SCHOOL OF MEDICAL DOSIMETRY

UNIVERSITY OF MARYLAND MEDICAL CENTER

DEPARTMENT OF RADIATION ONCOLOGY

School of Medical Dosimetry

A JRCERT Accredited Program

Student Handbook

2012-2013

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Note:

Due to the ongoing improvement of our program, any information is subject to change without notice.

The Profession

Medical dosimetry is the sub-specialty of Radiation Oncology that focuses on treatment planning, dose measurement, dose calculations, and quality assurance for radiotherapy treatments designed to treat cancer. The medical dosimetrist is an integral member of the “treatment team” which includes a radiation oncologist, a medical physicist, and radiotherapy technologists. Under the direction of the medical physicist and/or radiation oncologist, the dosimetrist determines the beam arrangements, beam shapes, beam weights, and beam energies that provide the most adequate treatment plan. The dosimetrist is also responsible for maintaining continuing quality assurance and for the construction of special treatment devices. In addition, the medical dosimetrist plays an important role in brachytherapy procedures providing technical assistance, inventory control of the radioisotopes, treatment planning and verification calculations.

Mission

"To provide world class education and training in medical dosimetry and provide competent dosimetrists to serve the needs of the community in the treatment of patients with radiation"

Objectives

1) Provide education and expertise in medical dosimetry through didactic and clinical instruction
2) Foster critical thinking, analytical skills, and problem solving in the rapidly changing world of science and technology
3) Promote a commitment to patient care and professional development.

Program Goals

1) Students will graduate as clinically competent dosimetrists.
2) Students will demonstrate the critical thinking skills required for medical dosimetry.
3) Students will effectively communicate within an interdisciplinary radiation oncology team.
4) Students will conduct themselves in a professional manner and practice the ideals of professional growth and lifelong learning.
5) Students will graduate as entry-level dosimetrists

Organization and Administration

Sponsoring Institution:

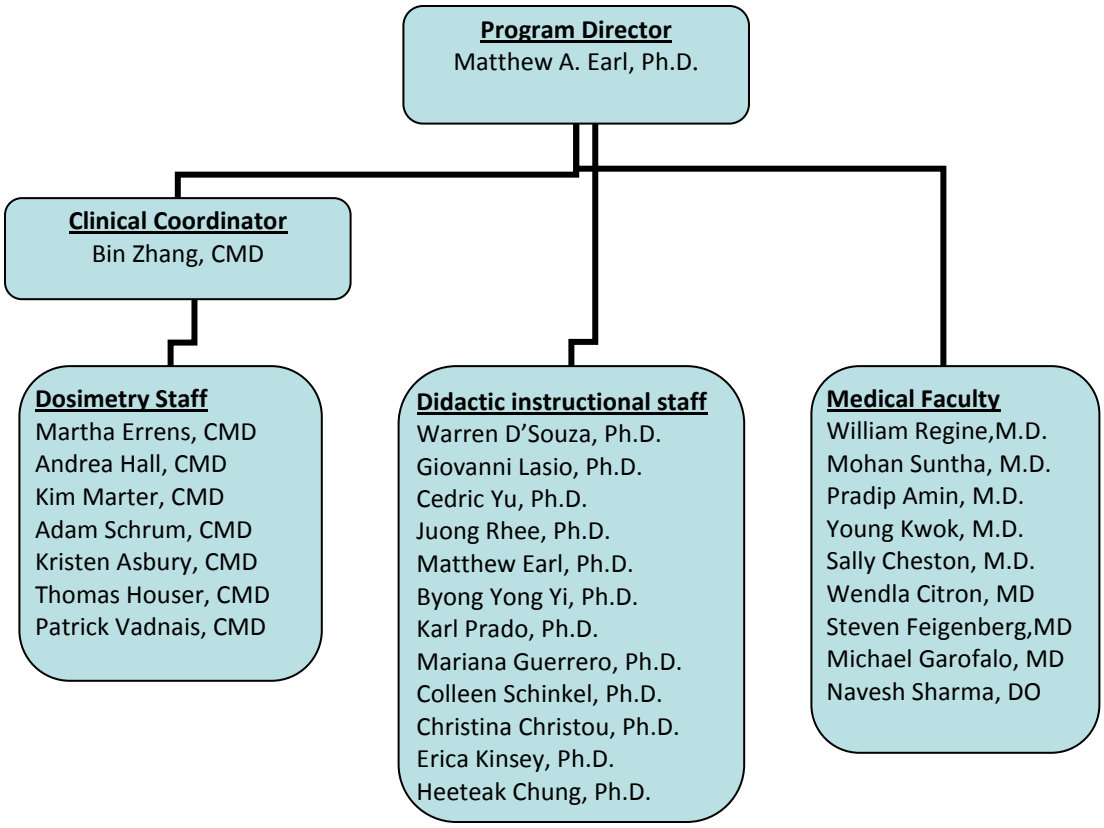
The program is a hospital-based program sponsored by the University of Maryland Medical Systems, Department of Radiation Oncology, 22 South Greene Street, Baltimore, Maryland, 21201. The hospital is a JCAHO accredited facility and the department meets the Standards for Radiation Oncology as defined by the ACR (Res. 38-1995)

Department Chairman -	William Regine, M.D., Professor
Vice Chairman -	Mohan Suntharalingam, M.D., Professor
Executive Director(s) –	Erika Maynor,
	Administrator Dosimetry School
	Operations Manager, UMMC
	Frank Young, Administrator

Program Officials

Program Director:	Matthew A. Earl, Ph.D., Associate Professor
Medical Advisor:	Navesh Sharma, D.O., PhD
Clinical Supervisor:	Bin Zhang, CMD
Educational Coordinators:	Matthew A. Earl, Ph.D.
	Bin Zhang, CMD
Physics Advisors:	Warren D. D'Souza, Ph.D., Associate Professor & Chief of Medical Physics Division
	Karl Prado, Ph.D., Associate Professor & Associate Chief of Clinical Physics

School of Medical dosimetry
Organizational Chart



Human Resources

Didactic Instructional Staff (Physics Faculty: UM School of Medicine):
Matthew A. Earl, Ph.D., Associate Professor (Program Director)
Cedric Yu, Ph.D., Professor
Byong Yong Yi, Ph.D., Professor
Giovanni Lasio, Ph.D., Assistant Professor
Warren D' Souza, Ph.D., Associate Professor
Karl Prado, Ph.D., Associate Professor
Erica Kinsey, Ph.D., Assistant Professor
Yildirim Mutaf, Ph.D., Assistant Professor
Heeteak Chung, Ph.D. Assistant Professor
Christina Christou, Ph.D. Assistant Professor
Colleen Schinkel, Ph.D. Assistant Professor
Nilesh Mistry, Ph.D. Instructor

Didactic Instruction Staff (Biology Faculty: UM School of Medicine)
Juong Rhee, Ph.D., Associate Professor

Clinical Dosimetry Instructors
Mr. Bin Zhang, C.M.D.
Ms. Kristen Asbury, C.M.D.
Ms. Martha Errens, C.M.D.
Ms. Kim Marter, C.M.D.
Ms. Andrea Hall, C.M.D.
Mr. Thomas Houser, C.M.D.
Mr. Adam Schrum, C.M.D.
Ms. Kristin Spaeth, C.M.D.
Mr. Patrick Vadnais, C.M.D.

Clinical Faculty (Medical Instructors):
Navesh Sharma, D.O., PhD Assistant Professor (Clinical Lecture Coordinator)
Pradip P. Amin, M.D., Associate Professor
Sally B. Cheston, M.D., Assistant Professor
Wendla K. Citron, M.D., Assistant Professor
Steven Feigenberg, M.D., Associate Professor
Michael Garofalo, M.D., Assistant Professor
Young Kwok, M.D., Assistant Professor
Mohan Suntha, M.D., Professor
William Regine, M.D., Professor

Clinical Practice Settings:

Our program has two clinical practice settings at off-site treatment facilities affiliated with the University of Maryland Medical System (UMMS):

Central Maryland Radiaton Oncology Center
Columbia, Maryland
443-546-1330
Preceptor: Adam Schrum, CMD

Baltimore Washington Medical Center
Glen Burnie, MD
410-553-8100
Preceptor: Thomas Houser, CMD

Financial Resources

The University of Maryland Medical System will provide full financial support for the program.

- The value of the Program for each student is Thirty Three Thousand Six Hundred and Twenty Four Dollars ($33,624.00). As part of the program value, the accepted student will receive an educational stipend of Thirteen Thousand Six Hundred and Twenty Four Dollars ($13,624.00). In consideration of the value of the program, including the Educational Stipend, the student agrees to full time employment with UMMC as a dosimetrist for a period of eighteen (18) months following graduation from the program, if a position is available. Students who are employed after graduation, by UMMC are paid a competitive salary during the eighteen-month obligation to the University of Maryland Medical Center. Notably, if a position is not available upon completion of the program, the student does not have to pay back any part of the $33,624.00 value of the program. If an applicant is accepted into the program and wishes not to enter the commitment to work for 18 months, a one time fee will be due of $33,624.00 to cover the value of the program. In such instance, the student will receive the stipend portion of that fee, back in the amount of $13,624.00 as a salary during their one year employment at UMMC. If a student should need or wish to breach the agreement to commit to employment after graduation, or at any time during the 18 months employment after graduation, a one time fee of 33,624.00 shall be due. It should be noted that both the tuition and the contractual obligations are reviewed on an annual basis and are subject to change.

- A student will not serve as a substitute for full-time equivalent (FTE) or part-time employees.
- The program will not charge any fees to the student.
- The program's policies and procedures have been reviewed by the hospital's legal office.

Learning Resources

Clinical practice settings:

University of Maryland Medical Center (UMMC)
Central Maryland Radiation Oncology (CMRO)
Baltimore Washington Medical Center (BWMC)

UMMC employs five MDCB certified dosimetrists; CMRO employs two certified dosimetrists; BWMC employs three certified dosimetrists. The Faculty includes nine physicists, nine clinicians, and six radiobiologists.

Students' achievement of required program competencies are evaluated via clinical dosimetry assignments based on the AAMD curriculum. The students rotate to the community practices as well as through each special procedure including brachytherapy, prostate implants and IMRT to complete the clinical experience.

Each student keeps a clinical logbook to record planned cases in both an assisted and an unassisted manner. This record ensures that all treatment sites are covered according to the AAMD curriculum, as well as required specialized treatments.

A treatment review is held each morning in the Nicole Regine Conference room where all patients are reviewed. New patients are also discussed in detail. Once each week, a presentation is provided by one of our radiation oncology residents. The students are encouraged to attend this conference at least once per week. A conference focusing on technology is also scheduled once per month. The students are required to attend this conference.

Facilities

The Nicola Regine Conference Room:
The Radiation Oncology Department conference room is used for all lectures. This conference room is equipped with a projector for all PC based lectures, review of CT, MRI and PET studies from the department of Radiology and Nuclear Medicine. There is also a whiteboard available for more detailed explanations.

Resident's Library:
The library is a smaller meeting room with a large collection of relevant books. It also has a blackboard for more informal, hands on lectures.

University of Maryland Health Sciences Library:
This facility is located across the street from the cancer center. It allows the student quiet access to the Internet to do research as well as a space to study on their "study day".

Clinical setting:
Students each have their own designated desk, in the Dosimetry room. Two "Pinnacle^3" planning computers are available at all times for practical assignments. They also have access to all the Pinnacle^3, Eclipse, and HDR-Oncentra workstations. The dosimetry room has its own small collection of books and course related materials.

Internet access:
Students have access to two Internet stations. Internet courses are available as well as long distance studies such as the "SCRIPPS" Anatomy in sectional images, available from Scripps Memorial Hospitals Educational Services.

Equipment

- **Linear Accelerators (4)**
  - VARIAN Clinac 21EX/S
  - VARIAN Trilogy with Stereotactic Capabilities, On Board Imaging and cone-beam CT
  - VARIAN clinic 6/100 with MicroMLC attachment
  - VARIAN Truebeam
- **Simulators**
  - Philips Brilliance Big Bore Multislice CT/Simulator
  - Varian Acuity Conventional Simulator
- **Treatment Planning Systems**
  - Philips Pinnacle^3
  - Varian – Eclipse
  - Nucletron Oncentra (HDR planning)
- **Immobilization**
  - MED-TEC Breast Boards
  - MED-TEC Aquaplast mask
  - Alpha – Cradles
  - Pituitary head holder
- **IGRT systems**
  - Varian Cone beam CT
  - Calypso 4D localization system
  - Nomos BAT localization system
  - Vision RT® surface localization and tracking system.

In addition to the above equipment Radiation Oncology Department has numerous radiation measurement devices including ionization chambers, survey meters, diodes and film.

Admission Process

The selection of all students will be through the admissions board. The admissions board will consist of at least the following individuals:

1. Physician Representative
2. Program Director
3. Clinical Supervisor
4. Chief of Medical Physics
5. Chief Medical Dosimetrist
6. Educational Coordinator

Admission Requirements:

Students must be registered radiation therapists with a minimum of one-year of clinical experience or persons with a baccalaureate degree in the physical sciences, minimum overall GPA of 3.0, preferably with one year of physics. All applicants must have completed post-secondary instruction in the following areas:

- Basic mathematics including algebra, trigonometry, and introductory calculus
- Basic physics
- Oral and written communication
- Biology
- Anatomy and physiology
- Medical terminology
- Computer competency

Admission Policy:

It is the policy of the school and its sponsor to admit students without regard to race, sex, religion, national origin, or handicap, unless that handicap would prevent the student from fulfilling their clinical requirements.

Selection Process:

The selection of all students will be through the admissions board. Admission data will be kept on file for five years in the department of radiation oncology. All federal and state nondiscriminatory laws will be observed.

Equal Opportunity:

The University of Maryland Medical Center is actively committed to providing equal educational and employment opportunity in all of its programs. It is the goal of the institution to assure that women and minorities are equitably represented among the faculty, staff and administration of the institution, so that its work force reflects the diversity of Maryland's population.

All employment policies and activities of the University of Maryland Medical Center shall be consistent with federal and state laws, regulations and executive orders on nondiscrimination on the basis of race, color, religion, age, ancestry or national origin, sex, sexual orientation, handicap, marital status and veteran status. Sexual harassment, as a form of sex discrimination, is prohibited among the work force of the institution.

The University of Maryland Medical Center's full equal opportunity policy is available in the institution's policies and procedure manual which will be handed to the students at the time of new employee orientation. The human resource website can be accessed at: http://www.umm.edu/center/allen.htm

Radiation Safety

The Radiation Oncology Department of the University of Maryland Medical Center (UMMC) including its satellites in accordance with the University of Maryland Baltimore (UMB) Radiation Safety Program (http://www.ehs.umaryland.edu) is committed to maintaining all employee radiation exposures and individual members of the public to the lowest possible levels achievable. To accomplish this goal, the radiation safety committee has adopted a formal ALARA Program designed to maintain employee radiation exposure to levels "As Low As Reasonably Achievable".

All students will receive radiation safety training conducted by the department's radiation safety officer and all students are issued film badges before they start the program. The training includes basics of radiation protection and the department's radiation safety policy. The students also participate in an annual radiation safety refresher course, taught by a medical physicist to all radiation workers in the department.

When performing procedures involving radiation, a qualified radiation worker will directly supervise each student. Monthly records of the personnel exposure (Film Badge Readings) shall be readily available for students review.

The declaration of pregnant worker status is voluntary and is administered by the office of environmental health and safety. Declared pregnant students will be offered an alternative schedule to gain competency in brachytherapy procedures when sources are present.

CURRICULUM

Didactic Modules:

1. Fundamentals of the Medical Management of Cancer
2. Anatomy for Medical Dosimetrists
3. Radiobiology for Medical Dosimetrists
4. Fundamentals of Radiation Safety
5. Physics Fundamentals for Radiation Therapy
6. Production of Teletherapy Radiation
7. Sources for Brachytherapy Radiation
8. Introduction to Radiological Imaging
9. Dosimetry Instrumentation
10. Measurement of Dose in Radiation Oncology
11. Introduction to Teletherapy Dose Calculations
12. Introduction to Brachytherapy Dose Calculations
13. Teletherapy Treatment Planning Techniques
14. Brachytherapy Treatment Planning
15. Radiographic and Virtual Simulation
16. Three-Dimensional Conformal and IMRT Treatment Planning
17. Treatment Planning for Stereotactic Radiosurgery

1. Fundamentals of the Medical Management of Cancer

1.1 Malignant Disease

1.2 Introduction to Cancer Biology

1.3 Etiology of Cancer

1.4 Introduction to Oncology Pathology

1.5 Fundamentals of Histology

1.6 Introduction to the Molecular Biology of Cancer

1.7 Cancer Incidence in the United States

1.8 Head and Neck

1.9 Brain

1.10 Central Nervous System

1.11 Lung

1.12Esophagus

1.13 Breast

1.14 Pancreas

1.15 Gallbladder and Biliary Duct Tumors

1.16 Stomach

1.17 Colon, Rectum, Anus

1.18 Kidney and Ureters

1.19 Prostate

1.20 Bladder

1.21 Rectum

1.22 Testicular tumors

1.23 Gynecologic tumors

1.24 Hodgkin's Disease

1.25 Extremities

1.26 Total Body Irradiation

1.27 Total Skin Electron

1.28 Intraoperative Irradiation

1.29 Mestastatic Disease

1.30 Superior Vena Cava Obstruction

2. Anatomy for Medical Dosimetrists

2.1 Introduction to Basic Terminology

2.2 Anatomical Systems

2.3 Gross Anatomy of the Skull

2.4 Skull Anatomy Exercises

2.5 Gross Anatomy of the Cranium

2.6 Cranial Anatomy Exercises

2.7 Gross Anatomy of the Head

2.8 Gross Head Anatomy Exercises

2.9 CT and MRI Head Anatomy Exercises

2.10 MRI Anatomy of the Head

2.11 CT and MRI Head Anatomy Exercises

2.12 Gross Anatomy of the Thorax

2.13 Thorax Anatomy Exercises

2.14 CT Anatomy of the Thorax

2.15 MRI Anatomy of the Thorax

2.16 CT and MRI Thorax Anatomy Exercises

2.17 Gross Anatomy of the Abdomen

2.18 CT Anatomy of the Abdomen

2.19 MRI Anatomy of the Abdomen

2.20 CT and MRI Abdomen Exercises

2.21 Gross Anatomy of the Male Pelvis

2.22 Gross Anatomy of the Female Pelvis

2.23 CT Anatomy of the Male Pelvis

2.24 CT Anatomy of the Female Pelvis

2.25 MRI Anatomy of the Male Pelvis

2.26 MRI Anatomy of the Female Pelvis

2.27 CT and MRI Male Pelvis Exercise

2.28 CT and MRI Female Pelvis Exercise

2.29 Ultrasonic Anatomy of the Male Pelvis

2.30 Ultrasonic Anatomy of the Female Pelvis

3. Radiobiology for Medical Dosimetrists

3.1 Interactions of Radiation with Matter

3.2 Ionizing Radiations

3.3 Absorption of X-rays

3.4 Ionizing Radiation

3.5 Linear Energy Transfer (LET)

3.6 Radiobiological Effect (RBE)

3.7 Absorption of Neutrons

3.8 Cell survival Curves

3.9 Slope of the line, D

3.10 Extrapolation number, N

3.11 Cell Kill

3.12 Chromosomes and Cell Division

3.13 Mitosis

3.14 Dose-Response Relationship

3.15 Radio sensitivity — Law of Bergonie and Tribondea

3.16 Clonogenic Assays

3.17 Oxygen Enhancement Radio (OER)

3.18 Radio Sensitizers

3.19 Hyperthermia

3.20 Chemotherapy

3.21 Radio Protectors

3.22 Tumor Systems

3.23 Dose-Rate Effect

3.24 Lethal, Sublethal damage, and Potential lethal damage

3.25 Fractionation

3.26 Four “Rs” of Radiobiology

3.27 Inverse Dose-Rate Effect

3.28 Acute versus Chronic Effects

3.29 Therapeutic Ratio

3.30 Radiation Carcinogenesis

4. Fundamentals of Radiation Safety

4.1 Dose Equivalent

4.2 Radiation Effects on Humans

4.3 Maximum Permissible Dose

4.4 Introduction to Radiation Safety Instrumentation

4.5 Radiation Safety principles: Time, Distance, Shielding

4.6 Shielding Design for Diagnostic X-rays

4.7 Radiation Protection Surveys of Diagnostic Facilities

4.8 Shielding Design for Therapy Facilities

4.9 Radiation Protection Surveys of Therapy Facilities

4.10 Measurement of Neutrons

4.11 Handling and Storage of Sealed Sources

4.12 Managing Sealed Source Incidents

4.13 Handling and Storage of Unsealed Sources

4.14 Managing Spills and Leaks

4.15 Monitoring personnel

4.16 Monitoring patients

4.17 Radiation Safety Officer

4.18 Radiation Safety Committee

4.19 Records and Misadministration

4.20 Radiation Safety Regulation at the National Level

4.21 Radiation Safety Regulation at the State Level

4.22 Radiation Safety Regulation at the Institutional Level

4.23 Radiation Safety Training

5. Physics Fundamentals for Radiation Therapy

5.1 Historical perspective

5.2 Basic Units of Measure

5.3 Velocity, Acceleration, and Forces

5.4 Electric and Magnetic Fields

5.5 Charged Particles in Electric and Magnetic Fields

5.6 Matter vs. Elements vs. Atoms and Forces of Nature

5.7 Atomic Particles and Atomic Structure

5.8 Nuclear Particles and Nuclear Structure

5.9 Electromagnetic and Particulate Radiation

5.10 Atomic Mass/Energy Units

5.11 Orbital Electrons, Atomic Energy Levels and Electron

5.12 Nuclear Energy Levels and Neutron and Proton Transitions

5.13 Photoelectric X-ray Absorption

5.14 Compton X-ray Absorption

5.15 Pair Production X-ray Absorption

5.16 Attenuation Coefficients and Exponential Attenuation

5.17 Interaction of Electrons with Matter

5.18 Stopping Power and Scattering Power

5.19 Physics of X-ray Production

5.20 X-ray Spectra

5.21 Interaction of Protons and Heavy Charged Particles with Matter

5.22 Interaction of Neutrons with Matter

5.23 Nuclear Transformations

5.24 Modes of Radioactive Decay

5.25 Radioactive Series

5.26 Radioactive Equilibrium

5.27 Nuclear Reactions

5.28 Nuclide Activation

5.29 Nuclide Activation in Nuclear Reactors

5.30 Nuclide Activation in Cyclotrons

6. Production of Teletherapy Radiation

6.01 Superficial units

6.02 Orthovoltage units

6.03 Medical Linear Accelerator Terminology

6.04 Overview of the Medical Linear Accelerator Design

6.05 Production of High-Energy Electrons in a RF Waveguide

6.06 Magnetrons and Klystrons

6.07 Bending Magnets

6.08 Beam Steering Magnets

6.09 Flattening Filters

6.10 Scattering Foils

6.11 Vacuum Systems

6.12 Water-Cooling Systems

6.13 Beam Energy

6.14 Collimator Assembly

6.15 Wedges, Physical, Internal, and Dynamic

6.16 Multileaf Collimators

6.17 Beam Monitoring

6.18 Photon beam characteristics

6.19 Electron beam characteristics

6.20 Medical Accelerator Computer Control Systems

6.21 Interlock Systems

6.22 Treatment Couches

6.23 Stereotactic Radiosurgery

6.24 Gamma Knife

6.25 Betatrons

6.26 Microtrons

6.27 Cyclotrons

6.28 Cobalt-60 Units

6.29 Neutron Sources

6.30 Medical Proton Accelerators

7. Sources for Brachytherapy Radiation

7.01 Review of Characterization of Activity Decay and Half-life

7.02 Review of Radiation Safety Procedures for Brachytherapy Sources

7.03 Review of Calibration Methods for Brachytherapy Sources

7.04 Radium: Physical Characteristics

7.05 Radium: Source Encapsulation

7.06 Cesium-137: Physical Characteristics

7.07 Cesium-137: Source Encapsulation

7.08 Iodine-121: Physical Characteristics

7.09 Iodine-121: Source Containers

7.10 Iodine- 125: Physical Characteristics

7.11 Iodine-125: Source Encapsulation

7.12 Iridium-192: Physical Characteristics

7.13 Iridium-192: Source Encapsulation

7.14 Phosphorus-32: Physical Characteristics

7.15 Phosporus-32: Liquid Sources

7.16 Phosporus-32: Encapsulation for Endovascular Brachytherapy

7.17 Strontium-90: Physical Characteristics

7.18 Strontium-90: Source Encapsulation

7.19 Gold-198

7.20 Cobalt

8. Introduction to Radiological Imaging

8.01 Introduction to Imaging Concepts

8.02 Production of Diagnostic X-rays

8.03 Diagnostic X-ray Film Emulsions

8.04 Intensifying Screens

8.05 Radiographic Gilds

8.06 Digital Radiography

8.07 Fluoroscopy

8.08 Image Intensifier

8.09 Display of Fluoroscopic Images

8.10 Flat Panel X-ray Detectors

8.11 Introduction to Radiotherapy Simulators

8.12 Display of Fluoroscopic Images for Radiotherapy

8.13 Simulator Radiographic Images

8.14 Introduction to Computerized Tomography — CT

8.15 CT Reconstruction Methods

8.16 CT Cross-sectional Anatomy Displays

8.17 CT numbers

8.18 Principles of Operation of Ultrasound

8.19 Doopler and Phased-Array Ultrasound

8.20 Ultrasonic Displays Cross-Sectional Anatomy

8.21 Principles of Operation of Nuclear Medicine Cameras

8.22 Functional Imaging

8.23 Properties and Usage of Pharmaceuticals

8.24 SPECT Cameras

8.25 PET Cameras

8.26 Introduction to Magnetic Resonance Imaging — MRI

8.27 MRI Reconstruction Techniques

8.28 MRI Displays of Cross-sectional Anatomy

8.29 MRJ Spectral Imaging

9. Dosimetry Instrumentation

9.01 Concept of Radiation Exposure — The Roentgen

9.02 Measurement of Exposure with a Free Air Chamber

9.03 Air Ionization Survey Meter

9.04 Air-Equivalent Thimble Chambers

9.05 Reentrant Well Air Ionization Chambers

9.06 Geiger Tubes and Scalers

9.07 GM Survey Meter

9.08 Proportional Counters

9.09 Neutron Survey Meters

9.10 Definition of Radiation Dose — The Gray

9.11 Absorbed Dose Calorimeters

9.12 Absorbed Dose Determination by Frickie Dosimetry

9.13 Absorbed Dose Determination by Gragg-Gray Cavity Ionization

9.14 Cylindrical Ionization Chambers

9.15 Parallel Plate Ionization Chambers

9.16 Operational Amplifers and Feedback

9.17 Electrometers

9.18 Transmission Ionization Chambers in Linear Accelerators

9.19 Quadrant QA Ionization Chambers

9.20 Thermoluminescence and TLD Readers

9.21 Radiation Detection Diodes

9.22 Radiation Detection Diamonds

9.23 Response of Film Emulsions to Radiation

9.24 Mechanical Film scanners

9.25 Raster Film Digitizers

9.26 Scintillation Detectors

9.27 Manual Water Phantoms

9.28 Scanning Water Phantoms

9.29 Tissue Equivalent Plastics

9.30 Anatomical Phantoms

10. <u>Measurement of Dose in Radiation Oncology</u>

10.01 Ionization of Air By Radiation and W_e

10.02 Definition of Kerma and Exposure

10.03 Ionization Chambers

10.04 Chamber Sensitivity

10.05 Correction of Ionization Chambers for Temperature and Pressure

10.06 Recombination at a Constant Dose Rate

10.07 Recombination in a Pulsed Beam

10.08 Effective Point of Measurement

10.09 Definition of Absorbed Dose

10.10 Determination of Dose from Exposure

10.11 Absorbed Dose to Air, Water, and Media

10.12 Stopping Power

10.13 Bragg-Gray Cavity Theory

10.14 Measurement of Dose by a Bragg-Gray Cavity

10.15 National Protocols

10.16 N_x

10.17 N_{gas}

10.18 Obtaining Chamber Calibrations

10.19 A_{ion}

10.20 P_{ion}

10.21 A_{wall}

10.22 P_{repl}

10.23 Calibration of X-ray Beams

10.24 Calibration of Electron Beams

10.25 Measurements with Cylindrical Ionization Chambers

10.26 Measurements with Parallel Ionization Chambers

10.27 Measurements with an Extrapolation Chamber

10.28 Measurement of Dose in a Non-water Media

10.29 Transferring Calibration Factors from a Local Standard

10.30 Maintaining Calibration Factors

11. <u>Introduction to Teletherapy Dose Calculations</u>

11.01 Output Factors

11.02 Head Scatter and Phantom Scatter

11.03 Equivalent Square and Circular Fields

11.04 Area/Perimeter Equivalent Fields

11.05 Inverse Square Factors

11.06 Wedge Factors and Compensator Factors

11.07 Photon Per Cent Depth Dose

11.08 Change in Per Cent Depth Dose with SSD

11.09 Calculation of Monitor Units for Fixed SSD Treatments

11.10 Tissue Air Ratio, Tissue Maximum, Tissue Phantom Ratio

11.11 Conversion Between Central Axis Representations

11.12 Calculation of Monitor Units for SAD Treatments

11.13 Emperical Numeric Models

11.14 Primary and Scatter

11.15 Clarkson Calculations for Per Cent Depth Dose

11.16 Clarkson Calculations for TARs, TMRs, and TPRs

11.17 Isodose Curves for Open Fields and Wedges

11.18 The Bently-Milan Model: OARs

11.19 Asymmetric Fields

11.20 Heterogeneity Correction Factors

11.21 Wedge Factors for Internal Wedges

11.22 Wedge Factors for Dynamic Wedges

11.23 Convolution and Superposition

11.24 Electron Per Cent Depth Dose

11.25 Electron Cone Ratios

11.26 Electron Gap Factors

11.27 Equivalent Rectangular Electron Fields

11.28 Calculation of Monitor Units for Electron Beams

11.29 Electron Pencil Beam Models

11.30 Monte Carlo Calculations of Electron and Photon Beam

12. Introduction to Brachytherapy Dose Calculations

12.01 Review of Isotope Decay and Half

12.02 Review of Properties of Commonly Used Isotopes

12.03 Exposure Around a Point Source

12.04 Isotope Factors

12.05 Isotope Specific Dose Rate Factors

12.06 Build-Up Around a Point Source

12.07 Conversion of Exposure to Dose

12.08 Linear Sources — The Sievert Integral

12.09 The Sievert Integral for Encapsulated Sources

12.10 Measurements of Doses Around Brachytherapy Sources

12.11 Monte Carlo Calculations for Brachytherapy

12.12 Far and Away Doses Around Encapsulated Radium Sources

12.13 Isodoses Around Encapsulated Radium Sources

12.14 Far and Away Doses Around Encapsulated Cesium Sources

12.15 Isodoses Around Encapsulated Cesium Sources

12.16 Far and Away Doses Around Encapsulated 1-125 Sources

12.17 Isodoses Around Encapsulated 1-125 Sources

12.18 Summation of Doses from Multiple Sources

12.19 Calibration of Reentrant Well Chamber

12.20 Determination of Source Activity for Encapsulated Sources

12.21 Determination of Source Activity for Seed Trains

12.22 1-125 Source Calibration

12.23 Determination of Source Activity for Isotopes in Liquid Form

12.24 Liquid Scintillation Counters

12.25 Determination of Activity Using Liquid Scintillation Counters

12.26 Introduction to MIRD Formalism

12.27 MIRD Formalism for 1-13 1

12.28 MIRD Formalism for P-32

12.29 MIRD Formalism applied to Radioimmunotherapy

13. <u>Teletherapy Treatment Planning Techniques</u>

13.01 Two-Dimensional and Central Axis Treatment Planning

13.02 Parallel Opposed Fields

13.03 Blocking with Cerrobend

13.04 Blocking with Multileaf Collimators

13.05 Spinal Cord and Other Special Blocking

13.06 Beam Weighting and Normalization

13.07 Two Fields with Wedges

13.08 Three Field Head and Neck

13.09 Treating Cranial Tumors with Vertex Fields

13.10 Missing Tissue Compensators

13.11 Bolus

13.12 Cervical Neck Electron Fields

13.13 Abutting Electrons with Photons

13.14 Common Breast Techniques

13.15 Lung Technique with Off-cord Boost

13.16 Three Field Treatment of Esophagus

13.17 Three Field Techniques in the Pelvis

13.18 Four Field Treatment of Pelvic Lesions

13.19 Mantel Field Technique for Hodgkin's Disease

13.20 Gap Calculations for Abutting Fields

13.21 Arc Therapy Calculations

13.22 Treating Meduloblastoma with Photons and Electrons

13.23 Whole Body Electron Irradiation

13.24 Whole Body Photon Irradiation

13.25 Dynamic Electron Arcs

13.26 Treatment of Sarcomas in the Limbs

13.27 Combining Pelvic External Beam with Brachytherapy

13.28 Treating with Orthovoltage X-rays

13.29 Treating Rectal Tumors with Superficial X-rays

13.30 Intraoperative Radiotherapy with Photons and Electrons

14. Brachytherapy Treatment Planning

14.01 Implants Using Linear Sources

14.02 Patterson Parker System

14.03 Planning Planar Implants using the Patterson-Parker System

14.04 Planning MultiPlanar Implants using the Patterson-Parker System

14.05 Planning Cylindrical Implants using the Patterson-Parker System

14.06 The Paris System

14.07 Determining Implant Geometry using Orthogonal X-rays

14.08 Determining Implant Geometry using Stereo X-rays

14.09 Determining Implant Geometry using CT scans

14.10 Implants of the Tongue

14.11 Breast Implants with Ir-192 seeds

14.12 Vaginal Implants

14.13 Vaginal Cylindical Applicators

14.14 Planning Vaginal Applications

14.15 Fletcher-Suit Applicators

14.16 Shielding in Fletcher-Suit Applicators

14.17 Planning Fletcher-Suit Applications

14.18 Low Dose-rate Remote After-loaders

14.19 Planning Fletcher-Suit Implants with Remote After-loaders

14.20 Seed Implant Guns

14.21 Prostate Implants with Templates

14.22 Ultrasonic Preplanning for Prostate Implants

14.23 Radiographic Post-planning of Prostate Implants

14.24 CT Post-planning of Prostate Implants

14.25 Treatment of Cranial Lesions with 1-125

14.26 Treatment of Cranial Lesions with Ir-192

15. Radiographic and Virtual Simulation

15.01 ICRU5O

15.02 Design and Function of radiographic Simulator

15.03 Radiographic Imaging for Radiotherapy Simulation

15.04 Use of Contrast for Radiotherapy Simulation

15.05 Fluoroscopic Imaging for Radiotherapy Simulation

15.06 Digital Fluoroscopy for Radiotherapy Simulation

15.07 Immobilization

15.08 Lasers and Skin Marking

15.09 CT Scanners Designed for Radiotherapy Simulation

15.10 CT Acquisition Parameters for Radiotherapy Simulation

15.11 Immobilization and Markers for Radiotherapy CT Scans

15.12 Contrast and Injectors for CT Scans

15.13 Digital Manipulations of CT Images: Hounsfeld Numbers

15.14 Virtual Simulation Strategies

15.15 Manual Tools for Structure Segmentation

15.16 Automated Tools for Structure Segmentation

15.17 Tools for Structure Display

15.18 Techniques for Determining Isocenter

15.19 Selection of Beam Number and Direction: BEV

15.20 Tools for Construction of Apertures and Blocks

15.21 Digitally Reconstructed Radiographs

15.22 Digitally Composited Radiographs

15.23 Fusing MRI Studies with CT Studies

15.24 Virtual Simulation in the Head and Neck

15.25 Virtual Simulation for Breast Treatments

15.26 Virtual Simulation for Lung Treatments

15.27 Virtual Simulation for Extended Mantle Field Technique

15.28 Virtual Simulation for Prostate and GYN

15.29 Virtual Simulation of Cranial Spinal Axis

15.30 Documenting Simulations and Transferring Date

16. Three-Dimensional Conformal and IMRT Treatment Planning

16.01 Prostate

16.02 Bladder

16.03 Rectum/Colon

16.04 Testicular tumors

16.05 Kidney/Ureters

16.06 Cervix/Uterus/Ovarian

16.07 Stomach

16.08 Pancreas

16.09 Liver/Bile ducts

16.10 Lung

16.11 Esophagus

16.12 Head and Neck

16.13 Larynx

16.14 Nasal cavity

16.15 Salivary glands

16.16 Nasopharynx

16.17 Maxillary sinus

16.18 Eye/Orbit

16.19 Thyroid gland

16.20 Breast

16.21 Hodgkins/Non Hodgkins lymphomas

16.22 Brain

16.23 Astrocytoma/GBM/Meningiomas

16.24 Pituatary gland

16.25 Spinal cord

16.26 Total body irradiation

17. Treatment Planning for Stereotactic Radiosurgery

17.01 Introduction

17.02 Rationale for radiosurgical treatments -- non-malignant lesions

17.03 Rationale for radiosurgical treatments -- malignant lesions

17.04 Accuracy of stereotactic radiosurgery

17.05 Techniques

17.06 Localization

17.07 Mechnical precision

17.08 Dose delivery

17.09 Patient safety/machine interlocks

17.10 Gamma knife acceptance tests

17.11 Linac systems

17.12 Gamma knife units

17.13 Phantoms

17.14 Dosimetry calculation

17.15 Probable risk analysis and QA

17.16 Treatment QA

17.17 Stereotactic couch mount

17.18 Routine QA

17.19 QA for a Gamma Knife

17.20 Stereotactic frames

17.21 Image correlation

17.22 Multiple Fractionation

17.23 Portal Imaging

17.24 Conformal SRS

17.25 Robot-guided linac

SCHOOL OF MEDICAL DOSIMETRY

UNIVERSITY OF MARYLAND MEDICAL CENTER

DEPARTMENT OF RADIATION ONCOLOGY

APPENDIX I:

STUDENT INFORMATION

Program

The University of Maryland Medical Center (UMMC) dosimetry program exists to provide training in the field of medical dosimetry. Upon completion of the program, graduates will be able to:

1. Perform entry-level dosimetry tasks.
2. Develop treatment plans for three-dimension conformal radiotherapy.
3. Develop treatment plans for intensity modulated radiation therapy.
4. Perform hand calculations to verify plan accuracy.
5. Develop brachytherapy treatment plans.
6. Understand the principles of IGRT in treatment planning and delivery
7. Communicate effectively orally and in writing.
8. Function in a professional manner as part of an interdisciplinary team.

Admission Requirements

Students must be registered radiation therapists with a minimum of one-year of clinical experience or persons with a baccalaureate degree in the physical sciences, minimum overall GPA of 3.0, preferably with one year of physics. All applicants must have completed post-secondary instruction in the following areas:

1. Basic mathematics including algebra, trigonometry, and introductory calculus
2. Basic physics
3. Oral and written communication
4. Biology
5. Anatomy and physiology

6. Medical terminology
7. Computer competency

Application Process

It is the policy of the school and its sponsor to admit students without regard to race, sex, religion, national origin, or handicap, unless that handicap would prevent the student from fulfilling their clinical requirements.

Applications including all associated materials such as personal references and transcripts must be received by December 1st for admission the following September 1st. The selection of candidates will occur on or before April 1st.

Selection Process

The selection of all students will be through the admissions board. All federal and state nondiscriminatory laws will be observed.

Grading Policy and Graduation Requirements

The Students of the School of Medical Dosimetry at University of Maryland Medical Center are evaluated in an ongoing basis from the beginning to the end of the one year program. The grading plan accumulates performance from; clinical duties, in class performance, completion of coursework and homework, completion of student presentations and associated preparation, and attendance. The grading policies are disclosed herein, to students, prospective students, faculty and staff. This grading policy is under continuous development to meet changes in the program and to adapt to shortcomings in its design. The sample transcript below shows the course weighting and grading and GPA calculation.

Program Grading Scale:

The absolute numerical grading system was discarded in favor of a normalized grading system starting September 2008. Due to a large number of faculty involved with teaching and relatively small number of dosimetry students, there is a large variation in the difficulty level of the various exams used for student assessment. The relative or normalized grading is introduced to make the assessment process fair to the students and reduce “fluctuations” from faculty to faculty and from one year to the next. The normalized grade is largely based on the mean and standard deviation. Usually 1.25 standard deviation above the average score is an A, and the average is “defined” to be between and B- and a B depending on the course. This grading scheme subject to adjustment based on the discretion of the particular faculty member involved. The

assigned grade must reflect the students ability compared to competent dosimetrists in our department as well as across the country. Some courses, such as the biology and physics didactic lectures are also attended by radiation oncology residents, who are taught at the same level as medical dosimetry students. To improve the statistics of the grading system, the scores of the residents are used in the calculation of the exam average and standard deviation. The following scale is used for GPA assignment.

Course Listing

2012-13 Academic Year

SCHOOL OF MEDICAL DOSIMETRY
UNIVERSITY OF MARYLAND MEDICAL CENTER
DEPARTMENT OF RADIATION ONCOLOGY

Fall Semester

Course Number	Description	Credit Hours
11.101	Radiation Oncology Physics I	3.0
21.101	Treatment Planning Concepts I	4.0
21.103	Treatment Planning Concepts I Lab	2.0
21.111	Clinical Practicum - 1st Semester	3.0
41.101	Radiobiology I	1.0
51.111	Medical Management of Cancer I	2.0
	Total	15.0

Spring Semester

Course Number	Description	Credit Hours
11.102	Radiation Oncology Physics II	3.0
21.102	Treatment Planning Concepts II	4.0
21.104	Treatment Planning Concepts II Lab	2.0
21.112	Clinical Practicum - 2nd Semester	3.0
41.102	Radiobiology II	1.0
51.112	Medical Management of Cancer II	2.0
	Total	15.0

Summer Term

Course Number	Description	Credit Hours
21.251	Treatment Planning Project	4.0
21.115	Clinical Practicum - Summer	1.0
	Total	5.0

GPA	Letter Grade
4.00	A
3.67	A-
3.33	B+
3.00	B
2.67	B-
2.33	C+
1.67	C
1.33	C-
1.00	D
0.00	F

Students must maintain a 3.0 GPA or higher, in order to avoid failing the program of the School of Medical Dosimetry. Graduates receiving a GPA higher than 3.0 will successfully complete the program and will receive a certificate of completion from the School of Medical Dosimetry.

For grading policies of the individual courses, please refer to the syllabi for the individual courses.

Scheduled Reporting of Grades to Students

The students will receive the evaluations of the tests and exams in a timely manner so that they are aware of their overall standing at any given time. The students falling short of the B average will be required to spend extra time with the director and appropriate faculty to maintain the mimimum standard.

Classroom Space

The departmental conference room will be utilized for classroom space. Computer-controlled audio-visual equipment is available. Independent study can occur at the UMMC Health Sciences Library. The Health Science Library also offers internet access.

Student to Instructor Ratio

Student to instructor ratio of 1:1

Tuition and Finances

The value of the Program for each student is Thirty Three Thousand Six Hundred and Twenty Four Dollars ($33,624.00). As part of the program value, the accepted student will receive an educational stipend of Thirteen Thousand Six Hundred and Twenty Four Dollars ($13,624.00). In consideration of the value of the program, including the

Educational Stipend, the student agrees to full time employment with UMMC as a dosimetrist for a period of eighteen (18) months following graduation from the program, if a position is available. Students who are employed after graduation, by UMMC are paid a competitive salary during the eighteen-month obligation to the University of Maryland Medical Center. Notably, if a position is not available upon completion of the program, the student does not have to pay back any part of the $33,624.00 value of the program. If an applicant is accepted into the program and wishes not to enter the commitment to work for 18 months, a one time fee will be due of $33,624.00 to cover the value of the program. In such instance, the student will receive the stipend portion of that fee, back in the amount of $13,624.00 as a salary during their one year employment at UMMC. If a student should need or wish to breach the agreement to commit to employment after graduation, or at any time during the 18 months employment after graduation, a one time fee of 33,624.00 shall be due. It should be noted that both the tuition and the contractual obligations are reviewed on an annual basis and are subject to change.

Transfer Credits

The UMMC Medical Dosimetry Training Program does not accept transfer credits.

Academic Calendar

This year long program commences the last week of August. Students receive two weeks of vacation, and must submit a request for any vacation days to the Program Director. Additionally, students receive 6 holidays per year (when the radiation oncology department is closed): New Years, Martin Luther King Holiday, Memorial Day, July 4th, Labor Day, and Thanksgiving.

The academic year is divided into two semesters (fall and spring) and a summer term. The fall semester runs from September through January, the spring semester runs February through June, and the summer term runs in June and July. Transcripts will be given for both semesters and the summer term.

Radiation Safety

All students will receive radiation safety training provided by the department's radiation safety officer and issued film badges before they start the program. The training consists of basics of radiation protection and department's Radiation Safety Policy. All student activities involving radiation fall under the rules and regulations of the Department of Environmental Health and Safety at the University of Maryland, Baltimore. The radiation safety policies and procedures can be found in Exhibit F and are available at http://www.ehs.umaryland.edu/rad/policies.cfm.

Pregnancy Policy

The pregnancy policy will be maintained in accordance with the policies of the University of Maryland Medical Systems, which are discussed in the UMMC policy and procedure manual, procedure #409, leave of absence.

Declaration of Pregnant Worker (DPW) Status

The declaration of pregnant worker status is voluntary and is administered by the office of environmental health and safety. Declared pregnant students will be offered an alternative schedule to gain competency in brachytherapy procedures when sources are present. The pregnancy policy of our Department of Environmental Health and Safety is available through their website at: http://www.ehs.umaryland.edu/rad/raddosim.cfm. Additionally, this page includes a link where one can voluntarily disclose their status as a pregnant radiation worker.

Student Services

The University of Maryland Baltimore's Health Sciences and Human Services Library (HS/HSL) is located directly across the street from the Department of Radiation Oncology. Serving all schools on campus and the University of Maryland Medical Center, the HS/HSL contains more than 350,000 volumes, including more than 2,500 journal titles. The library has more than 900 seats, 40 study rooms, three microcomputer labs, a satellite conferencing center, and network connections throughout the building.

Additionally, our medical dosimetry students have access to our residents' library that contains scores of books on radiation therapy and most of the important scholarly journals in the field. We also maintain a library of dosimetry texts in our dosimetry room that the students can borrow.

Students can take advantage of The Counseling Center at the University of Maryland, Baltimore. It serves as the primary centrally administered service center providing short-term individual, couples, family and group counseling for dysfunctions that impinge on academic or work achievement. It also provides direct service to students, faculty and staff members with acute problems and acute exacerbations of chronic problems.

Health and Insurance

All students are required to have a complete physical exam before entering the program. This exam must include:

1. History and physical
2. Blood pressure check

3. Immunizations: polio, tetanus, rubella, measles and hepatitis B
4. TB skin test
5. Chest x-ray, if TB test is positive
6. Free of any communicable diseases

Physicals will be accepted if conducted within the past six months. General health should be taken care of by a family physician.

Students who accept the stipend will be offered health coverage by UMMC.

Liability Insurance

All students accepted into the program will be covered by UMMC.

Transportation

All students will be responsible for providing their own transportation to and from the clinical sites of the Department of Radiation Oncology. Students will be responsible for paying their own parking costs.

Housing

All students will be responsible for providing their own housing. University and/or the Medical Center facilities will not be available.

Curriculum

The length of the program will be 12 months. It consists of 1700 hours of clinical training and 300 hours of formal classroom, laboratory exercises or modules. There will not be a difference in the length for a student with an RTT versus a student with a BS.

Due Process Procedures

Students with a complaint should first present the complaint orally to the person(s) involved. If the complaint is not resolved in five business days, the student can present a formal written complaint to the program director. This formal written complaint should be filed within ten business days of the original oral presentation. A review of the appeal and rendering of a decision will be completed within five business days. If the student wishes to appeal beyond the program director, he or she can file a written appeal to the Human Resources Department. The appeal process of the Human Resources Department is outlined in detail on our intranet at:
http://intra.umm.edu/ummc/human_resources/hr_policies_index.htm

A copy of this document will be provided to any student upon request.

Reporting Non-Compliance of JRCERT standards

The School adheres to the standards for medical dosimetry set by JRCERT ("Standards-MD"). The procedure for reporting non-compliance can be found the JRCERT website and will be given to each student in printed form at the start of the program. The form for filing complaints can be found at

http://www.jrcert.org/pdfs/accreditation_process/forms_&_checklists/other_forms/allegations_reporting_form.pdf

Disciplinary Action

Any activities or behavior that violate the policy and procedures of the University of Maryland Medical System (the sponsoring organization of this program) as outlined in the policy and procedure manual of the University of Maryland Medical Center will be grounds for disciplinary action to include dismissal from the program. The final authority for all disciplinary action rests with the chairman, department of radiation oncology.

Confidentiality

Student records will be maintained in accordance with the Family Education Rights and Privacy Act (Buckley Amendment).

SCHOOL OF MEDICAL DOSIMETRY

UNIVERSITY OF MARYLAND MEDICAL CENTER

DEPARTMENT OF RADIATION ONCOLOGY

APPENDIX II:

ADMISSIONS APPLICATION FORMS

SCHOOL OF MEDICAL DOSIMETRY
UNIVERSITY OF MARYLAND MEDICAL CENTER
DEPARTMENT OF RADIATION ONCOLOGY

Admissions Application for University of Maryland Medical Center

School of Medical Dosimetry

22 South Greene Street
Baltimore, MD 21201
(410) 328-2323 *phone* (410) 328-2618 *fax*

TYPE OR PRINT INFORMATION:

_____ _____ _____

Last Name First Name Middle

Street Address: _____

_____

Home Phone: ( ) _____ Work Phone: ( ) _____

Email address: _____

May we contact you at home? ____Yes _____No May we contact you at work? _____Yes _____No

SS#: _____- _____ - _____ Veteran: _____ Yes _____No

Military Record: Branch: _____ Status: _____

If you are a student applying from outside of the United States, do you have a permit/visa to attend school and/or work in the United States? _____Yes _____No

Applicant's signature: _____

Date: _____

Please mail application, school transcripts, and certificate of completion (if applicable) to the program address below.

Applications must be received by December 1, 2012 for the 2013-2014 academic year.

Mail to:

Matthew A. Earl, Ph.D.

Director - School of Medical Dosimetry

University of Maryland Medical Center- Department of Radiation Oncology

22 S. Greene Street, Baltimore, MD 21201

Educational Background

Official transcripts for all educational levels must be forwarded to our program address by December 1, 2012.

High School:_____

Address: _____

Date Graduated: _____

College: _____

Address: _____

Date Attended: _____

Degree: _____

College: _____

Address: _____

Date Attended: _____

Degree: _____

College: _____

Address: _____

Date Attended: _____

Degree: _____

Certified Programs Attended: _____

Address: _____

Date Attended: _____

Certification Awarded: _____

Certified Programs Attended: _____

Address: _____

Date Attended: _____

Certification Awarded: _____

Employment History: List employment history for the past five years starting with the most recent employer. If you were in school, please indicate.

Employer: _____

Address: _____

Supervisor's Name: _____ *Phone No.:* _____

Position Held: _____ *Dates Employed:* _____

Describe your job duties and responsibilities:

_____

_____

_____

Employer: _____

Address: _____

Supervisor's Name: _____ *Phone No.:* _____

Position Held: _____ *Dates Employed:* _____

Describe your job duties and responsibilities:

_____

_____

_____

Employer: _____

Address: _____

Supervisor's Name: _____ *Phone No.:* _____

Position Held: _____ *Dates Employed:* _____

Describe your job duties and responsibilities:

_____

_____

_____

Employer: _____

Address: _____

Supervisor's Name: _____ *Phone No.:* _____

Position Held: _____ *Dates Employed:* _____

Describe your job duties and responsibilities:

_____

_____

_____

Personal References

1. List at least two (2) personal references below. We encourage the selection of work supervisors and professors. Co-workers and friends are not acceptable references. Please ensure the references list their relationship to you on the reference form.
2. Fill in your name on the personal reference form.
3. Give the form to person(s) providing reference.
4. The form must be completely filled out.
5. Have your reference fill out the form and mail it to the address provided.
6. Your application will not be complete without two (2) references. If a reference is received and later withdrawn your application will not be considered for the current school year.

Name: _____

Phone No.: _____ Relationship: _____

Profession: _____

Name: _____

Phone No.: _____ Relationship: _____

Profession: _____

Name: _____

Phone No.: _____ Relationship: _____

Profession: _____

Name: _____

Phone No.: _____ Relationship: _____

Profession: _____

Name: _____

Phone No.: _____ Relationship: _____

Profession: _____

SCHOOL OF MEDICAL DOSIMETRY
UNIVERSITY OF MARYLAND MEDICAL CENTER
DEPARTMENT OF RADIATION ONCOLOGY

Student applicant's name: _____

The above applicant has applied for admission to our training program in medical dosimetry and has listed your name as a reference. We would appreciate your opinion of this applicant's suitability for this type of training.

How long have you know the applicant? In what relationship have you known the applicant?

_____

What do you consider the applicant's strongest characteristics?

_____

What do you consider the applicant's weakest characteristics?

_____

List any other information on the qualities of this applicant that would contribute to success in this fie1d.

_____

Please rate the applicant in the following categories, using a scale of 1 to 5 with 5 being superior and 1 being poor.

Characteristics	Superior"5"	"4"	"3"	"2"	"1"	No Basis
Mathematics and Computer Skills						
Ability to Work with People						
Ability to Work Independently						
Problem Solving Ability						
Organizational Ability						
Sense of Responsibility						
Reliability						
Oral Communication Skills						
Written Communication Skills						
Ability to Adapt to New Situations						
Leadership						

Recommendation (circle one):

Strongly Recommend Recommend Recommend w/Reservations Do Not Recommend

Name: _____ Title: _____

Address: _____

_____ Phone No._____

Signature: _____ Date: _____

Please return to: Matthew A. Earl, Ph.D.
Department of Radiation Oncology
University of Maryland Medical Center
22 S. Greene St., Baltimore, MD 21201

SCHOOL OF MEDICAL DOSIMETRY
UNIVERSITY OF MARYLAND MEDICAL CENTER
DEPARTMENT OF RADIATION ONCOLOGY

Student applicant's name: _____

The above applicant has applied for admission to our training program in medical dosimetry and has listed your name as a reference. We would appreciate your opinion of this applicant's suitability for this type of training.

How long have you know the applicant? In what relationship have you known the applicant?

_____

What do you consider the applicant's strongest characteristics?

_____

What do you consider the applicant's weakest characteristics?

_____

List any other information on the qualities of this applicant that would contribute to success in this fie1d.

_____

Please rate the applicant in the following categories, using a scale of 1 to 5 with 5 being superior and 1 being poor.

Characteristics	Superior"5"	"4"	"3"	"2"	"1"	No Basis
Mathematics and Computer Skills						
Ability to Work with People						
Ability to Work Independently						
Problem Solving Ability						
Organizational Ability						
Sense of Responsibility						
Reliability						
Oral Communication Skills						
Written Communication Skills						
Ability to Adapt to New Situations						
Leadership						

Recommendation (circle one):

Strongly Recommend Recommend Recommend w/Reservations Do Not Recommend

Name: _____ Title: _____

Address: _____

_____ Phone No._____

Signature: _____ Date: _____

Please return to: Matthew A. Earl, Ph.D.
Department of Radiation Oncology
University of Maryland Medical Center
22 S. Greene St., Baltimore, MD 21201

Statement of Interest

Please write a statement of interest (focusing on the reasons you wish to participate in our program). You may consider answering the following questions when writing your statement:

1. What do you feel you will receive from this program?
2. What do you feel you will contribute to this program?
3. How did you become interested in this program?

SCHOOL OF MEDICAL DOSIMETRY

UNIVERSITY OF MARYLAND MEDICAL CENTER

DEPARTMENT OF RADIATION ONCOLOGY

APPENDIX III:

ENROLLMENT POLICIES

SCHOOL OF MEDICAL DOSIMETRY

UNIVERSITY OF MARYLAND MEDICAL CENTER

DEPARTMENT OF RADIATION ONCOLOGY

School of Medical Dosimetry

The Department of Radiation Oncology

Enrollment Policies: Acceptance, Initial UMMC Probationary Period, Completion, Probation and Dismissal

22 South Greene Street, Gudelsky Tower, Room GGJ-02 Baltimore, Maryland 21201

The Enrollment Policies of the School of Medical Dosimetry at University of Maryland Medical Center are instituted to provide a scholastic, professional and fair environment. This document focuses on the four major areas of enrollment; acceptance, program completion, probation and dismissal. All aspects are reviewed by a School of Medical Dosimetry Committee:

Acceptance:

Two positions are available each year, to be filled by individual applicants. The individual applicant that will be accepted to fill one position will have to complete the application process, submitting all pertinent documentation of school records, recommendation letters and assurance that all information is honest and true.

The School of Medical Dosimetry Committee, composed of the Program Director, Clinical Driector, One clinical preceptor, one faculty physicist and one faculty clinician shall review all applications. An objective scoring system shall be used to review GPA, letters of recommendation, letter of intent of the applicant and past professional experience. The closest match of interest of the applicant, experience, GPA and referral by a referee are considered to be the source of information in matching the candidate to the position.

Interviews are conducted in person, at UMMC. Candidates are responsible for covering transportation, lodging and ancillary expenses to arrive at the interview. Each year, the program invites 4 to 6 candidates to search for the two individuals who will first receive an offer to join the program. Should the applicants not meet the requirements to fill both positions, or reject an offer, another group of 4 applicants, next in line from the application review process shall be invited for interview.

Applications are due on Dec. 1 of the year prior to starting the program. Interviews are conducted no later than mid-March of the year the student would start the program.

Acceptance may be denied based on the candidate being under-ranked relative to other applicants in GPA, recommendation, statement of interest, professional experience and overall performance in the interview process. Acceptance may also be revoked if a candidate is found to have submitted untrue information, or misled the program into believing any information submitted in the application that may be related to another person. Applications are reviewed objectively. In recent application material versions, age, sex, and race are omitted. Ultimately, the application process is aiming towards and objective, performance-based evaluation to find the best candidate to perform the student role in the program.

Initial UMMC Employee Probationary Period

Students of the School of Medical Dosimetry become University of Maryland Medical Center employees when they join the program. The UMMC rules and laws institute a 6 week probationary period on all full-time hospital employees. During this period, termination, dismissal and student review is subject to administrative review by the hospital at any time. Students will not have access to the appeal process during these first 6 weeks, as this is not available to employees of UMMC, until after they complete their initial 6 week probationary period. This does not mean the student starts the program in bad standing, rather this signifies that UMMC reserves the right to oversee employee conduct, professional ability and commitment to patient care through direct approach from administration if that is necessary. Such circumstances would become active if a student were to display disciplinary misconduct, failure to show up for work, or evident inability to conduct basic tasks assigned during the initial 6 weeks of employment. The students are advised to review the UMMC guidelines in the UMMC intranet. A copy of the appeal process is also available to prospective students on request. The intranet link for all policies and procedures is http://intra.umm.edu/ummc/reference/policies_index.htm

Completion of the Program

Completion of the one-year program will yield a Certificate of Completion and its associated recognition as the student may expect, to support application for other employment. Completion is important to our program. Our current graduation rate is 100%. We encourage each student to advance and to complete the program to the best of their ability. However, it is important that all competencies be completed. Delays in completion are addressed in the monthly grading report and if necessary by meeting with the clinical director and program director, as this may be required. If a student falls outside of the bounds of reasonable time to complete a competency requirement, displays undue behavior or disrespect of faculty and staff, or deliberately decides not to conduct certain competencies, the student will default to a probationary period.

At completion of the program the school goals shall be met:

1) Demonstrate a clear understanding of medical dosimetry of radiation oncology so that the students can easily adapt to every changing technology.
2) Design treatment plans for three-dimensional conformal radiotherapy.
3) Design treatment plans for intensity modulated radiation therapy (IMRT).
4) Design treatment plans for brachytherapy treatments.
5) Perform hand calculations to verify plan accuracy.
6) Understand the emerging technology of image-guided radiation therapy (IGRT) it applies to radiation treatment planning and delivery
7) Effectively communicate with an interdisciplinary radiation oncology team.
8) Pursue a career that embraces professional development.

The School of Medical Dosimetry believes deeply in these goals and will guide each student to reach these goals recognizing that students may fall behind at times or need additional support. Unkind, inhumane, disrespectful or belligerent behavior will not be fostered and students exhibiting such trends will be held accountable in a probationary period.

School of Medical Dosimetry Probationary Period.

Hospital employees are subject to rules and regulations within hospital grounds. Hospital employees are sanctioned, and possibly dismissed due to smoking on hospital grounds, inappropriate behavior, tardiness, activities that place patient care at risk, or unwillingness to conduct assigned work. Within the program of the School of Medical Dosimetry, focus is placed on student achievement in learning, and clinical duties. The student shall enter a period of probation within the school of medical dosimetry that will span from 1 to 3 months. For example, if a student fails more than one of the courses during a single month's time, the student will be advised of this in the monthly grade report (see grading policy). The School of Medical Dosimetry Committee will assign the program director, or clinical director to discuss the student's performance with the student. In such discussion the source of the failure in that competency shall be reviewed with the student, and a written statement will be delivered to the student and signed of awareness by the student. The student will be allowed to explain the reasons for such performance and a solution will be proposed by the clinical or program director. Review of progress will occur in one month. If the student has recovered to a passing performance in all areas, the student will be released of the probationary period, with due note in writing. If the student does not correct the performance in all areas to be at passing or better, the student will have a committee meeting. At the committee meeting the student will be allowed to explain if extraordinary circumstances are preventing the student from performing at an acceptable level in the program, in any one of the areas where the student is failing. The status will be summarized by the committee in writing. The student will also be asked to return to the committee in one month where performance shall be reviewed. If the student returns to normal levels of performance, the probationary period shall be stopped, and the student will be expected to continue to perform at an acceptable level, with a letter to the student from the committee of the resolution of probation.

Should a student show some improvement in performance after the second month of probation, but continue to fail in one or more areas, the student will be granted one final month of probation before the hospital is advised to consider dismissal at the administrative level. Also, at this point the student will be clearly informed in person and in writing of these circumstances and a permanent record will be placed in the student file. At the completion of this third month the student will have to demonstrate passing level in all areas and will be held in close observation. Misconduct, failure in any competency, tardiness, or incomplete assignments will be due cause to initiate termination without further notice.

Should a student continue to fail in any area at the completion of the third month of probation a written statement will be issued to the hospital administration to pursue termination of the student's contract with UMMC.

The student has access to the hospital appeal process if the student finds that any probationary period assigned by the School of Medical Dosimetry is not due, is unfair, or simply wishes to challenge the probationary period instituted by the program. Students are advised on how to use the appeal process from the hospital intranet and from the appeal documents provided to each new employee.

Dismissal

A student may be dismissed from the program due to extraordinary circumstances such as unusual behavior that may threaten co-workers, staff, faculty, students, or patients. Any student, who reaches three months of school probation will also be forwarded for dismissal to the UMMC administration. Dismissal due to students violating any aspect of the employee regulations not expressed herein, are at the discretion of the UMMC administration. Such regulations include sexual harassment, threatening intimidation, dangerous behavior, smoking in hospital grounds after disciplinary actions have been taken, or extended absence from work. Students are alerted to review the hospital employee handbook from the UMMC intranet at their earliest enrollment in the program.