University of Maryland Resident Radiation Biology Education Curriculum

Year 1 Curriculum

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