy and radiation
Abscopal effects
Question and Answers Review Session – Part 1
Question and Answers Review Session – Part 2
Topic 5: Late effects and radiation protection
Radiation carcinogenesis
Heritable effects of radiation and radiation effects in the developing embryo/fetus
Radiation protection
Question and Answers Review Session
Topic 6: Additional Topics
Radiation sensitivity syndromes and molecular DNA repair
Molecular imaging
Radiopharmaceuticals
Theranostics
Oligometastatic Disease
FLASH in the rearview mirror