



University of North Carolina Hospitals
Medical Dosimetry Program
Student Handbook
2013-2014

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INTRODUCTION

The following general information regarding policies, procedures, regulations and schedules has been prepared for the student entering the UNC Hospitals Medical Dosimetry Education Program. Therefore, you, as the student, need to familiarize yourself with these policies, procedures, etc., ask questions you may need for a better understanding and abide by them to the best of your ability.

Students of all backgrounds are equally welcome to the program irrespective of race, sex, or national origin. Members of the program faculty are glad to discuss career opportunities and related matters in nuclear medicine technology with all interested students.

University of North Carolina Hospitals

Medical Dosimetry Program

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University of North Carolina Hospitals
Medical Dosimetry Program

Mission, Goals, Description, Purpose, Accreditation

Mission

The mission of the Medical Dosimetry Program through the University of North Carolina Hospitals is to prepare outstanding entry-level medical dosimetrists with an ability to evaluate treatment processes to enhance patient safety.

Note: the program mission statement is evaluated annually by the UNC Hospitals Medical Dosimetry Education Program Development Committee. Meeting notes are available (JRCERT Standard 3.1).

Program Goals (2013-2014)

Goal 1: The student will be clinically competent in the planning of treatment.

Goal 2: The student will communicate effectively with patients, faculty, and staff.

Goal 3: The student will develop critical thinking skills to enhance patient safety.

Goal 4: The student will demonstrate professionalism.

Program Description

The medical dosimetrist is a vital and essential member of radiation oncology team. The UNC Hospitals Education Program is located at the University of North Carolina Department of Radiation Oncology in Chapel Hill, North Carolina. The University of North Carolina Department of Radiation Oncology was formed in 1987 from the UNC Division of Radiation Therapy. The UNC Division of Radiation Therapy began in 1969 with the purchase of a Cobalt 60 unit.

The Program course material and practicum covers radiation physics, radiation protection, dose calculations, tumor localization, external beam treatment planning, brachytherapy, quality assurance, medical imaging/anatomy, clinical radiation oncology, and radiobiology. Clinical practicum includes external beam treatment planning, brachytherapy treatment, preparation and planning, chart reviews and dose calculations, record and verify system data entry, treatment machine quality assurance, cyberknife, IMRT planning and treatment. Special project assignments, conference attendance and presentation, and journal article reviews are also part of the curriculum.

Program Purpose

The purpose of the UNC Hospitals Medical Dosimetry Program is to fulfill its mission and goals through the completion of stated objectives. The program provides superior quality higher education with

flexibility to accommodate expanding technological growth in radiation oncology and medical dosimetry created knowledge and clinical practice. The program maintains a relationship with other educational programs for support and collaboration to improve medical dosimetry education.

The student has the responsibility to make the most of available educational experiences, and once accepted, is obligated to abide by the policies and procedures of the UNC Hospitals educational program in medical dosimetry.

Non-Discrimination

The program, as with UNC Hospitals Policy, does not discriminate in student recruitment or admission practices on the grounds of race, color, sex, religion, gender, age, disability, marital status, national origin, or any other protected class. If the student has a question/concern about discrimination, he/she may contact the UNC Department of Radiation Oncology Administrative Director at (919) 445-5201. (JRCERT Standard 1.12) <http://www.unchealthcare.org/site/humanresources/careers/why/code/>

Advising

Being housed within a Carnegie Level 1 Research Institution allows the UNC Hospitals educational program to offer student excellent supportive academic, behavioral, and clinical advisement.

The UNC Hospitals Medical Dosimetry Program Director and (didactic and clinical) instructors are available for recruitment and pre-admissions advising as necessary. The admissions procedure for the program includes an extensive advising session. The enrolled student has an orientation advising session at the beginning of each semester.

The Program Director and (didactic and clinical) instructors are also available for individual academic, behavioral and/or clinical student advising as needed. Each didactic instructor provides formative and summative mid-semester feedback to the medical dosimetry students. Additionally, the Program Director meets both mid-semester and post semester individually with each UNC Hospitals Medical Dosimetry student to discuss his/her progress through the curriculum.

Because the medical dosimetry education program is housed within the UNC Department of Radiation Oncology, the program director/faculty/clinical instructors orally communicates with each student, faculty, and clinical instructor almost every day. This type of continuous oral communication allows for both informal and formal feedback between the student and the program director, thus allowing a continuous type of advice/advising between the program director and the medical dosimetry students on academic, behavioral, and/or clinical issues.

Additionally, each UNC Hospitals Medical Dosimetry student has access to the University of North Carolina at Chapel Hill library system (5 university-based academic libraries on campus, including a dedicated Health Sciences Library) to check out/access journals, check out books, and have use of the library academic and learning resources. The UNC Hospitals students also have access to the UNC Libraries via departmental Internet. Moreover, the UNC Hospitals students, for a small fee of \$120 dollars

per year, have access to the various University of North Carolina fitness centers and health programs on campus.

Finally, academic, behavioral, and clinical advisement is also offered by the University of North Carolina Department of Radiation Oncology School of Medicine faculty. As an external advisement measure, the UNC Hospitals Nuclear Medicine Program Director, Greg Beavers, Ph.D., is available as a student advisor for any academic, behavioral or clinical issues. (JRCERT Standard 3.7)

JRCERT Program Accreditation

The program is recognized by the Joint Review Committee on Education in Radiologic Technology (JRCERT). A current copy of the Standards for an Accredited Educational Program in Medical Dosimetry is available online and the UNC Program Director. Any questions about the program may be forwarded to either the Program Director or the JRCERT (JRCERT Standard 1.7). The JRCERT contact information is:

JRCERT
20 N. Wacker Drive
Suite 2850
Chicago, Illinois 60606-2901

Phone: (312) 704-5300

E-mail: mail@jrcert.org

In addition to being in this student handbook, The UNC Hospitals Medical Dosimetry Education Program effectiveness data is also available via the JRCERT's Web site: jrcert.org. (JRCERT Standard 5.2)

The medical dosimetry educational program effectiveness data information is also on the UNC Hospitals Medical Dosimetry Educational Program Webpage (JRCERT Standard 5.3).

UNC Hospitals Medical Dosimetry Education Program Effectiveness (JRCERT Standard 5.2)

Outcome	Measurement Tool	Benchmark	Timeframe	Responsible Party	Results
Attrition	Program completion rate	50%	Annual	Program Director (reported annually to the advisory committee)	2013: 0% 2012: 0% 2011: 0% 2010: 0% 2009: 0% 2008: 0%
Pass Rate	Credentialing examination pass rate	75%	5-year average pass rate (at 1 st attempt within 6 months of graduation)	Program Director (reported annually to the advisory committee)	2013: 100% 2012: 100% 2011: 100% 2010: 100% 2009: 100% 2008: 100%
Employment	Job placement rate	75%	5-year average job placement rate (within 6 months of graduation)	Program Director (reported annually to the advisory committee)	2013: 100% 2012: 100% 2011: 100% 2010: 100% 2009: 100% 2008: 100%
Graduate Satisfaction	Graduate survey	At least a 4 on a 5 point scale	Annual	Program Director (reported annually to the advisory committee)	2013: 4.4/5 2012: 4.3/5 2011: 4.3/5 2010: 4.2/5 2009: 4.2/5 2008: 4.1/5
Employer Satisfaction	Employer survey	At least a 4 on a 5 point scale	Annual	Program Director (reported annually to the advisory committee)	2013: 4.8/5 2012: 4.8/5 2011: 4.7/5 2010: 4.6/5 2009: 4.6/5 2008: 4.5/5

The Sponsoring Institution

UNC Hospitals sponsors the Medical Dosimetry Program. All program functions, including administration structure (organizational structure and administrative support, as well as didactic and clinical educational faculty, faculty continuing professional education, and clerical support services are coordinated and administered by UNC Hospitals and UNC School of Medicine faculty and staff

(JRCERT Standards 2.1, 2.2, 2.3, 2.4). Moreover, the educational program has a dedicated didactic classroom, dedicated student work area, dedicated individual student clinical work stations, and the education program reviews and maintains student learning resources and student services as would be expected at a Carnegie Level 1 research hospital and university (JRCERT Standards 2.6, 2.7, 2.8, 2.9). Finally, the UNC Hospitals clinical medical dosimetry setting is recognized by the JRCERT. The educational program has no external clinical sites. (JRCERT Standard 2.5)

The UNC Department of Radiation Oncology has the following student groups/educational programs: 1) UNC radiation therapy students, 2) UNC radiation oncology medical physics students, 3) UNC radiation oncology medical residents, 4) UNC medical dosimetry students; and the following visiting students: UNC UNC medical students, nursing and radiography students. The UNC Department of Radiation Oncology has a tripartite mission of clinical service, research, and education. This mission correlates with the UNC medical school and the greater University of North Carolina at Chapel Hill. The university, medical school, hospital and its programs are all physically located in the contiguous Chapel Hill campus area.

Professional Liability Insurance coverage is taken care of by a group policy through the UNC Hospitals.

UNC Hospitals Medical Dosimetry Educational Program Student Policies and Contact Information

Agreement to Adhere to the Program's Policies and Procedures

The student indicates acceptance of these policies and procedures by enrollment in the UNC Hospitals Medical Dosimetry educational program. The program reserves the right to change these policies and procedures when in the best interest of the program. Upon implementation, the student will receive written notification of any changes. It should be noted that during orientation there is a review of the student handbook. Each student will sign and date a form that he/she understands all policies and procedures within the UNC Hospitals Medical Dosimetry student handbook.

Policies Governing Student Continuation and Promotion

The student is responsible for observing the policies and procedures of the University of North Carolina (UNC) Hospitals Medical Dosimetry Program as they are announced in this document. The Program Director will assist the student with the details of his/her program and/or academic problems. This assistance does not relieve the student of his/her individual responsibility for meeting the requirements and observing the regulations of UNC Hospitals, the UNC Department of Radiation Oncology, and the UNC Hospitals Medical Dosimetry Program.

Corrective Action and Grievance Procedure: Student Right to Appeal (Due Process)

The Medical Dosimetry Program Director must address issues in which the student fails to follow dosimetry program curriculum guidelines or university policies.

The issue will be adjudicated in the following manner:

- Program Director determines necessary course of action and presents to student.
- If formal discussions with the Program Director do not resolve the violation, misinterpretation, or inequitable application of any existing policy, procedure, or regulation; or other action issue to the student's satisfaction, the student has the right to submit a written appeal to the Medical Dosimetry Program Development Committee within 10 working days following the initial date of the issue. The appeal will then be directed to the UNC Department of Radiation Oncology Administrative Director. If the issue is not resolved to the student's satisfaction, the student has 10 working days to submit a second written appeal to the Medical Dosimetry Program Development Committee. The appeal will then be directed to the UNC Department of Radiation Oncology Associate Chair. If the issue is still not resolved to the student's satisfaction, the student has 10 working days to submit a third written appeal to the Medical Dosimetry Program Development Committee. The final appeal will then be directed to a mediation committee, whose members are outside of the UNC Department of Radiation Oncology. This committee consists the following members: UNC Nuclear Medicine Program

Director, the UNC Nuclear Medicine Chair, and a UNC Nuclear Medicine student. This is the final appeal process for the student. (JRCERT Standard 1.6)

The program also assesses current student and also alumni evaluations for the general overall structure and function of the education program via specific questions through its semester course evaluations and alumni surveys. The UNC Program Director, faculty, staff, and clinical instructors are always available for comments/suggestions about any components of the educational program that need improvement. (JRCERT Standard 1.6 added 1/1/14). If for any reason a student feels his/she is not being heard, they should speak directly with the program director to make sure the request/suggestion/complaint has been communicated properly. Examples of recent improved structure has been the design and implementation of a separate student work area for the UNC Hospitals Medical Dosimetry students on the B Level floor area. Secondly, has been the implementation of a second layer of window shades in the UNC Hospitals Medical dosimetry classroom to filter the afternoon sun.

If the student wishes to contact the Joint Review Committee Education in Radiologic Technology (JRCERT) regarding a situation they may do so with the following information. All JRCERT Standards for Accreditation are listed on their website as well.

JRCERT	Phone: (312) 704-5300
20 N. Wacker Drive	Fax: (312) 704-5304
Suite 2850	E-mail: mail@jrcert.org
Chicago, IL 60606-3182	Website: www.jrcert.org

Workplace Hazards, Harassment, Communicable Disease, and Substance Abuse

In the event that a student is concerned with workplace hazards, harassment, communicable diseases, or substance abuse, he/she should contact the Program Director or faculty immediately. The Program Director will work with the facility to ensure the safety of the student. (JRCERT Standard 4.6)

Grades

To be eligible for a Certificate in Medical Dosimetry, the student must satisfactorily pass all courses in the UNC Hospitals Medical Dosimetry Program curriculum. If the student's academic and/or clinical performance is considered to be unsatisfactory, the student will be placed on formal probation. In order to remove the probationary status, the student must make at least 80% on subsequent assignments during the next semester and complete any remedial work/examinations as required by the didactic instructor and approved by the Medical Dosimetry Program Development Committee. Should the probationary status go unremoved, the student will be dismissed from the program. To satisfactorily pass a course means that the

student earns a grade of at least C. To satisfactorily pass a course in which the student makes C-, the student must complete any required remedial work/examinations as required by the didactic instructor and approved by the Medical Dosimetry Program Development Committee.

Any student making a grade of D in any one course will automatically be dismissed from the program.

If the student is dissatisfied with any didactic and/or clinical grade during the course of the year, he/she has the right to appeal. Please see the Right to Appeal: Grievance section in this document.

Code of Conduct

Expulsion or suspension, or lesser sanctions, may result from the commission of any of the following offenses:

Academic cheating, including (but not limited to) unauthorized copying, collaboration, or use of notes/book on examinations, and plagiarism (defined as the intentional representation of another person's words, thoughts, or ideas as one's own).

For academic cheating, suspension is the normal sanction for the initial offense, unless the Program Development Committee determines that unusual mitigating circumstances justify a lesser sentence.

The furnishing of false information, with the intent to deceive, to members of the UNC Hospitals community who are acting in the exercise of their official duties, forgery, falsification, and/or fraudulent misuse of UNC Hospitals documents, records, or identification cards will result in expulsion from the program.

It is noted that a sanction against a student may also result in the student being dismissed from the program. For example, if a grade of "F" is given in a course in which the student has admitted cheating, he/she will be dismissed from the program.

Every student has the right to appeal any infraction of the Code of Conduct. Please see the Right to Appeal: Grievance section in this document.

Dismissal from the Program

In addition to academic ineligibility to complete the program, the student may be dismissed for inappropriate professional attitudes and/or actions, as described in the American Association of Medical Dosimetrists (AAMD) Code of Ethics, and the Practice Standards established by the profession. These

Standards are important professional standards for the student preparing to deliver a high standard of healthcare delivery and service.

A student may be judged unacceptable for continuation in the UNC Hospitals Medical Dosimetry Program when he/she has displayed a lack of professionalism with respect to other students, patients, faculty, and/or staff.

The UNC Hospitals Medical Dosimetry Program reserves the right to dismiss a student from the program when the student does not, in its judgment, demonstrate sufficient promise to justify continuation of study in the UNC Hospitals Medical Dosimetry Program.

If the student is dismissed from the program, he/she has the right to appeal, as stated in this document.

Readmission

A student who withdraws from the program must reapply and go through the admissions process again. No refunds are made after orientation is completed.

Use of Illegal Drugs

Students, faculty, and staff of UNC Hospitals are responsible, as citizens, for knowing about and complying with the provisions of North Carolina law that make it a crime to possess, sell, deliver, or manufacture those drugs designated collectively as “controlled substances” in Article 5 of Chapter 90 of the North Carolina General Statutes. Any member of the Hospitals community who violates that law is subject both to prosecution and punishment by civil authorities and to disciplinary proceedings by the UNC Department of Radiation Oncology. Disciplinary proceedings against a student, faculty member, or staff member will be initiated when the alleged conduct is deemed to affect the interests of UNC Hospitals.

Before entry into the UNC Hospitals Medical Dosimetry Educational Program, the accepted student will have to pass a documented official drug test.

Health Program

Students in the UNC Hospitals Medical Dosimetry Program are under the healthcare program of UNC Hospitals. It is mandatory that the student carry a hospitalization insurance policy to cover any necessary operations or special services that may be required during his/her education.

Holidays

Students will not have class or clinical practicum on hospital holidays:

New Year’s Day, Martin Luther King Day, Memorial Day, 4th of July, Labor Day, Day before Thanksgiving, Thanksgiving, Day after Thanksgiving, and Christmas Eve, Christmas, and the day after Christmas. Students must be present on all other holidays unless pre-approved by program director.

Sick Time

Student must contact clinic instructor/program director in all cases if sick, by 7:45 a.m. that morning. Any time missed by student due to calling in sick must be made up. If student misses class time, he/she is responsible to contact instructor and make up missed information – notes, quiz, or exam. If student misses clinical rotation he/she must make up time within scheduled dates of particular clinical rotation – extra hours/day - early and late. Students may also make up time during scheduled vacations. Student may not exceed more than 40 hours/week or more than 10 hours in any day. If the student exceeds these time limits, he or she must do so voluntarily.

Due to the nature of the program's curriculum, class attendance and timeliness are mandatory, with the exception of student/family illness or attendance of professional meetings/seminars. These exceptions will constitute an excused absence and the student is to make up any missed didactic work. Class absences are excused only by the didactic instructor or Program Director; any absence regarding professional meetings/seminars must be approved in advance.

Excessive tardiness is subject to corrective discipline, in the form of probation and/or dismissal. Excessive tardiness is defined as more than three instances of lateness in a semester. After four instances, the student will be placed on formal probation. Any five instances in a semester will result in dismissal from the program.

Banking Time: In order to be fair and equitable to each student and the program, it is the policy of the UNC Medical Dosimetry Program that medical dosimetry students cannot bank time beforehand. However, students can make up time after the absence. (see time off on page 17)

Inclement Weather Policy

If bad weather (snow, ice, flooding, tornado, earthquake, etc.) occurs on a clinical day, the student is responsible for finding out if the local university in the clinical site area is closed. Make sure to coordinate which university to use with your clinic instructor. If they are closed due to hazardous road conditions, then the student is excused from going to clinical even though SIUC may be open. The student must write "Snow Day" on this/her Time Sheet, and this absence will be verified by the Clinical Supervisor. If the local university is open but the student cannot get to his/her clinical site, then he/she must make up the day.

Please note: All unexcused "snow days" must be made-up.

Dress Code

All clothing and jewelry must be consistent with professional/business dress standards applicable to the work responsibilities involved, and must be appropriate for reasonably anticipated public contact. Students should wear a white mid length lab coat at all times. Students dress clothes should be neatly pressed for a professional appearance. Males should also wear a tie. Dress shoes should also be worn however no open toe dress shoes are allowed.

All students must wear the UNC Hospitals student name badge each clinical day. The identification badge must be worn so that the picture, name and department are easily visible at all times.

1. Hair, including beards and mustaches, is to be clean, neatly groomed, and kept in such a way as not to interfere with student duties or safety. Hair that is longer than the collar on males, or longer than the shoulder on females, is to be pulled back and fastened to prevent contamination and to decrease the spread of microorganisms such as pseudomonas and staphylococcus.
2. Make up, perfume and cologne are to be moderately applied.
3. Fingernails are to be clean, trimmed, and extend no further than 1/4" beyond fingertips. Clear or conservative light-colored nail polish may be worn.
4. No visible tattoos area allowed. Piercings are limited to ears only (one set of earrings).

Disability, Illness, Pregnancy

The Program Director will determine if a student may continue the Program should illness or disability arise. The decision will be made on an individual basis, taking into account the nature and degree of the disability, as well as a physician's recommendation that the student may continue the program.

If a student becomes pregnant while in the program the pregnancy policy within this handbook will be followed.

Students must make up all missed clinic and class time. Students unable to complete assigned time commitment by end of program, will not graduate until they successfully complete class and clinical rotations.

Student Clinical Hours

8:00am – 4:30 pm, Monday-Friday

Hours vary depending upon the clinical rotation requirements. Students may need to remain in clinic beyond the normal hours in order to complete a project related to their learning. On rare occasions, the

student may need to work on a Saturday or Sunday to complete a quality assurance procedure. However, these student clinical clock hours must not exceed 25% of the total clock hours (10 hours during the weekend) (JRCERT Standard 1.3)

Clinic Site	Phone Number	Clinical Instructors
University of North Carolina Department of Radiation Oncology 101 Manning Drive Chapel Hill, North Carolina 27514-7512	(919) 445-5547	Katharin Deschesne, MS (Lead) Jackie Carter (CMD), Mark Kostich (CMD), Misty Lehman-Davis (CMD), Purvi Patel (CMD), Raina Erwin (CMD), Leslie Hoyle (CMD)

Emergency/Safety Orientation

During the initial program orientation an incoming medical dosimetry student will participate in an emergency procedures/safety orientation specific to the University of North Carolina Hospitals. These health and safety issues are completed before the student is allowed in the UNC Hospitals clinical areas. The policies and procedures are included, but not limited to, the following areas (JRCERT Standard 4.7):

1. Hazards: Fire, electrical, chemical emergencies
2. Emergency Preparedness
3. Medical Emergencies
4. HIPPA
5. Standard Precautions
- 6.

Attendance

Students must report to assigned class or clinical rotation for the duration of hours specified by schedule, unless pre-approved by program director for absence or tardiness. If a student misses 5 days throughout the program their clinical grade will be lowered one letter grade. If a student missed six or more days during the year, the student can be removed from the program.

The student is expected to report to the clinical facility at the designated time. Tardiness is not considered responsible, professional behavior. Three late arrivals, each in excess of 10 minutes, will be considered the equivalent of one absence for grade determination. It is the student's responsibility to call the Clinical Instructor within 30 minutes prior of the beginning of the clinical time period if you are not going to be present or if you are going to be late. Failure to do this will result in two points being deducted from the final clinical grade average for each infraction.

Vacation

Students receive five days of vacation, which must be taken during the one year program.

Students are allowed one personal day (wedding or funeral) and two interview days while in the program. The interview days require documentation and may only be taken during the spring or summer semesters.

The students are given release to attend conference and/or professional meetings. The student is responsible to fund his or her travel, hotel, and conference fee.

Health Insurance – Emergency Situation

If a UNC Hospitals medical dosimetry student has an emergency they are to go to a local hospital ER or Urgent Care clinic.

Radiation Monitoring

All students must wear a personnel monitoring device at all times in the clinic. Exposure reports will be available for review once processed via Desire2Learn. If a dose reading exceeds normal limits (≥ 0.125 Rem or ≥ 1.25 mSv per quarter) the student will be contacted by the University of North Carolina Radiation Safety Officer or the program personnel. In the event an accidental exposure occurs, the student must notify the Program Director regarding the incident. The Program Director will work with the Radiation Safety Officer and make a plan of action for the event. If the badge is lost, damaged, or any other concerns, please contact the Program Director. (JRCERT Standards 4.1 & 4.3)

If a student feels that he/she has received a high radiation dose exposure (exceeding normal limits of ≥ 0.125 rem or ≥ 1.25 mSv per quarter) for any reason, the student should immediately contact the Program Director. The student should NOT wait. An emergency reading will be done by UNC Radiation Safety. Please refer to the UNC Hospitals Radiation Safety Manual, which will be reviewed during program orientation. UNC Hospitals film badges are read quarterly. When the quarterly radiation reports come to the UNC Department of Radiation Oncology, they are posted in the M and B level break rooms. It is each student's responsibility to look at their report.

The University of North Carolina has a Radiation Safety Department on campus. If anyone has a high radiation reading, the UNC Radiation Safety Department will notify both the Program Director and student in writing and in person.

Direct Supervision Policy

All procedures performed by a student while at clinical must be directly supervised by a qualified practitioner. This individual will review the procedure in relation to the student's achievement, evaluates the condition of the patient in relation to the student's knowledge, is present during the procedure, and reviews and approves the procedure. All clinical work performed by a student must be checked prior to clinical implementation. Anytime a student is having direct contact with a patient, facility personnel must be present. (JRCERT Standard 4.5)

Classroom behavior/Conduct Code:

The classroom is a “safe” environment for students. The focus will be on learning. Causing disruptions, harassment of other students, foul language, disrespect for others, or entertaining at someone else’s expense will not be tolerated.

UNC HOSPITALS MEDICAL DOSIMETRY EDUCATION PROGRAM PREGNANCY POLICY

The UNC Hospitals Medical Dosimetry faculty recognize the basic premise of providing the pregnant student with the information to make an informed decision based on her individual needs and preferences. Thus all UNC Hospitals Medical Dosimetry students are requested to read the following documents, contained in this Policy.

1. NCRP Report #116, 1993, Section 10 “Protection of the Embryo-Fetus”.
2. U.S. Nuclear Regulatory Commission Regulatory Guide 8.13, Revision 3,
December 1999, “Instruction Concerning Prenatal Radiation Exposure”.

Further information on the fetal effects of radiation may be found in Bushong’s radiographic physics book, on pages 543-548 and pages 559-565 (Bushong, S.C. (2004). Radiologic science for technologists: Physics, biology & protection, 8th ed. St. Louis, MO: Elsevier Science/Mosby, Inc.)

Finally, UNC Hospitals Medical Dosimetry faculty believe it is the responsibility of the pregnant Medical Dosimetry student to advise her Clinical Instructor and Program Director voluntarily and in writing of her pregnancy and estimated date of the baby’s birth (delivery). Formal, voluntary notification (declaration of pregnancy) is the only means by which the clinical facility and the UNC Hospitals Medical Dosimetry program can ensure that the dose to the embryo-fetus is limited during the pregnancy (no to exceed 5 mSv [500 mrem]). In the absence of the voluntary, written disclosure, a student cannot be considered pregnant.

Therefore, at the beginning of the program, each UNC Hospitals Medical Dosimetry student shall read the documents in this Appendix, have his/her questions answered to his/her satisfaction, and choose to proceed with his/her Radiologic Sciences education as indicated on the Pregnancy Policy form contained herein. If a Medical Dosimetry student becomes pregnant during a clinical semester, it is still the student’s responsibility to advise her Clinical Instructor and Program Director voluntarily and in writing (only if she

wishes to declare pregnancy) of her pregnancy and estimated date of the baby's birth (delivery), and to indicate, on the Pregnancy Policy form, her decision towards the Medical Dosimetry program.

The voluntary, written disclosure of her pregnancy and her decision towards the Medical Dosimetry program will be kept in the pregnant student's clinical file, maintained by the Program Director. Release of such information may occur only upon the written permission of the student in question.

PREGNANCY POLICY for MEDICAL DOSIMETRY

The UNC Hospitals Medical Dosimetry faculty believe it is the responsibility of the pregnant Medical Dosimetry student to advise her Clinical Instructor and Program Director voluntarily and in writing of her pregnancy and estimated date of her baby's birth (delivery). Formal, voluntary notification of pregnancy is the only means by which the clinical facility and the University's Medical Dosimetry program can ensure that the dose to the embryo-fetus is limited during the pregnancy not to exceed 5 mSv (500 mrem). In the absence of the voluntary, written disclosure, a student cannot be considered pregnant.

To comply with this embryo-fetus dose limit, the pregnant Medical Dosimetry student has been given the following documents to read:

- a. NCRP Report #116, 1993, Section 10 "Protection of the Embryo-Fetus".
- b. U.S. Nuclear Regulatory Commission Regulatory Guide 8.13, Revision 3, December 1999, "Instruction Concerning Prenatal Radiation Exposure".

WAIVER:

I fully understand the contents of these documents, have had my questions answered to my satisfaction, and I choose to proceed with my Medical Dosimetry education as indicated below.

_____ I am fully aware of the UNC Hospital Medical Dosimetry Education Program pregnancy policy and choose to continue my clinical and didactic education without modification or interruption. If I am currently pregnant or become pregnant while in the Medical Dosimetry program, I may notify my Clinical Instructor and Program Director voluntarily and in writing of my pregnancy with one of the options below if I want to declare pregnancy.

_____ I am pregnant and choose to continue my clinical and didactic education without modification or interruption. I accept full responsibility for my own actions and the health of my baby. Furthermore, I absolve, discharge, release, and hold harmless my Clinical site and its Oncology staff, and the Board of Trustees for UNC Healthcare together with its officers and employees (the Medical Dosimetry program its faculty) for any legal liability, claims, damages or complications that may occur during fetal growth, birth, and postnatal development of my baby.

_____ I am pregnant and choose to continue my clinical and didactic education with some modification of my clinical assignments. I will not participate in brachytherapy or cyber knife procedures. A grade of Incomplete "INC" will be given until I have completed all clinical education missed during my pregnancy. The completion of the "INC" may delay my sitting for the MDCB Exam.

_____ I am pregnant and choose to take a leave of absence from the clinical assignments during my pregnancy. A grade of Incomplete "INC" will be given until I have completed all clinical education missed during my pregnancy. The completion of the "INC" may delay my sitting for the MDCB Exam.

_____ I am pregnant and choose to take a leave of absence from the SIUC Medical Dosimetry program. If I notify the Program Director of my desire to return, I will be offered a position in the next class, the following year.

_____ I wish to withdraw my previous declaration of pregnancy.

I agree to comply with the above-stated policy and with my decision as indicated above.

Student Signature

Date

Program Director

Date

APPENDIX B

PRENATAL RADIATION EXPOSURE, REGULATORY GUIDE 8.13

A. INTRODUCTION The Code of Federal Regulations in 10 CFR Part 19, “Notices, Instructions and Reports to Workers: Inspection and Investigations,” in Section 19.12, “Instructions to Workers,” requires instruction in “the health protection problems associated with exposure to radiation and/or radioactive material, in precautions or procedures to minimize exposure, and in the purposes and functions of protective devices employed.” The instructions must be “commensurate with potential radiological health protection problems present in the work place.”

The Nuclear Regulatory Commission’s (NRC’s) regulations on radiation protection are specified in 10 CFR Part 20, “Standards for Protection Against Radiation”; and 10 CFR 20.1208, “Dose to an Embryo/Fetus,” requires licensees to “ensure that the dose to an embryo/fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman, does not exceed 0.5 rem (5 mSv).” Section 20.1208 also requires licensees to “make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman.” A declared pregnant woman is defined in 10 CFR 20.1003 as a woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception.

This regulatory guide is intended to provide information to pregnant women, and other personnel, to help them make decisions regarding radiation exposure during pregnancy. This Regulatory Guide 8.13 supplements Regulatory Guide 8.29, “Instruction Concerning Risks from Occupational Radiation Exposure” (Ref 1), which contains a broad discussion of the risks from exposure to ionizing radiation.

Other sections of the NRC’s regulations also specify requirements for monitoring external and internal occupational dose to a declared pregnant woman. In 10 CFR 20.1502, “Conditions Requiring Individual Monitoring of External and Internal Occupational Dose,” licensees are required to monitor the occupational dose to a declared pregnant woman, using an individual monitoring device, if it is likely that the declared pregnant woman will receive, from external sources, a deep dose equivalent in excess of 0.1 rem (1 mSv). According to Paragraph (e) of 10 CFR 20.2106, “Records of Individual Monitoring

Results,” the licensee must maintain records of dose to an embryo/fetus if monitoring was required, and the records of dose to the embryo/fetus must be kept with the records of dose to the declared pregnant woman. The declaration of pregnancy must be kept on file, but may be maintained separately from the dose records. The licensee must retain the required form or record until the Commission terminates each pertinent license requiring the record.

The information collections in this regulatory guide are covered by the requirements of 10 CFR Parts 19 or 20, which were approved by the Office of Management and Budget, approval numbers 3150-0044 and 3150-0014, respectively. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

B. DISCUSSION

As discussed in Regulatory Guide 8.29 (Ref. 1), exposure to any level of radiation is assumed to carry with it a certain amount of risk. In the absence of scientific certainty regarding the relationship between low dose exposure and health effects, and as a conservative assumption for radiation protection purposes, the scientific community generally assumes that any exposure to ionizing radiation may cause undesirable biological effects and that the likelihood of these effects increases as the dose increases. At the occupational dose limit for the whole body of 5 rem (50 mSv) per year, the risk is believed to be very low.

The magnitude of risk of childhood cancer following in utero exposure is uncertain in that both negative and positive studies have been reported. The data from these studies “are consistent with a lifetime cancer risk resulting from exposure during gestation which is two to three times that for the adult” (NCRP Report No. 116, Ref. 2). The NRC has reviewed the available scientific literature and has concluded that the 0.5 rem (5 mSv) limit specified in 10 CFR 20.1208 provides an adequate margin of protection for the embryo/fetus. This dose limit reflects the desire to limit the total lifetime risk of leukemia and other cancers associated with radiation exposure during pregnancy.

In order for a pregnant worker to take advantage of the lower exposure limit and dose monitoring provisions specified in 10 CFR Part 20, the woman must declare her pregnancy in writing to the licensee. A form letter for declaring pregnancy is provided in this guide or the licensee may use its own form letter for declaring pregnancy. A separate written declaration should be submitted for each pregnancy.

C. REGULATORY POSITION

1. Who Should Receive Instruction

Female workers who require training under 10 CFR 19.12 should be provided with the information contained in this guide. In addition to the information contained in Regulatory Guide 8.29 (Ref. 1), this information may be included as part of the training required under 10 CFR 19.12.

2. Providing Instruction

The occupational worker may be given a copy of this guide with its Appendix, an explanation of the contents of the guide, and an opportunity to ask questions and request additional information. The information in this guide and Appendix should also be provided to any worker or supervisor who may be affected by a declaration of pregnancy or who may have to take some action in response to such a declaration.

Classroom instruction may supplement the written information. If the licensee provides classroom instruction, the instructor should have some knowledge of the biological effects of radiation to be able to answer questions that may go beyond the information provided in this guide. Videotaped presentations may be used for classroom instruction. Regardless of whether the licensee provides classroom training, the licensee should give workers the opportunity to ask questions about information contained in this Regulatory Guide 8.13. The licensee may take credit for instruction that the worker has received within the past year at other licensed facilities or in other courses or training.

3. Licensee's Policy on Declared Pregnant Women

The instruction provided should describe the licensee's specific policy on declared pregnant women, including how those policies may affect a woman's work situation. In particular, the instruction should include a description of the licensee's policies, if any, that may affect the declared pregnant woman's work situation after she has filed a written declaration of pregnancy consistent with 10 CFR 20.1208.

The instruction should also identify who to contact for additional information as well as identify who should receive the written declaration of pregnancy. The recipient of the woman's declaration may be identified by name (e.g., John Smith), position (e.g., immediate supervisor, the radiation safety officer), or department (e.g., the personnel department).

4. Duration of Lower Dose Limits for the Embryo/Fetus

The lower dose limit for the embryo/fetus should remain in effect until the woman withdraws the declaration in writing or the woman is no longer pregnant. If a declaration of pregnancy is withdrawn, the dose limit for the embryo/fetus would apply only to the time for the estimated date of conception until the time the declaration is withdrawn. If the declaration is not withdrawn, the written declaration may be considered expired one year after submission.

5. Substantial Variations Above a Uniform Monthly Dose Rate

According to 10 CFR 20.1208(b), “The licensee shall make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman so as to satisfy the limit in paragraph (a) of this section,” that is, 0.5 rem (5 mSv) to the embryo/fetus. The National Council on Radiation Protection and Measurements (NCRP) recommends a monthly equivalent dose limit of 0.05 rem (0.5 mSv) to the embryo/fetus once the pregnancy is known (Ref. 2). In view of the NCRP recommendation, any monthly dose of less than 0.1 rem (1 mSv) may be considered as not a substantial variation above a uniform monthly dose rate and as such will not require licensee justification. However, a monthly dose greater than 0.1 rem (1 mSv) should be justified by the licensee.

D. IMPLEMENTATION

The purpose of this section is to provide information to licensees and applicants regarding the NRC staff’s plans for using this regulatory guide.

Unless a licensee or an applicant proposes an acceptable alternative method for complying with the specified portions of the NRC’s regulations, the methods described in this guide will be used by the NRC staff in the evaluation of instructions to workers on the radiation exposure of pregnant women.

APPENDIX C

QUESTIONS AND ANSWERS CONCERNING PRENATAL RADIATION EXPOSURE

1. Why am I receiving this information?

The NRC's regulations (in 10 CFR 19.12, "Instructions to Workers) require that licensees instruct individuals working with licensed radioactive materials in radiation protection as appropriate for the situation. The instruction below describes information that occupational workers and their supervisors should know about the radiation exposure of the embryo/fetus of pregnant women.

The regulations allow a pregnant woman to decide whether she wants to formally declare her pregnancy to take advantage of lower dose limits for the embryo/fetus. This instruction provides information to help women make an informed decision whether to declare a pregnancy.

2. If I become pregnant, am I required to declare my pregnancy?

No. The choice whether to declare your pregnancy is completely voluntary. If you choose to declare your pregnancy, you must do so in writing and a lower radiation dose limit will apply to your embryo/fetus. If you choose not to declare your pregnancy, you and your embryo/fetus will continue to be subject to the same radiation dose limits that apply to other occupational workers.

3. If I declare my pregnancy in writing, what happens?

If you choose to declare your pregnancy in writing, the licensee must take measures to limit the dose to your embryo/fetus to 0.5 rem (5 millisievert) during the entire pregnancy. This is one-tenth of the dose that an occupational worker may receive in a year. If you have already received a dose exceeding 0.5 rem (5 mSv) in the period between conception and the declaration of your pregnancy, an additional dose of 0.05 rem (0.5 mSv) is allowed during the remainder of the pregnancy. In addition, 10 CFR 20.1208, "Dose to an Embryo/Fetus," requires licensees to make efforts to avoid substantial variation above a uniform monthly dose rate so that all the 0.5 rem (5 mSv) allowed dose does not occur in a short period during the pregnancy.

This may mean that, if you declare your pregnancy, the licensee may not permit you to do some of your normal job functions if those functions would have allowed you to receive more than 0.5 rem, and you may not be able to have some emergency response responsibilities.

4. Why do the regulations have a lower dose limit for the embryo/fetus of a declared pregnant woman than for a pregnant worker who has not declared?

A lower dose limit for the embryo/fetus of a declared pregnant woman is based on a consideration of greater sensitivity to radiation of the embryo/fetus and the involuntary nature of the exposure. Several scientific advisory groups have recommended (References 1 and 2) that the dose to the embryo/fetus be limited to a fraction of the occupational dose limit.

5. What are the potentially harmful effects of radiation exposure to my embryo/fetus?

The occurrence and severity of health effects caused by ionizing radiation are dependent upon the type and total dose of radiation received, as well as the time period over which the exposure was received. See Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Exposure" (Ref. 3), for more information. The main concern is embryo/fetal susceptibility to the harmful effects of radiation such as cancer.

6. Are there any risks of genetic defects?

Although radiation injury has been induced experimentally in rodents and insects, and in the experiments was transmitted and became manifest as hereditary disorders in their offspring, radiation has not been identified as a cause of such effect in humans. Therefore, the risk of genetic effects attributable to radiation exposure is speculative. For example, no genetic effects have been documented in any of the Japanese atomic bomb survivors, their children, or their grandchildren.

7. What if I decide that I do not want any radiation exposure at all during my pregnancy?

You may ask your employer for a job that does not involve any exposure at all to occupational radiation dose, but your employer is not obligated to provide you with a job involving no radiation exposure. Even if you receive no occupational exposure at all, your embryo/fetus will receive some radiation dose (on average 75 mrem [0.75 mSv]) during your pregnancy from natural background radiation.

The NRC has reviewed the available scientific literature and concluded that the 0.5 rem (5 mSv) limit provides an adequate margin of protection for the embryo/fetus. This dose limit reflects the desire to limit the total lifetime risk of leukemia and other cancers. If this dose limit is exceeded, the total lifetime risk of cancer to the embryo/fetus may increase incrementally. However, the decision on what level of risk to accept is yours. More detailed information on potential risk to the embryo/fetus from radiation exposure can be found in References 2-10.

8. What effect will formally declaring my pregnancy have on my job status?

Only the licensee can tell you what effect a written declaration of pregnancy will have on your job status. As part of your radiation safety training, the licensee should tell you the company's policies with respect to the job status of declared pregnant women. In addition, before you declare your pregnancy, you may want to talk to your supervisor or your radiation safety officer and ask what a declaration of pregnancy would mean specifically for you and your job status.

In many cases you can continue in your present job with no change and still meet the dose limit for the embryo/fetus. For example, most commercial power reactor workers (approximately 93%) receive, in 12 months, occupational radiation doses that are less than 0.5 rem (5 mSv) (Ref. 11). The licensee may also consider the likelihood of increased radiation exposures from accidents and abnormal events before making a decision to allow you to continue in your present job.

If your current work might cause the dose to your embryo/fetus to exceed 0.5 rem (5 mSv), the licensee has various options. It is possible that the licensee can and will make a reasonable accommodation that will allow you to continue performing your current job, for example, by having another qualified employee do a small part of the job that accounts for some of your radiation exposure.

9. What information must I provide in my written declaration of pregnancy?

You should provide, in writing, your name, a declaration that you are pregnant, the estimated date of conception (only the month and year need be given), and the date that you give the letter to the licensee. A form letter that you can use is included at the end of these questions and answers. You may use that letter, use a form letter the licensee has provided to you, or write your own letter.

10. To declare my pregnancy, do I have to have documented medical proof that I am pregnant?

NRC regulations do not require that you provide medical proof of your pregnancy. However, NRC regulations do not preclude the licensee from requesting medical documentation of your pregnancy, especially if a change in your duties is necessary in order to comply with the 0.5 rem (5 mSv) dose limit.

11. Can I tell the licensee orally rather than in writing that I am pregnant?

No. The regulations require that the declaration must be in writing.

12. If I have not declared my pregnancy in writing, but the licensee suspects that I am pregnant, do the lower dose limits apply?

No. The lower dose limits for pregnant women apply only if you have declared your pregnancy in writing. The United States Supreme Court has ruled (in *United Automobile Workers International Union v. Johnson Controls, Inc.*, 1991) that “Decisions about the welfare of future children must be left to the parents who conceive, bear, support, and raise them rather than to the employers who hire those parents” (Reference 7). The Supreme Court also ruled that your employer may not restrict you from a specific job “because of concerns about the next generation.” Thus, the lower limits apply only if you choose to declare your pregnancy in writing.

13. If I am planning to become pregnant but am not yet pregnant and I inform the licensee of that in writing, do the lower dose limits apply?

No. The requirement for lower limits applies only if you declare in writing that you are already pregnant.

14. What if I have a miscarriage or find out that I am not pregnant?

If you have declared your pregnancy in writing, you should promptly inform the licensee in writing that you are no longer pregnant. However, if you have not formally declared your pregnancy in writing, you need not inform the licensee of your nonpregnant status.

15. How long is the lower dose limit in effect?

The dose to the embryo/fetus must be limited until you withdraw your declaration in writing or you inform the licensee in writing that you are no longer pregnant. If the declaration is not withdrawn, the written declaration may be considered expired one year after submission.

16. If I have declared my pregnancy in writing, can I revoke my declaration of pregnancy even if I am still pregnant?

Yes, you may. The choice is entirely yours. If you revoke your declaration of pregnancy, the lower dose limit for the embryo/fetus no longer applies.

17. What if I work under contract at a licensed facility?

The regulations state that you should formally declare your pregnancy to the licensee in writing. The licensee has the responsibility to limit the dose to the embryo/fetus.

18. Where can I get additional information?

The references to this Appendix contain helpful information, especially Reference 3, NRC's Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Radiation Exposure" for general information on radiation risks. The licensee should be able to give this document to you.

For information on legal aspects, see Reference 7, "The Rock and the Hard Place: Employer Liability to Fertile or Pregnant Employees and Their Unborn Children – What Can the Employer Do?" which is an article in the journal Radiation Protection Management.

You may telephone the NRC Headquarters at (301) 415-7000. Legal questions should be directed to the Office of the General Counsel, and technical questions should be directed to the Division of Industrial and Medical Nuclear Safety.

You may also telephone the NRC Regional Offices at the following numbers: Region I, (610) 337-5000; Region II, (404) 562-4400; Region III, (630) 829-9500; and Region IV, (817) 860-8100. Legal questions should be directed to the Regional Counsel, and technical questions should be directed to the Division of Nuclear Materials Safety.

REFERENCES FOR APPENDIX B & C REPORTS

1. National Council on Radiation Protection and Measurements, Limitation of Exposure to Ionizing Radiation, NCRP Report No. 116, Bethesda, MD, 1993.
 2. International Commission on Radiological Protection, 1990 Recommendations of the International Commission on Radiological Protection, ICRP Publication 60, Ann. ICRP 21: No. 1-3, Pergamon Press, Oxford, UK, 1991.
 3. USNRC, "Instruction Concerning Risks from Occupational Radiation Exposure," Regulatory Guide 8.29, Revision 1, February 1996.¹ (Electronically available at www.nrc.gov/NRC/RG/index.html)
 4. Committee on the Biological Effects of Ionizing Radiations, National Research Council, Health Effects of Exposure to Low Levels of Ionizing Radiation (BEIR V), National Academy Press, Washington, DC, 1990.
 5. United Nations Scientific Committee on the Effects of Atomic Radiation, Sources and Effects of Ionizing Radiation, United Nations, New York, 1993.
 6. R. Doll and R. Wakeford, "Risk of Childhood Cancer from Fetal Irradiation," *The British Journal of Radiology*, 70, 130-139, 1997.
 7. David Wiedis, Donald E. Jose, and Timm O. Phoebe, "The Rock and the Hard Place: Employer Liability to Fertile or Pregnant Employees and Their Unborn Children – What Can the Employer Do?" *Radiation Protection Management*, 11, 41-49, January/February 1994.
 8. National Council on Radiation Protection and Measurements, Considerations Regarding the Unintended Radiation Exposure of the Embryo, Fetus, or Nursing Child, NCRP Commentary No. 9, Bethesda, MD, 1994.
 9. National Council on Radiation Protection and Measurements, Risk Estimates for Radiation Protection, NCRP Report No. 115, Bethesda, MD, 1993.
 10. National Radiological Protection Board, Advice on Exposure to Ionizing Radiation During Pregnancy, National Radiological Protection Board, Chilton, Didcot, UK, 1998.
 11. M. L. Thomas and D. Hagemeyer, "Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities, 1996," Twenty-Ninth Annual Report, NUREG-0713, Vol. 18, US
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Safety Procedures

Only you can make your experience a safe one. Most accidents are caused by unsafe acts of the person involved. Because of the nature of some of the activities at the hospital, it is of vital importance that each student become well-acquainted with the hazards involved in the operations of this department to protect him/herself, his/her coworkers, and his/her patients, and to effectively safeguard hospital/university equipment and property.

It is important that you observe safe practices, keep your clinical area clean, and actively participate by suggesting improvements that will help make your clinical experience a safe one.

In the case of an accident, incident reports must be filled out and forwarded to the department Administrative Director immediately. Should the incident involve a patient, the patient is not to be sent away until seen by a physician. Appropriate care must be administered and the incident report should be signed by the involved patient. The Program Director is to be informed immediately, even if the incident appears to be of minor significance.

Incident Reports

All incidents involving patients, visitors, students, or faculty/staff must be documented via a written incident report on forms provided.

Patient/Visitor Incident

Where real or potential injury occurs, medical attention must be provided immediately. All involved persons must inform the Clinical Supervisor as soon as possible. In the event a student is involved, the Program Director should be notified. A patient incident report form is to be filled out by the student and given to the Clinical Supervisor.

Student Incident

In the event that a student is injured or suspectedly exposed to a communicable disease, the student is to notify the Program Director. The student is to obtain a release form from a physician before returning to the clinical area. A copy of this release form is to be maintained in the student's record.

Health Status

For students to maintain their own health, it is necessary for them to have adequate health insurance coverage. Students are responsible for the expenses associated with illnesses and/or injuries. Clinical sites will provide emergency care, but are not responsible for the expenses associated with that care. Each student must provide proof of health insurance at the time of matriculation.

Student Maltreatment

The UNC Hospitals Medical Dosimetry Program has a “zero tolerance” policy for maltreatment of any student. Maltreatment is defined as any of the following behaviors:

1. Public humiliation
2. Threats of physical or psychological harm
3. Requirements to perform personal service for another individual
4. Limiting opportunities, grades, or any other activities because of gender, race, religion, or sexual orientation
5. Sexual advances, remarks, or innuendos
6. Offensive racial or religious remarks or actions

In order to be sure that these activities do not occur, the following will be observed:

1. The policy will be disseminated to all current and new students/employees.
2. There will be an annual discussion of maltreatment with employees at faculty/staff meetings.
3. Any individual who experiences or observes evidence of others not following this policy is obligated to report this to the Program Director, Clinical Supervisor, attending physician, or Administrative Director. The Program Director will make an independent decision based on the situation as to whether the action is best reported to a higher level.”

Additional policies (those that follow) are covered in program orientation. Students also receive background checks, drug tests, immunizations, identification badges, and personal radiation monitors to protect their health and safety. Annually, each UNC Hospitals employee must sign a ‘UNC Way’ statement as part of his/her understanding of the above policy.

Graduation Requirements/National MDCB Certification Examination

Students who successfully complete the curriculum may be eligible to take the national certification examination offered by the Medical Dosimetrist Certification Board (MDCB), through Route 1. Successful completion of this program does not guarantee the student is eligible to take this examination, since the MDCB reviews the applications and determines eligibility for the examination.

Questions regarding eligibility should be directed to the MDCB (mdcb.org). It is the responsibility of the student to apply for the certification examination. Applications usually take 90 days to process.

Before a student enrolled in the UNC Hospitals Medical Dosimetry Program can be certified as eligible to apply for the medical dosimetry examination or receive his/her certificate, he/she must fulfill the following requirements and obligations to UNC Hospitals:

1. The student must have successfully met the academic requirements of the program as established by the grading system and academic standards of the program.
2. The student must have his/her fees and any fines accumulated paid in full before he/she can receive credit for his/her courses.
3. A student that has exceeded his/her allowable personal days (up to 40 hours), must make compensation for this extra time. This will involve clinical assignments after the scheduled date of completion. Refer to the Absences section of this document.
4. The student must have completed all projects and required work before he/she will be allowed to officially graduate.
5. The student must return all property (i.e. books, keys, identification badges, etc.) or remit financial compensation for lost property.

*The entering student will graduate twelve full months following the entrance date, provided he/she has met the full requirements.

Release of Student Records

The student must sign a consent form to release his/her student records if he/she wants faculty/staff to provide verbal or written recommendations. Faculty may need to refer to student records to make recommendations. All student records are released under the federal guidelines of the Family Educational Rights and Privacy Act (FERPA 1974). Student records are maintained in a locked file cabinet. Students wishing to review any appropriate records should make an appointment with the Program Director. Students are encouraged to do such if they have any questions regarding their progress in the program. (JRC 1.5)

UNC Hospitals Medical Dosimetry Program Curriculum

The UNC Hospitals Medical Dosimetry Program curriculum is designed to integrate classroom and clinical education throughout the professional year. The student is limited to no more than 40 contact hours per week. The courses below must be taken in sequence, beginning with the Fall semester.

Courses

MD 500 Orientation to Radiation Oncology 1 hour

This course provides the student with an overview of radiation therapy/medical dosimetry, and is taught during the initial weeks of the students matriculation into the medical dosimetry education program. The student will understand the student handbook and sign/date all policies and procedures. All medical, regulatory, and financial business will be completed. The student will be given hospital/department tours, have pictures taken, and meet different groups and individuals with the department and greater organization. Included in the orientation are all health and safety policies of UNC Hospitals, including radiation safety and protection. Tours, introductions, and general hospital and program information are disseminated during this course. Most importantly, the student will complete Lean CQI classes on good catches, A3's, kaizens and other quality improvement tools. Finally, the student will give written and oral reports on medical dosimetry professionalism (Assessment Tool, Goal 4, Objective 3). Clinical orientation is given during this initial period of time.

Prerequisite: Admission to the UNC Hospitals Medical Dosimetry Program.

MD 501 Introduction to Medical Dosimetry 1 hour

This course is an introduction to medical dosimetry techniques at the UNC Department of Radiation Oncology. Includes treatment charts, patient information flow, and basic and irregular field calculations. This course also covers the various quality assurance procedures performed in a radiation oncology department. Also included are various statistics topics to educate the student in becoming a good consumer of medical dosimetry research literature. Professional development, billing/coding, HIPAA, and professional service are also addressed.

Prerequisite: Admission to the UNC Hospitals Medical Dosimetry Program.

MD 502 Medical Dosimetry Physics 3 hours

This course teaches basic theories and calculations for radiation oncology. This course covers the following topics: radiologic physics, production of x-rays, radiation treatment and simulation machines,

interactions of ionizing radiation, radiation measurements, dose calculations, computerized treatment planning, dose calculation algorithms, electron beam characteristics, and brachytherapy physics and procedures. In addition, imaging for radiation oncology, IMRT, stereotactic radiosurgery, special procedures, particle therapy, hyperthermia, and radiation safety. This course is 15 weeks in length.

Prerequisite: Admission to the Medical Dosimetry Program. Note: the student must complete the medical and physics resident course during the fall semester. Before beginning this course, the medical dosimetry student will be given a 180 question pre-physics examination to determine their medical physics knowledge level.

MD 503 Brachytherapy Dosimetry 2 hours

This course teaches the physics of brachytherapy. Includes source characteristics, dosimetry systems, and dose calculations.

Prerequisite: A grade of “C” or better in MD 502, Medical Physics.

MD 504 Research Methodology and Design Statistics I 3 hours

This course is an introduction to basic research concepts and statistics. Development of the project begins. The course is 15 weeks in length.

Prerequisite: Admission to the UNC Hospitals Medical Dosimetry Program.

MD 505 Research Methodology and Design Statistics II 3 hours

This course is a continuation of MD 504 with projects finalized. The course is 15 weeks in length.

Prerequisite: MD 504 passed with a minimum grade of “C”.

MD 506 Clinical Education I 6 hours

This is the first course of a three course sequence. During the three course sequence, students will complete eight clinical rotations including Brachytherapy, External Beam, Physics, Special Measurements and QA. The length of these rotations varies from one to eleven weeks. While in the clinical setting students will observe and work directly with a medical dosimetrist. Emphasis is given on learning and understanding the role and responsibilities of a medical dosimetrist in the clinical setting. This course is 15 weeks in length.

Prerequisite: Admission to the Medical Dosimetry Program.

MD 507 Clinical Education II 6 hours

This is the second of a three course sequence. During the three course sequence, students will complete clinical rotations including IMRT, External Beam, Physics, Special Measurements and QA. While in the clinical setting students will observe and work directly with a medical dosimetrist. Emphasis is given on learning and understanding the role and responsibilities of a medical dosimetrist in the clinical setting. This course is 15 weeks in length.

Prerequisite: A grade of “C” or better in MD 506.

MD 508 Clinical Education III 6 hours

This is the third course of a three course sequence. During the three course sequence, students will complete including Brachytherapy, Cyber Knife, IMRT, External Beam, Physics, Special Measurements and QA. The length of these rotations varies from one to three weeks. While in the clinical setting students will observe and work directly with a medical dosimetrist. Emphasis is given on learning and understanding the role and responsibilities of a medical dosimetrist in the clinical setting. This course is 12 weeks in length.

Prerequisite: Prerequisite: A grade of “C” or better in MD 507.

MD 509 Radiation Safety and Protection 1 hour

This course is an introduction to the sources of radiation. Includes detection and measurements, source handling, surveys, maximum permissible doses, room design, and governmental regulations.

Prerequisite: Admission to the Medical Dosimetry Program.

MD 510 Anatomy for Radiation Oncology 1 hour

This course teaches human anatomy with an emphasis on sectional anatomy and topography as it applies to radiation oncology. Identification of cross-sectional anatomy at different anatomical locations within the human body is also reviewed. This course is 12.5 contact hours in length.

Prerequisite: Admission to the Medical Dosimetry Program.

MD 511 Radiation Oncology Pathology 1 hour

This course is an introduction to bodily responses to injury, including neoplasia, carcinogenesis, and staging/grading of tumors.

Prerequisite: Admission to the medical dosimetry program.

hospital, university, and state while attending such functions and should conduct him/herself accordingly.

MD 500 Orientation to Radiation Oncology
Fall 2013

Course Instructor

Robert Adams, EdD, CMD, RT(R)(T)
Program Director, Assistant Professor
UNC Department of Radiation Oncology
UNC School of Medicine

NC Cancer Hospital, Radiation Oncology Administration, B Level, Room Faculty 4
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Email: robert_adams@med.unc.edu

Course Description

This course provides the student with an overview of radiation oncology/medical dosimetry, and is taught during the initial weeks of the students matriculation into the medical dosimetry education program. The student will understand the student handbook and sign/date all policies and procedures. All medical, regulatory, and financial business will be completed. The student will be given hospital/department tours, have pictures taken, and meet different groups and individuals with the department and greater organization. Included in the orientation are all health and safety policies of UNC Hospitals, including radiation safety and protection. Tours, introductions, and general hospital and program information are disseminated during this course. The student will attend orientation lectures with the UNC medical resident and medial physicists. Most importantly, the student will complete Lean CQI classes on good catches, A3's, kaizens and other quality improvement tools. Finally, the student will give written and oral reports on medical dosimetry professionalism (Assessment Tool, Goal 4, Objective 3). Clinical orientation is given during this initial period of time.

This is the equivalent of a 1 credit course.

Required Text and Handout Materials

Handouts are designed to guide the student through the course.

Grading and Assignments

The course is graded A, B, C, D, or F. At minimum, a student must earn a grade of C to remain in the program.

Prerequisites: Admittance to the UNC Hospitals Medical Dosimetry Program.

Attendance and Special Assistance

Course attendance is strongly recommended. Absence will not be considered a valid excuse for failure to obtain the necessary information, except under the most unusual of circumstances.

Honor Code

The University of North Carolina's Honor Code is recognized and enforced in this course. The principles of academic honesty, integrity, and responsible citizenship govern the performance of all academic work and student conduct. Your acceptance of enrollment presupposes a commitment to the principles embodied in the code of student conduct.

MD 501 Introduction to Medical Dosimetry
Fall 2013

Course Instructors

Robert Adams, EdD, CMD, RT(R)(T)
Program Director, Assistant Professor
UNC Department of Radiation Oncology
UNC School of Medicine

North Carolina Cancer Hospital, Radiation Oncology Administration, B Level Room Faculty 4
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Course Description

This is a two day intensive course that reviews all content from a radiation therapy dosimetry course. At the end of the second day, the student is given a comprehensive test.

This is the equivalent of a 1 credit course.

Required Text and Handout Materials

Handouts are designed to guide the student through the course.

Prerequisites: Admittance to the UNC Hospitals Medical Dosimetry Program.

Grading and Assignments

The course is graded A, B, C, D, or F.

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by:

Test Performance	70%
Quizzes/Homework/Presentations	30%

TEXTBOOKS:

Required:

- Khan, F. M. (2009). The physics of radiation therapy (4th ed.). Baltimore: Williams & Wilkins.
- Washington, C. M., & Leaver, D. T. (2009). Principles and practices of radiation therapy (3rd Ed). St. Louis: Mosby.

MD 501, Example of Problems/Class Lecture

GOAL: This rotation will introduce the student to medical dosimetry. In addition, this rotation will provide the student with background knowledge of dosimetry theory, equipment, and special considerations in medical dosimetry.

OBJECTIVES: At the end of this rotation, the student will:

1. Define the following terms: percentage depth dose, tissue maximum ratio, tissue phantom ratio, tissue air ratio, geometric and physical penumbra, scatter air ratio, monitor unit, rad, backscatter factor, isodose curves, dose profiles.

Percentage Depth Dose: maximum dose remaining at a particular depth in a phantom or patient; percentage of the absorbed dose at any depth to the absorbed dose at a fixed reference depth.

Tissue Maximum Ratio: measured with a constant distance to the point of interest; it is defined as

$$\text{TMR} = \frac{\text{Dose at depth } d}{\text{Dose at } d_{\text{max}}}$$

Tissue Phantom Ratio: used to develop depth dose charts

Tissue Air Ratio: Ratio of dose in phantom to air; does not depend on SSD

$$\text{Defined as TAR} = \frac{\text{Dose at a given depth in phantom at SAD}}{\text{Dose without phantom at SAD}}$$

Geometric Penumbra: Exists both inside and outside the geometrical boundaries of the beam

Physical Penumbra: The lateral distance between two isodose curves at a certain depth

Scatter Air Ratio: ratio at a point in the radiation field of dose due to scatter and the dose in air at that point

Monitor Unit: The basic unit of machine output

Rad: Unit of radiation absorbed dose

Backscatter Factor: The component of dose at or near the surface of a phantom attributed to photons and secondary electrons from the medium recoiling back toward the direction of the incident photon

Isodose Curves: Lines passing through points of equal dose; demonstrates the characteristics of radiation beams

Dose Profiles: A graph of dose distribution produced by passing a dosimeter across the beam

2. Describe the major advantages and disadvantages of various dosimetry software systems.

Most of dosimetry software are developed and distributed commercially. It is typically a closed system. You are unable to add features desired by individual oncology departments. Changes can not be made by a department such as updating a system or adding features. These systems are outdated by the time they are fully implemented in the clinical area. It is very costly to add features to a commercially distributed dosimetry software. To add a special feature for a facility, it could cost anywhere from 100,000 to 250,000 dollars. This data will just be out dated in a few years and need to be updated. Having your own dosimetry software allows a facility to add and change features as needed.

3. Discuss the theory behind Clarkson calculations.

Clarkson calculation is used when a block is added to the field and the scatter dose may be affected without affecting the primary dose. With the Clarkson calculation, the scattered component of the dose can be calculated separately from the primary dose. The Clarkson theory changes an irregularly shaped field to be calculated as if it were a circle

4. Describe the mechanism of the PLUNC system.

PLUNC is a treatment planning software developed at UNC. It has separate modules for image acquisition, registration, contouring of anatomy, beam selection, placement, and shaping, dose computation, dose analysis, and dose optimization. It has fully integrated functions and allows multidirectional workflow. It allows an integration of digitally reconstructed radiographs with dose inhomogeneity computation and dose optimization. Beams may be shaped by blocks or MLC. It also allows changes with wedges, compensators, and MLC.

5. Discuss the application of CT and MRI in radiation therapy.

Technology today is able to construct a 3D image of a patient using CT and MRI scans. This 3D image is placed in the treatment planning computer and allows one to highlight the organs of interest such as the tumor or critical structures. Beam directions may be modified until an optimal treatment plan is designed with minimal irradiation to normal tissues. Blocks may be designed in the computer. A digital radiograph is produced with the actual treatment fields and set-up films. These features allow a greater degree of precision in treatment designs. Having the treatment plan designed before the simulation will help conserve and shorten time in the simulator.

CTs are only able to provide transverse axial images which may be reconstructed into three dimensions. MRI can directly scan in axial, sagittal, coronal, or oblique planes. With MRI, you are not using ionizing radiation to get the images. It also offers better contrast and imaging of soft tissue tumors.

6. Discuss the differing roles of medical physicists, medical dosimetrists, and radiation therapists.

Physicists are responsible for the calibration and quality assurance of the treatment machines. They must ensure the accuracy of the machine and the emerging beam.

Medical Dosimetrists are responsible for determining the actual treatment plan and dose for each patient. They must design an optimal treatment plan to target and, hopefully, cure the patient while minimizing the dose to normal structures. They determine the treatment angles, whether any blocks or compensators are in the beam, and the dose delivered for each field. Their role is now expanding because of the new technology of 3D planning and treatment planning systems.

Radiation therapists are responsible for the treatment of cancer patients. They have daily contact with the patients and help to monitor the side effects of the treatment on the patients. They are also responsible for accurately delivering the treatment and monitoring the patient.

7. Comprehend various methodologies for correcting tissue inhomogeneities.

There are differing methods of correcting for inhomogeneities in tissue. These include wedges, blocks, bolus, and compensators. Wedges are used mostly for sloping surfaces. Blocks are used to prevent treatment to normal tissues. Bolus is used to bring the dose closer to the surface and in the case of missing tissue in an area. Compensators are useful for irregularly shaped treatment areas. There are also tissue inhomogeneities in fields with bone or air.

8. Describe the certification board for medical dosimetry and the profession society.

The professional society for medical dosimetrists is the AAMD. The certification board consists of 165 very difficult questions. This exam is only given twice a year and is only given to those who have met the criteria as described by the MDCB Board of Directors.

9. Demonstrate beginning clinical dosimetry competence by completing the following planning sessions spine, whole brain, breast, head and neck, AP-PA lung, 4-field pelvis on the PLUNC Computer Based Learning Modules system with faculty review.

10. Discuss the various methods by which anastructs are constructed and identified.

Anastructs are placed automatically developed into the dosimetry programs. They are used to differentiate between different tissues. It is able to distinguish between soft tissue and bone or air. It is also used to distinguish different tissues of organs. Once they are distinguished, they may be shaded in with different colors to show the different organs.

11. Provide an overview of treatment planning techniques.

Treatment planning techniques begin with image acquisition through CT or MRI scans and then image registration. Different anatomy is contoured with the use of different shades and colors. Beam selection/placement/shaping may occur with blocks, MLC, IMRT, wedges, and compensators. Dose computation of both photon and electron fields based on inhomogeneities with dose optimization. Dose analysis utilizes isodose lines and surfaces, DVH, and EUD. Dose optimization uses different beams with weightings that limit dose to normal tissues and optimize dose to the tumor.

12. Demonstrate acquaintance with the medical dosimetry literature by completing one written abstract of a professional journal article dealing with an aspect of medical dosimetry.
13. Demonstrate participation in procedures by providing a record of all procedures encountered during rotation.
14. Demonstrate professional growth and competence by submitting a self-evaluation and a performance evaluation from the clinical instructor.

Attendance and Special Assistance

Course attendance is strongly recommended. Absence will not be considered a valid excuse for failure to obtain the necessary information, except under the most unusual of circumstances. Any student who feels the need for extra support for studying or test taking should notify the instructor as soon as possible.

Honor Code

The University of North Carolina's Honor Code is recognized and enforced in this course. The principles of academic honesty, integrity, and responsible citizenship govern the performance of all academic work and student conduct. Your acceptance of enrollment presupposes a commitment to the principles embodied in the code of student conduct.

MD 502 Medical Dosimetry Physics
Spring 2014

Course Instructors

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Program Director, Assistant Professor
UNC Department of Radiation Oncology
UNC School of Medicine

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Course Description

This course teaches basic theories and calculations for radiation oncology. This course covers the following topics: radiologic physics, production of x-rays, radiation treatment and simulation machines, interactions of ionizing radiation, radiation measurements, dose calculations, computerized treatment planning, dose calculation algorithms, electron beam characteristics, and brachytherapy physics and procedures. In addition, imaging for radiation oncology, IMRT, stereotactic radiosurgery, special procedures, particle therapy, hyperthermia, and radiation safety. This course is 15 weeks in length.

Prerequisite: Admission to the Medical Dosimetry Program. Note: the student must complete the medical and physics resident course during the fall semester. Before beginning this course, the medical dosimetry student will be given a 180 question pre-course physics examination to determine their medical physics knowledge level. This is a 3 hour credit course.

Required Text and Handout Materials

Khan, Faiz. The Physics of Radiation Therapy.

Grading and Assignments

The course is graded A, B, C, D, or F. Students must satisfactorily complete each assignment. Each class assignment must be completed on the day specified.

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by:

Test Performance (4 tests in class) 70%

Homework (physics questions) 30%

TEXTBOOKS:

Required:

1. Khan, F. M. (2009). The physics of radiation therapy (4th ed.). Baltimore: Williams & Wilkins.
2. Washington, C. M., & Leaver, D. T. (2009). Principles and practices of radiation therapy (3rd Ed). St. Louis: Mosby.

SPRING 2014
MD 502 UNC HOSPITALS MEDICAL DOSIMETRY PROGRAM
PHYSICS COURSE
LECTURE TOPICS

Section 1: Radiologic Physics

<u>Lecture #</u>	<u>Date</u>	<u>Topic</u>
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Atomic and Nuclear Structure

A. Atomic Structure

1. Rest Mass
2. Energy
3. Fundamental Particles
4. Atomic Structure
5. Atomic Binding Energy
6. Atomic Shell Filling Rules
7. Transitions
8. Energy Level Diagrams

9. Characteristic Radiation
 10. Auger Electrons
 11. Fluorescent Yield
- B. Nuclear Structure
1. Mass, Atomic, and Neutron Number
 2. Periodic Table of the Elements
 3. Nuclear Binding Energy
 4. Fission, Fusion
- C. Radioactive Decay
1. Modes of Decay
 2. Special Types of Nuclides
 3. Mathematics of Radioactive Decay
 4. Equilibrium
 5. Natural Radioactivity

Production of X-Rays

- A. X-Ray Tubes
1. Anode and Cathode
 2. Focal Spot Size
 3. Reflection and Transmission Targets
 4. Heel Effect
 5. X-ray Emission Spectrum
 6. Factors That Affect the X-ray Emission Spectrum
 7. X-ray Circuits
- B. Physics of X-Ray Production
1. Bremsstrahlung

2. Characteristic X-Rays
 3. X-Ray Energy Spectra
 4. Operating Characteristics
- C. Simulators
1. Conventional Simulators
 2. CT-Simulators

Radiation Treatment & Simulation Machines

- A. Kilovoltage Units
- B. Linear Accelerators
1. Major Subsections
 2. Accelerator Section
 3. Microwave Power (Magnetrons, Klystrons)
 4. Bending Magnet Types
 5. Monitor Chamber
 6. Photon Beam Production
 - (a) Target
 - (b) Flattening Filter
 - (c) Collimation (including Multileaf Collimators)
 - (d) Beam Profiles ("Horns")
 7. Computer Control System
 8. Electron Beam Production
 - (a) Scattering Foil Systems
 - (b) Scanning Electromagnet Systems
 - (c) Collimation
- C. New Machines

1. ViewRay
2. Vero

Interactions of Ionizing Radiation

- A. Types of Electromagnetic Radiation
- B. Properties of Photons, Relationship of Energy & Wavelength
 1. Direct and Indirect Ionizing Particles
- C. Photon Interaction Process, Kerma
 1. Attenuation and Absorption Coefficients
 - a) Attenuation Coefficients
 - b) Transfer Coefficients
 - c) Absorption Coefficients
- D. Relationship of Kerma and Absorbed Dose
- E. Attenuation in the Body
- F. Modes of Interaction
 1. Coherent Scattering
 2. Photoelectric Absorption
 3. Compton Scattering
 4. Pair Production
 5. Triplet Production
 6. Photodisintegration
 7. Energy Dependence of Interaction Probabilities
 8. Attenuation in the Human Body
- G. Interaction of Particle Radiation
 1. Heavy Charged Particles
 2. Interactions of Electrons
 3. Interactions of Neutrons

Radiation Measurements

- A. Photon and Energy Flux Density and Fluence
- B. The Roentgen
- C. Electronic Equilibrium
- D. Ionization Chambers
 - 1. Free-air Chambers
 - 2. Thimble Chambers
 - 3. Condenser Chambers
 - a) Stem Effect
 - 4. Farmer Chambers
 - 5. Parallel-Plate Chambers
 - 6. Extrapolation Chambers
 - 7. Diode Detectors
 - 8. Electrometers
 - a) Integrate Mode
 - b) Rate Mode
- E. Exposure Calibration of X-Ray or Gamma-Ray Beams
 - 1. Selection of Calibration Variables
 - 2. Selection of Chamber
 - 3. Positioning of Chamber
 - 4. Corrections to Readings

External Beam Dosimetry Concepts

- A. Dosimetric Variables
 - 1. Inverse Square Law

2. Backscatter factor
3. Peak Scatter Factor
4. Electron Buildup
5. Percent Depth Dose
 - a) Mayneord F-factor
 - b) TAR Correction to F-factor
6. Equivalent Squares
7. Tissue-air Ratio
8. Scatter-air Ratio
9. Tissue-phantom Ratio
10. Tissue-maximum Ratio

System of Dose Calculations

- A. Monitor Unit Calculations
 - Output Factor
 - Field Size Correction Factors
 3. Collimator Scatter Factor and Phantom Scatter Factor
 4. Beam Modifier Factors
 5. Patient Attenuation Factors
- B. Calculations in Practice
 1. SSD Technique
 - a) SSD Treatment same as SSD of Calibration
 - b) SSD Treatment Different from SSD of Calibration
 - c) SSD Treatment and SAD Calibration
 2. SAD Technique
 - a) SAD Treatment and SAD Calibration
 - b) SAD Treatment and SSD Calibration
 - c) SAD Rotational Treatment

- C. Beam Weighting
- D. Arc rotation therapy
- E. Irregular Fields

Computerized Treatment Planning

- A. Isodose curves (beam characteristics)
- B. Skin Dose
- C. Parallel Opposed Beam Combination
- D. Wedge Isodose Curves
 - Wedge Angle and Hinge Angle
 - Wedge Factor
- E. Wedge Techniques
 1. Wedge Pair
 2. Open and Wedged Field Combination
 3. Skin Compensation
- Beam Combination (3-,4-,6- field techniques)
- Dose-Volume Specification
 - ICRU 50
 1. GTV, CTV, PTV
 2. Organs at Risk
 3. Dose Specification
 - ICRU 62
 1. ITV
 2. Planning Risk Volume
 3. Conformity Index

Electron Beam

- A. Depth-dose/Isodose characteristics
 1. AAPM TG-25

B. Treatment Planning with Electrons

- Rules of Thumb

- Selection of energy, field size

3. Electron Skin Dose

4. Electron Bolus

5. Electron Field Shaping

C. Field Matching

1. Electron-electron Gapping

2. Electron-photon Gapping

D. Electron Backscatter

E. Inhomogeneities and Electrons

Dose Calculation Algorithms

A. Basic Dose Algorithms

Generation of Isodoses

Irregular Fields

B. Corrections for Inhomogeneities

- a) Simple 1-D and 2-D Methods

- Convolutions Methods

- Monte Carlo Methods

- Dose Perturbations at Interfaces

3D CRT Including ICRU Concepts and Beam Related Biology

A. 3DCRT concepts volumetric (3DCRT) vs. non-volumetric

1. Technology and methods for planning (volume-based planning)

2. Building patient models (image reconstruction and segmentation)

3. Virtual simulation

4. Implications of treatment variabilities

Systematic and random setup variability, patient breathing

Contouring variability

B. Volumetric Beam Placement

1. DRR Generation
2. BEV, DVH
3. Non-coplanar beams
4. Planning Tools

Biological implications of uniform vs. non-uniform dose delivery

Non-biological and biological dose-volume metrics (DVHs, TCPs, NTCPs)

Margins (PTVs, PRVs)

C. Treatment Planning Methods

Beam Selection

4D Imaging and Planning

Dose Reporting

Volumetric vs. Point Prescriptions

Adjoining Fields & Special Dosimetry Problems

- A. Two-Field Problem
- B. Three-Field Problem
- C. Craniospinal Gapping
- D. Peripheral Dose
- E. Pacemaker
- F. Gonadal Dose
- G. Pregnant Patient

H. Surface Dose

Imaging for Radiation Oncology: MRI -

Physical principles

T1, T2, TE, TR imaging characteristics

Advantages & limitations of MRI images for diagnosis and computerized treatment planning

Imaging: Nuc. Med, US, EPID

A. Ultrasound

Physical principles

Utility in diagnosis and patient positioning

PET Imaging

B. PET Physical principles

Utility for Radiation Therapy

SPECT

C. Electronic Portal Imaging

Overview of electronic portal imaging devices

Types of portal imaging devices

Clinical applications of EPID technology in daily practice

Imaging: Radiographic, CT, 4D

A. Diagnostic Imaging

Physical principles

Port Film Imaging

Film based

XV-2 film, EDR-2 film characteristics

B. CT

Physical principles: Serial, Helical

Hounsfield Units, CT numbers, inhomogeneity corrections based on CT scan images

Imaging: Fusion, Image Registration

A. Image Fusion

Advantages

Challenges

Techniques

Limitations

B. Deformable body/structure image fusion

C. Quality assurance

Image transfer process, accuracy, fidelity

Image fusion process

IMRT

A. IMRT Delivery Systems

1. Segmental MLC (SMLC) and Dynamic MLC (DMLC)

2. Serial Tomotherapy (MIMiC)

3. Helical Tomotherapy

4. Robotic Linac

B. Simulation, Dose prescription & inverse planning

1. Organ motion and IMRT (prostate, parotid, lung, patient weight loss during treatment, etc.)

2. Treatment calculations
 3. “Forward planned” IMRT
 4. Compare/contrast various treatment planning software available
 5. How to distinguish a good IMRT plan versus a poor IMRT plan
- C. IMRT Quality assurance
1. Systematic QA
 2. Patient specific QA
 3. Record/verify
- D. ViewRay
1. Basic magnetic field and MRI concept review
 2. Overview of MRI-guided delivery systems
 3. Treatment planning
- Quality assurance for an MRI-guided delivery system
 - ViewRay-specific operations issues (NRC overview, MRI safety, etc)

Informatics

- A. DICOM
- B. PACS
- C. Network Integration and Integrity
- D. Storage and Archival
- E. IS Maintenance

Stereotactic Radiosurgery

- A. SRS Delivery Systems
 1. Linac based
 2. Gamma Knife

- 3. Robotic Linac
- B. Simulation and immobilization/repositioning
- C. Dose prescription & treatment planning
- D. Treatment calculations
- E. SRS quality assurance

Particle Therapy

- A. Protons
 - Proton Beam Energy Deposition
 - Equipment for Proton Beam Therapy
 - Clinical Beam Dosimetry
 - Clinical Proton Beam Therapy
 - Treatment Planning
 - Treatment Delivery
 - Clinical Applications
 - Clinical Beam Dosimetry
- B. Other Particles
 - Carbon
 - Neutrons
- C. Biology
 - LET
 - RBE

Special Procedures

- A. TBI

1. Patient Set-up
 2. Dosimetry
 3. Selection of energy, field size, distance
 4. MU calculations
- B. ESRT
- C. TSET
- D. Electron Arc

University of North Carolina Hospitals
MD 502
Medical Physics Course Questions (30% of grade in this course)
Spring 2014

Note: All answers must be typed

Note: 5% reduction in grade for each 24 hour period from the due date

Note: All due dates times are 4 pm of the assigned date.

Atomic and Nuclear Physics

Kahn Chapters 1 & 2
Due January 24, 2014

1. How do atomic and nuclear energy levels differ?
2. Are atomic energy levels defined absolutely or in terms of probability? Explain your answer
3. What is the Z number represent?
4. What does A represent?
5. What does X represent?
6. What is the relationship between the number of neutrons and protons in stable nuclei?
7. What is the relationship between wavelength and frequency?
8. Are x-rays electromagnetic radiation?
9. What type of model is used to understand electromagnetic radiation?
10. What energy equation is used in terms of wavelength/frequency?
11. Give definitions of the following terms
 1. Activity

2. half life
12. Define the two terms and construct a model demonstrating transient and secular equilibrium.
13. When would radioactive equilibrium be achieved?
14. Describe positron emission and annihilation.
15. Is electron capture an alternative process to process to positron decay or negatron decay?
16. Define the process, internal conversion.
17. What is isomeric transition?
18. Distinguish between x and gamma rays.
19. Explain the difference between indirectly and directly ionizing radiation.
20. Define whether x rays and electrons are indirectly ionizing radiation are directly ionizing radiation or both.
21. Define the following terms:
 1. Exposure-
 2. absorbed dose
 3. Roentgen
 4. cGy
 5. Becquerel
 6. Isotope
 7. Isomer
 8. Isobar
 9. Isomers
 10. Atomic Mass Unit
 11. Avagadro's Law
 12. Mass Defect
 13. Binding Energy of the Nucleus
22. What is the formula that is the principle of equivalence of mass and energy?
23. What force does the strong nuclear force overcome that keeps the nucleus together?
24. What are the three series of radioactive elements?

Section II

Types of Radiation

Due February 7 2014

1. What is ionizing radiation?
2. What is the lowest kinetic energy to call a type of radiation ionizing?
3. List the x-ray energies for the following radiation therapy terms:
 1. grenz
 2. contact
 3. superficial
 4. orthovoltage
 5. megavoltage
4. What is the energy of a photon with the wavelength .001 nm?
5. What is the approximate range of alpha particles in tissue?

6. What is the energy range of protons in radiotherapy?
7. What is the approximate range in water of 150 MeV proton? 300 MeV deuteron? 100 MeV negative pion?
8. Is the Bragg peak for a pion sharper or broader than for a proton?

Section III

Radiation Machines

Due February 25, 2014

1. Which emits electrons, the cathode or the anode?
2. Are both the cathode and anode sealed in the glass tube and at high vacuum?
3. Which material is commonly used for the target?
4. Why is the target placed at an angle?
5. Why does the target rotate?
6. Name three designs for cooling of the target?
7. Are most modern x-ray systems self rectified or fullwave rectified? Why?
8. What is the approximate efficiency of bremsstrahlung production in a 100 KVP system? What happens to the rest of the energy?
9. Does an x-ray tube produce monoenergetic photons or spectrum of energies?
10. Why are diagnostic x-ray systems filtered?
11. The medical linear accelerator uses high power _____ waves to accelerate _____ particles to high energies.
12. Most accelerators today use the _____ wave design.
13. The thyatron is essentially a very high-power switch, and is used in the _____ to produce short pulses of high voltage, which are delivered to the _____ (or _____) and to the electron gun simultaneously.
14. Is the magnetron or klystron more commonly used in high energy LinAcs? Why?
15. Why is a flattening filter necessary for X-Ray mode and scattering foils for electron mode?
16. What type of beam is most commonly produced in the cyclotron for radiotherapy?
17. Why is Co60 used as the only isotope teletherapy machine (think of the physical characteristics – T_{1/2}, gamma, energy, specific activity)?

Section IV

Interaction of Radiation With Matter

Due March 7, 2014

1. What is ionization and how is it different from excitation?
2. How do photons ionize atoms?
3. If the Half-Value Layer of a photon beam is 5 centimeters in water, what is it?
4. Is each successive half value layer equal to the preceding half value layer from a Cs137 source?
5. Briefly describe the photoelectric effect. How does the intensity of the photoelectric process vary with E? with Z?
6. Describe briefly the Compton effect. Does the photon stop and transfer all its energy? How does the Compton effect vary with Z? With electron density? With E?

7. Write the formula for the energy of the Compton-scattered proton. What is the energy of a 5 MeV photon after scattering through an angle of 30 degree? After an angle of 90 degrees?
8. Briefly describe the pair production process. What is the threshold energy for this process? What are pair production events at this energy almost never seen in clinical applications? How does pair production vary with Z ?
9. What is KERMA? How does it differ from absorbed dose? Which value is higher near the surface for a megavoltage beam?
10. What is the traditional unit of exposure? Is it formally defined for a 25 MV photon beam?
11. Graphically compare the measurement conditions for PDD, TAR, and TPR?
12. Where is field size defined for each measurement? Which parameter shows an inverse-square effect?
13. Why would we be concerned about underdosing at the edge of a tumor which protrudes into the lung, if treating with an 18 MV beam.
14. Do electrons interact with matter by processes similar to photons? Explain your answer.
15. When comparing the variation in effective beam energy with depth for a photon and electron beam, which beam becomes harder and why?
16. What is the approximate rate of energy change of megavoltage electrons in water?
17. Which beam would deliver a higher surface dose, 18 MeV or 7 MeV?
18. Why do we use applicators to collimate the electron beams almost all the way to the patient surface, but not for photons?
19. What would be the potential disadvantage of a lead sheet on the skin when treating a lesion close to a critical structure?
20. Assume you were planning an electron beam treatment to a left chest wall scar, and the beam geometry was such that the exit path would transverse bone (chest wall) then lung, then heart. If the determination of chest wall depth showed large variations and you would prefer to use 16 MeV rather than 9 MeV to ensure full coverage with the 90% isodose line, which physical effects of electron beam interactions should you reconsider? Name at least two.

Section V

Measurement of Megavoltage Radiation Rotation

Answers Due: April 3, 2014

1. Why must ionization chamber walls be “air equivalent”?
2. What are the outer dimensions of the Farmer chamber’s collecting volume?
3. If we wanted to check depth-dose on isodose distributions, but did not have a scanning water tank system, which solid-state dosimetry method would be most convenient?
4. If we used film for dosimetric measurements, which resolution would be worse, spatial resolution or dose resolution?
5. List five types of dosimetric data which we would need to measure in order to provide complete and accurate 2-D dose calculations for all types of photon and electron fields?
6. How is the wedge angle defined? Is it the physical wedge’s angle?

Section VI

Mathematical Modeling of Measured Doses

Answers Due: April 17, 2014

1. Would you need to perform a scatter integration for an asymmetric field with no blocks? Explain
2. What is head scatter and why does its value increase with field size?
3. What is Tissue Reference Ratio (TRR), which physical processes are included in this factor, does the TRR have units, how does it differ from TMR and TPR?
4. Does a national standard exist for the calculation of meter sets?
5. Why does the beam profile change with depth? Do all centers account for this in their meter set calculations?
6. Is the wedge factor a single, constant value for each wedge? Explain
7. What would be some of the practical problems with treatment planning CT scans in the radiology CT scanner?
8. Describe the differences between 2-D, 2.5D, and 3-D treatment planning?
9. The AAPM TG 40 report defines the accuracy goal in radiation oncology to 5% overall. From the following four steps, state the uncertainty in percentage:
 1. Localization
 2. Simulation
 3. Dosimetry
 4. Oncologists
 5. Treatment
10. How much uncertainty is allowed in patient data measurements?
11. Define the following terms:
 1. Gross tumor volume
 2. Clinical tumor volume
 3. Planning tumor volume
 4. Treatment volume

Section VII

Alpha and Omega

Due April 29, 2014

1. Describe the variation of d_{max} with field size.
2. How does the depth dose change with increasing TSD?
3. What would be an advantage and a disadvantage of treating a mantle technique with 18 MV?
4. If a patient had a separation of 30 cm., would 18 MV or 6 MV be a better treatment and why?
5. If a target volume is centered in the body and treated AP-PA, and the tumor volume extends to 1 centimeter from the field edges, would the entire target volume receive 100% of the treatment dose? Why?
6. When two fields are at 90 degree angles relative to each other, would the resulting dose distribution be uniform in the intersecting volume? Using the antiquated hinge angle formula, what would your calculated wedges be used?

External Electron Beams

1. How does surface dose vary with electron beam energies?
2. How does electron depth dose change with increasing TSD?
3. What would be a good rule of thumb for lateral distance from the light field edge to the 90% isodose line?

4. Based on #3 above, what would be the smallest advisable light field dimension for assuring a reliable daily dose to a measurable light field dimensions for assuring a reliable daily dose to a measurable area?
5. Can the photon field matching formulas be applied to electron beams?
What are the depths: 90%, 80%, and 0% electron beams?

Brachytherapy

1. Calculate the exposure rate produced by a 15 mg radium source at a distance of 30 cm.
2. Draw how an anisotropic distribution would look emanating from a radium source.
3. Calculate the activity of Co60 needed to produce the same exposure as 20 mg radium.
4. A radium treatment consists of 1200 mg-hours. If the same treatment is given using 30 Mci of Cs137, how long will the implant last?
5. If 1200 mg-hrs is needed to complete the implant in number four, how much gold would be required (a permanent implant)?
6. A radon source is left on a counter for several months. Calculate the total exposure to a point in the next room in the initial rate was 12 mr/hr.

Attendance and Special Assistance

Course attendance is strongly recommended. Absence will not be considered a valid excuse for failure to obtain the necessary information, except under the most unusual of circumstances. Any student who feels the need for extra support for studying or test taking should notify the instructor as soon as possible.

Honor Code

The University of North Carolina's Honor Code is recognized and enforced in this course. The principles of academic honesty, integrity, and responsible citizenship govern the performance of all academic work and student conduct. Your acceptance of enrollment presupposes a commitment to the principles embodied in the code of student conduct.

MD 503 Brachytherapy Dosimetry

Summer 2014

Course Instructors

Robert Adams, EdD, CMD, RT(R)(T)
Program Director, Assistant Professor
UNC Department of Radiation Oncology
UNC School of Medicine

NC Cancer Hospital, Radiation Oncology Administration, B Level Room Faculty 4
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Course Description

This course will provide the student with an introduction to the sources of radiation, their detection, measurement, and shielding, room design, biological effects, source handling, and personnel monitoring, maximum permissible doses, and regulations.

This is the equivalent of a 1 credit course.

Required Text and Handout Materials

Textbooks

- Perez, C.A., Brady, L.W., Principles and Practices of Radiation Oncology, Chapter 15 and chapter on HDR by Ezzell
- Khan, F. M., The Physics of Radiation Therapy
- Bentel, G., Treatment Planning and Dose Calculation in Radiation Oncology
- Brachytherapy Physics, ed. Williamson, Thomadsen and Nath. Medical Physics Press
- Principles and Practice of Brachytherapy, ed. by Subir Nag Futura Press

Reports

- “Comprehensive QA for Radiation Oncology: Report of the American Association of Physicists in Medicine, Task Group No. 40.” Med Phys 21(4): 581-618, 1994
- “Dosimetry of Interstitial Brachytherapy Sources: Report of the American Association of Physicists in Medicine, Task Group No. 43.” Med Phys 22(2): 209-234, 1995
** Look for summary by Meiggonni
- “Code of Practice for Brachytherapy Physics: Report of the American Association of Physicists in Medicine, Task Group No. 56.” Med Phys 24(10): 1557-1598, 1997
- “High Dose-Rate Brachytherapy Treatment Delivery: Report of the American Association of Physicists in Medicine, Task Group No. 59.” Med Phys 25(4): 375-403, 1998
- “Permanent Prostate Seed Implant Brachytherapy: Report of the American Association of Physicists in Medicine Task Group No. 64.” Med Phys. 26(10): 2054-2076, 1999

- Code of Federal Regulations, chapter 10, parts 20 & 35
- Williamson, J.F., Coursey, B.M., DeWerd, L.A., Hanson, W.F., Nath, R. and Ibbott, G. “Guidance to Users of Nycomed Amersham and North American Scientific, Inc. I-125 Interstitial Sources: Dosimetry and Calibration Changes: Recommendations of the American Association of Physicists in Medicine Radiation Therapy Committee Ad Hoc Subcommittee on Low-Energy Seed Dosimetry,” Med. Phys. 26:570-573, 1999
- Williamson, J.F., Coursey, B.M., DeWerd, L.A., Hanson, W.F., Nath, R., Rivard, M.J., and Ibbott, G., “Recommendations of the American Association of Physicists in Medicine on ^{103}Pd Interstitial Source Calibration and Dosimetry: implications for dose specification and prescription,” Med. Phys. 27(4):634-642, 2000.
- Williamson, J.F., Coursey, B.M., DeWerd, L.A., Hanson, W.F., Nath, R., Rivard, M., Ibbott, G., "On the use of Apparent Activity A_{app} for Treatment Planning of ^{125}I and ^{103}Pd Interstitial Brachytherapy Sources: Recommendations of the American Association of Physicists in Medicine Radiation Therapy Committee Subcommittee on Low-Energy Brachytherapy Source Dosimetry." Med. Phys. 26: 2529-2530, 1999.
- Williamson, J.F., Coursey, B.M., DeWerd, L.A., Hanson, W.F., and Nath, R., “Dosimetric Prerequisites for routine clinical use of new low energy photon interstitial brachytherapy sources,” Med. Phys. 25: 2269-2270, 1998.

Journal Articles

Applicable articles from the following journals and those assigned by staff:

- Medical Dosimetry
- Medical Physics
- International Journal of Radiation Oncology Biology and Physics
- Radiotherapy and Oncology

Online Websites

- medicaldosimetry.org
- aapm.org/pubs/reports
- radiotherapy.com

Articles

- Mutic, S., “Residents Physics Orientation Course”, 2000.
- Mutic, S., handouts on Radiopharmaceuticals
- Applicable problem sets and questions
- Li, Z., Annual Operator Refresher Training for HDR brachytherapy
- Williamson, J.F., “Quality Assurance of Brachytherapy Treatment Delivery and Planning Devices”, RSNA Categorical Course in Brachytherapy Physics 1997, pp 111-130

- Handouts from related conferences

Personal Contacts and Responsibilities at UNC Hospitals Radiation Oncology

- Brachytherapy Staff
 - Implant procedures, documentation, QA
- Physics Staff.
 - Overall QA procedure, regulatory issues
 - QA, Treatment planning, HDR commissioning
 - Treatment planning software operation, commissioning and QA
 - Source room preparation, isotope check-in, and QA sources
- Facility Radiation Safety Officer
 - Radiation safety
- Dosimetry Staff
 - Source localization, computer treatment planning, documentation – GYN and Prostate implants

Prerequisite: A grade of “C” or better in MD 502, Medical Physics.

Grading and Assignments

The course is graded A, B, C, D, or F. Students must satisfactorily complete each assignment. Each class assignment must be completed on the day specified.

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by:

Test Performance (1 test in class)	80%
Course Assignments	20%

Course Sequence

Brachytherapy Principles

- A. Handling of Sealed Radioactive Sources
- B. Dose Distributions for Sealed Implant Source
- C. Radium and Radium Substitutes
 - 1. Radium Source Specification
 - 2. Radium Source Types
 - 3. Exposure Rate Constant
 - 4. Exposure Rate Calculations
 - 5. Disadvantages of Radium
 - 6. Replacement Sources for Radium
- D. Sealed Source Production and Decay Mechanisms
- E. Other Sealed Sources in Therapy
- F. Unsealed Source Production and Decay Mechanisms

- 1. Converting Between mgRaEq and mCi
- 2.
- 3. Remote Afterloading Units
 - 1. Low Dose Rate (LDR)
 - 2. High Dose Rate (HDR)
 - 3. Calibration

Brachytherapy Dosimetry

- A. Point Source Calculations

- B. Linear Source Calculations
 - 1. Sievert Integral
 - 2. Approximations
 - 3. Along and away tables
- C. TG-43 Formalism

HDR Procedures

- A. Afterloader principles
- B. Source and transfer system design
- C. Treatment sites
- D. Treatment planning
- E. Quality assurance

Brachytherapy Intracavitary

- A. Linear Source Implant Calculations
 - 1. Along and Away Tables
- B. Intracavitary Applications
 - 1. Cylinders
 - a) Surface Dose and Cylinder Size
 - 2. Tandem and Ovoid
 - a) Classical Intracavitary Dosage Systems
 - (1) Prescription Points
 - (2) Dosage Systems
- C. ICRU Report 38 Dose Reporting
 - 1. Source Information
 - 2. Applicator Information
 - 3. Source Strength
 - 4. Reference Volume
 - 5. Reference Point Doses

6. Time-Dose Patterns

Interstitial Implants

A. Paterson-Parker System

1. Planar Implant
2. Volume Implant

B. Quimby System

1. Planar Implant
2. Volume Implant

C. Paris System

Prostate Breast, Eye Brachytherapy Implants

A. I-125, Pd-103 for Prostate

B. HDR for Prostate

C. HDR for Breast

D. Eye Applicators, Plaques COMS protocol Sr-90 applicators

Radiopharmaceutical

A. Methods of production and Clinical treatments

- Reactor-produced isotopes
- Cyclotron-based production
- Isotope decay characteristics
- Radiochemistry basics

Clinical treatments using internally administered radioisotopes

- Iodine treatment for thyroid
- Radioimmunotherapy
- Microspheres
- Emerging treatments

B. Internal dosimetry and Safety

- Dosimetry systems
- Compartmental models

MIRD method

Dose estimates for embryo/fetus and breast-feeding infant

Radiation safety

- Equipment

Survey meters, NaI probes, well counters, radionuclide calibrators

Instrument quality controls and checks

- Safety procedures

Radiation protection

Internal protection

Decontamination

Written directive/medical event

Package receipt

Area surveys

- Regulations

Attendance and Special Assistance

Course attendance is strongly recommended. Absence will not be considered a valid excuse for failure to obtain the necessary information, except under the most unusual of circumstances. Any student who feels the need for extra support for studying or test taking should notify the instructor as soon as possible.

Honor Code

The University of North Carolina's Honor Code is recognized and enforced in this course. The principles of academic honesty, integrity, and responsible citizenship govern the performance of all academic work and student conduct. Your acceptance of enrollment presupposes a commitment to the principles embodied in the code of student conduct.

MD 504 Research Methodology and Design Statistics I
Fall 2013

Course Instructor

Robert Adams, EdD, CMD, RT(R)(T)
Program Director, Assistant Professor
UNC Department of Radiation Oncology
UNC School of Medicine

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Course Description

This course will provide the student with an overview of research methodology, descriptive and inferential statistics, and the completion of a written research project.

This is the equivalent of a 3 credit course. The course is 15 weeks in length.

Required Text and Handout Materials

Handouts are designed to guide the student through the course.

This course is an introduction to basic research concepts and statistics. Development of the project begins.

Prerequisite: Admission to the UNC Hospitals Medical Dosimetry Program.

Grading and Assignments

The course is graded A, B, C, D, or F. Students must satisfactorily complete each assignment. Each class assignment must be completed on the day specified. Letter grade ranges are at the bottom of the Grading Rubric.

UNC HOSPITALS MEDICAL DOSIMETRY PROGRAM: RUBRIC FOR GRADING RESEARCH PAPERS

Name		Course		Assignment		Date Rec'd	Due Date				
Item		Criterion Evaluated				Possible Points					
						Poor	Fair	Average	Good	Excellent/ N/A	
1	Introduction Section	1. Research included introductory paragraph	2. Intro included reason for writing paper (Background of problem)	3. Intro motivated reader to read the paper	4. Intro had an effective thesis	5. Intro clearly identified areas to be discussed later in the work	5	7	9	10	11

2	Body	<ol style="list-style-type: none"> 1. Writing was clear and concise 2. Discussion was understandable 3. Discussion was accurate 4. Discussion was logical 5. Discussion sufficiently summarized each theory 6. Discussion was written in 3rd person 	5	7	9	10	11
3	Conclusion	<ol style="list-style-type: none"> 1. A conclusion was written 2. Conclusion summarized the findings 3. Conclusion written in 3rd person 	5	7	9	10	11
4	Reference Section	<ol style="list-style-type: none"> 1. Appropriate references were used 2. A least 10 references were cited 3. All references were cited in paper 4. All citations in paper had corresponding reference listed 5. Reference page in APA format 	5	7	9	10	11
5	Style (According to AMA)	<ol style="list-style-type: none"> 1. Paper and references double spaced 2. Paper written in correct font and font size 3. Sections of paper properly headed 4. Citations in text in AMA format 5. Quotes were formatted and cited properly 	5	7	9	10	11
6	Grammar Vocabulary Spelling Punctuation	<ol style="list-style-type: none"> 1. Vocabulary appropriate to academic/ publication level 2. Correct grammar used 3. Punctuated correctly 4. Spell check used 	5	7	9	10	11

7	General Construction	<ol style="list-style-type: none"> 1. Sentence structure is correct, clear, concise and varied 2. Paragraphs have a topic sentence 3. Paragraphs have a transition sentences 4. Unified, coherent paragraph structure 5. Organized with an introduction, discussion, and conclusion/summary 6. Discussion was not one continuous quote 	5	7	9	10	11
8	Research Effort	Each reference directly supports some aspect the discussion, conclusion, and summary	5	7	9	10	11
9	Development Effort	<ol style="list-style-type: none"> 1. Discussion developed with clear, concrete, and relevant support 2. Research met the objective of the assignment 3. Work demonstrates presence of critical thought and analysis 4. Research produced a meaningful discussion and conclusion 5. All work was turned in on time 	5	7	9	10	11
Sub-Total Points							
Total Points (Total Point Letter Grade Conversion: A>89; B>79; C>69; D>59; F<60							

Guidelines for Research Papers

Introduction: Requirements and Options

This document addresses the particular conditions under which the medical dosimetry student is to meet the requirements of the knowledge, skills, and abilities associated with the research paper.

Rationale

The purposes of the research paper are:

1. to gain an in-depth understanding of a medical dosimetry-related issue or problem;
2. to gain a critical appreciation for available relevant literature;
3. to develop and implement the skills necessary to:
 - a. formulate a researchable problem;
 - b. locate, summarize, and cite pertinent literature;
 - c. prepare a research protocol, including the selection of a methodology for the collection, analysis, and reporting of the information;
 - d. to determine, locate, and assess the appropriateness of data necessary and available to answer the question/resolve the problem, and
 - e. analyze, interpret, and present the data;
4. to have the opportunity to integrate the knowledge and skills required through course materials, by applying didactic and clinical knowledge to a subject of particular interest to the student, and in a manner to prepare the student for similar professional tasks after graduation;
5. to strengthen communication skills, and
6. to develop and enhance professional self-confidence.

Character of the Paper

The research paper is a serious piece of research, analysis, and writing, whose purpose is to foster an understanding and application of the scientific method as a basis for studying problems in medical dosimetry. Moreover, it serves to demonstrate the student's ability to organize a study logically and systematically, as well as to present it in accurate and coherent writing.

Building on the student's work, the research paper begins with a question in the mind of the student (researcher), and continues with the following:

- a. the expression of the question in the form of a problem, stated in clear, unambiguous terms, and buttressed by a review of the literature that is pertinent to the problem;
- b. an hypothesis, or educated conjecture, that will give direction to the student's thinking while examining the question;
- c. a plan, or design, for exploring the problem and its appropriate sub-problems;
- d. the collection of data/generation of information, and
- e. an analysis of the data/information, organized into meaningful aggregates and appropriate interpreted.

This paradigm of the research process has been further simplified into five questions that the paper is to explain and answer in the main sections indicated:

What is the question/problem?	Problem Statement
What is/was known about it?	Literature Review
How will/did we find out more?	Research Design
What did we find?	Data Presentation and Analysis
What do the findings mean?	Conclusions and Implications

These elements of the research paper are to be reflected in the student's paper.

Types of Papers

Four types of papers are described in the following paragraphs.

Hypothesis Testing

This type of research involves the study of causal relationships: why things are as they are (or how they might be different than they are). Studies may be directed to the effects (or feasibilities or utilities) of programs, emerging technologies, or interventional strategies such as patient education. Almost invariably, this type of research requires the use of substantial amounts of quantitative data, which may be primary (collected by the student) or secondary (use of existing data). Any of a broad variety of research designs – experimental, quasi-experimental, and non-experimental – may be used.

Bibliography-based Descriptive Studies

This type of research is in the tradition of the scholarly treatise, drawing upon documentary material (published or unpublished). The contribution of this type of research to the field of medical dosimetry is the development of fresh synthesis of ideas and information, which can serve to further understand

issues and conditions, as well as provide a basis for the generation of hypotheses for further research. It is expected that, because the paper is mainly a literature review, the source information consulted and used will be extensive and exhaustive.

Organizational Problem Analysis

This type of research, usually cited in one or more specific organizations, is directed to the exploration/solution of a problem or method, resources, or intervention. As with other types, the problem orientation and the point of departure for solution as based on a search of the relevant literature. A wide variety of research designs may be drawn upon, also including the case study. Almost invariably, these studies depend strongly on the collection of primary data/information to identifying the outcomes of the solution.

Data-based Descriptive Studies

This type of research is aimed at describing a situation and finding out what the state of affairs is, with or without some explanatory elements. Its utility is mainly in gaining knowledge and understanding of problems, needs, and constraints (attitudinal and objective). It may be directed toward problematic aspects of medical dosimetry practice and the environment. Conduct of such studies usually involves the collection of survey data, with analysis at varying levels of statistical sophistication. Like the preceding types, these studies require extensive review of the literature to gain insights into the structure of problems, so as to identify the variables on which data are to be collected.

Advisement

All papers are developed under the advisement of a qualified member of the UNC Department of Radiation Oncology faculty/staff.

The paper must be judged acceptable to fulfill the program's requirements by both the faculty advisor and the second reader.

Selecting the Paper Topic

Each student, in consultation with and with the approval of the faculty/staff advisor, decides upon the topic of the paper to be completed. The student should selected a topic in which his or her interest is sufficient to maintain a high level of motivation and satisfaction throughout the research endeavor. Conducting the research and preparing the paper often requires more work and takes more time than the student anticipates, and so the topic should be one of personal or professional importance.

Specifications of the Paper

The paper should, in general, include the elements below. However, in papers of the bibliography-based descriptive studies type, the elements with an asterisk may require substitutions.

Title page

Abstract

Table of contents

Introduction, including a statement of the problem studied and the significance of the topic for medical dosimetry

Literature review, including substantive summaries of the major subjects and a statement that defines the point from which the original investigation begins

Research design and methodology

Presentation of all data/information

Analysis and interpretation of data and statement of findings

Conclusions regarding the significance of the findings for the problem, for further studies, and for the field of medical dosimetry

References/bibliography

Appropriate appendices

Format

Approximate length of the paper will range from 8-20 pages. Appropriate length of the paper is judged by the nature of the topic and the need to give adequate attention to all specified elements of the paper rather than to any pre-established standard.

All papers should be prepared with the standards of journal publication in mind. If judged appropriate by the faculty/staff advisor, the paper may be submitted in the form of an article-length manuscript.

The form and style of the paper may follow that of the American Medical Association.

The paper should be typed on 8 ½'' x 11'' white paper, double spaced.

Expenses

All expenses related to the research paper are the responsibility of the student

Publications Resulting from the Papers

In many cases the faculty/staff advisor and the second reader – and perhaps others – may play a significant role in guiding the student through the development of the paper.

Publications resulting from the paper may, therefore, raise questions with regard to publication credit.

Responsibilities in the Paper Process

The student is responsible for the following:

1. selecting the type and topic of the paper with the concurrence of the advisor, and
2. conducting the research and writing the paper.

Course Attendance and Special Assistance

Course attendance is strongly recommended. Absence will not be considered a valid excuse for failure to obtain the necessary information, except under the most unusual of circumstances. Any student who feels the need for extra support for studying or test taking should notify the instructor as soon as possible.

Honor Code

The University of North Carolina's Honor Code is recognized and enforced in this course. The principles of academic honesty, integrity, and responsible citizenship govern the performance of all academic work and student conduct. Your acceptance of enrollment presupposes a commitment to the principles embodied in the code of student conduct.

MD 505 Research Methodology and Design Statistics II
Spring 2014

Course Instructors

Robert Adams, EdD, CMD, RT(R)(T)
Program Director, Assistant Professor
UNC Department of Radiation Oncology
UNC School of Medicine

NC Cancer Hospital, Radiation Oncology Administration, B Level Room Faculty 4
Phone: (919) 445-5210
Email: robert_adams@med.unc.edu

Course Description

This course is a continuation of MD 504 with projects finalized. The course is 15 weeks in length.

Prerequisite: MD 504 passed with a minimum grade of “C”.

This is the equivalent of a 3 credit hour course.

Required Text and Handout Materials

Handouts are designed to guide the student through the course.

Grading and Assignments

The grading for this course is different from other courses. Course grades are subject to quality and must be submitted by the required deadlines. These deadlines will be discussed during the first week of class. Primary classroom activities will be independent research, writing, and individual and collective meetings. It is the student’s responsibility to manage his/her time wisely, as the course is predominantly independent study. The student is required to meet a minimum of three times for one-on-one instructor evaluation. It is the student’s responsibility to schedule these dates and times.

Note: See grading rubric in MD 504

Attendance and Special Assistance

Course attendance is strongly recommended. Absence will not be considered a valid excuse for failure to obtain the necessary information, except under the most unusual of circumstances. Any student who

feels the need for extra support for studying or test taking should notify the instructor as soon as possible.

Honor Code

The University of North Carolina's Honor Code is recognized and enforced in this course. The principles of academic honesty, integrity, and responsible citizenship govern the performance of all academic work and student conduct. Your acceptance of enrollment presupposes a commitment to the principles embodied in the code of student conduct.

 MD 506 Clinical Education
 Fall 2013

Course Instructors
 UNC Certified Medical Dosimetrists

Course Schedule

Mondays, Wednesdays, and Fridays, 9:30 a.m. – 4:30 p.m.

Course Schedule

Mondays, Wednesdays, and Fridays, 8:00 a.m. – 4:30 p.m.

Fall 2013

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 – 9:30	Clinic	Morning Conference & Sim Review	Sim Review	Morning Conference & Sim Review	Morning Conference & Sim Review
9:30 – 12:00		Class	Clinic	Clinic	Clinic
12:00 – 1:00	Lunch	Lunch	Lunch	Lunch	Lunch & Chart Rounds
1:00 – 2:30	Clinic	Class	Clinic	Class	Clinic
2:30 – 4:30					

Course Description

This is the first course of a three course sequence. During the three course sequence, students will complete eight clinical rotations including Brachytherapy, External Beam, Physics, Special Measurements and QA. The length of these rotations varies from one to eleven weeks. While in the clinical setting students will observe and work directly with a medical dosimetrist. Emphasis is given on learning and understanding the role and responsibilities of a medical dosimetrist in the clinical setting. This course is 15 weeks in length.

Prerequisite: Admission to the Medical Dosimetry Program.

This is the equivalent of a 6 credit course.

Course Objectives

The course is designed to do the following:

1. Introduce the student to basic clinical operations
2. Teach the student basic (2D) medical dosimetry procedures in laboratory sessions
3. Introduce the student to various quality assurance procedures
4. Introduce the student to the performance of various clinical procedures, simulations linked with treatment planning
5. Allow the student to perform under direct supervision less complex set-ups with treatment planning
6. Demonstrate an understanding of the basic clinical concepts of medical dosimetry.
7. Demonstrate an understanding of theory and principles of operation of treatment planning computers.
8. Demonstrate an understanding of the different types of radiation production.
9. Understand and calculate radiation attenuation and decay.
10. Demonstrate an understanding of the different types of radiation detectors.
11. Demonstrate a basic understanding of treatment planning.
12. Demonstrate an understanding of the role of a medical dosimetrist.

Required Text and Handout Materials

Handouts are designed to guide the student through the course.

Clinical Time Sheet

Clinical time must be recorded on a clinical time sheet.

Assessment

Clinical competencies 50%

Clinical evaluations	35%
Weekly Journal	10%
Self evaluations	5%

Grades:

90-100	A
89-89	B
70-79	C

Competencies

The student must complete 5 competencies by the end of the semester. Competencies are graded pass/fail. To complete a clinical competency is considered to be a numerical grade of 100.

Attendance and Special Assistance

Course attendance is strongly recommended. Absence will not be considered a valid excuse for failure to obtain the necessary information, except under the most unusual of circumstances. Any student who feels the need for extra support for studying or test taking should notify the instructor as soon as possible.

Honor Code

The University of North Carolina's Honor Code is recognized and enforced in this course. The principles of academic honesty, integrity, and responsible citizenship govern the performance of all academic work and student conduct. Your acceptance of enrollment presupposes a commitment to the principles embodied in the code of student conduct.

Note: On clinical rotations the UNC Hospitals Medical Dosimetry student can only work under the direct supervision of a UNC medical dosimetrist or medical physicist. All medical dosimetry calculations and treatment plans must be approved by either a UNC medical dosimetrist or medical physicist prior to implementation on the treatment machine.

CLINICAL TIME SHEET

NAME: _____

CLINICAL ROTATION: _____

*Time sheet is to be kept current at all times and turned in at end of semester. Turn in a separate sheet at the end of each clinical rotation. You cannot be at UNC more than 40 hours per week.

*Indicate: Number of hours present when present Number of hours absent when absent H = Holiday V = Vacation Day I = Interview Day

*Failure to comply with the hours assigned by your clinical site will affect your clinical internship grade.

UNC Hospitals

Medical Dosimetry Program

Clinical Rotation

Goals and Assessment (1st, 2nd, 3rd semesters)

Clinical Rotation

Students will learn clinical practices through direct clinical experiences, reviewing related journal articles, attending related conferences, and keeping a journal of experiences and questions. Student, clinical instructors, program advisory board, program director, and clinical preceptor will provide ongoing assessment throughout the program.

Goals of each rotation

Brachytherapy

Student will be capable of preparation, treatment, and follow-up of the brachytherapy patient. Student will act in the role of the brachytherapy technologist, medical dosimetrist, and medical physicist as related to brachytherapy cases

Dose Calculations/Chart Review

Student will perform dose calculations and review therapy charts for consistency among dose prescription, isodose, calculation sheet, and daily treatment record.

External Beam Treatment Planning

Student will evaluate patient's case, consider physician's prescription, delineate normal structures from CT images, utilize virtual simulation software, optimize a plan for treatment, discuss plan with Dosimetrist, Physician, Physicist, and Radiation Therapist, document patient's set-up and plan, use patient measurements and set-up parameters to calculate fields for treatment, enter set-up and dose into the treatment verification computer system.

Cyberknife

Student will observe/perform quality assurance procedures for cyberknife treatments, work with the Medical Physicist, Radiation Oncologist and Neurosurgeon in generating a treatment plan, and observe the planning and treatment of gamma knife patients.

IMRT

Using IMRT capable planning systems, the student will plan a variety of IMRT cases, including organ delineation, verifying reference point, reviewing target volume definition and dose prescription with radiation oncologist, verifying plan with medical physicist, performing treatment machine QA with physicist, and documenting plan for treatment. Student will assist Radiation Therapists in the treatment of a few patients.

Plan and QA all for all treatment units

The student will participate in treatment planning and QA for all treatment and simulator machines that are available.

Quality Assurance

Student will perform and document daily, weekly, monthly and annual quality assurance procedures on linear accelerators to include mechanical checks, output checks, calibration measurements, laser checks. Student will perform and document quality assurance procedures on gamma knife, simulators, CT scanner.

Objectives

Student uses objectives as a guide during his/her clinical practicum.

Competencies

Student will complete practicum-related competencies as described by the objectives, throughout his/her clinical rotation. Students should inform his/her clinical instructor when they are ready to complete a specific competency.

Written Journal

The student will write experiences, thoughts, and questions related to his/her current clinical practicum through a question each week. The program director will review the journal weekly and comment back. The journal is based upon a different question each week from the program director to the student. The one page response is due each Monday at 8 am. (note: see end of handbook for a list of weekly questions)

MD 507 Clinical Education II
Spring 2014

Course Instructors

UNC Certified Medical Dosimetrists

Course Description

This is the second of a three course sequence. During the three course sequence, students will complete clinical rotations including IMRT, External Beam, Physics, Special Measurements and QA. While in the clinical setting students will observe and work directly with a medical dosimetrist. Emphasis is given on learning and understanding the role and responsibilities of a medical dosimetrist in the clinical setting. This course is 15 weeks in length.

Prerequisite: A grade of “C” or better in MD 506.

This is the equivalent of a 6 credit course.

Course Schedule

Mondays, Wednesday, and Friday, 8:00 a.m. – 4:30 p.m.

Spring 2014

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 – 9:30	Clinic	Morning Conference & Sim Review	Sim Review	Morning Conference & Sim Review	Morning Conference & Sim Review
9:30 – 12:00		Class	Clinic	Class	Clinic
12:00 – 1:00	Lunch	Lunch	Lunch	Lunch	Lunch & Chart Rounds
1:00 – 2:30	Clinic	Class	Clinic	Class	Clinic
2:30 – 4:30					

Course Objectives

The course is designed to do the following:

1. Introduce the student to basic clinical operations
2. Teach the student basic (2D and 3D) medical dosimetry procedures in laboratory sessions
3. Introduce the student to various quality assurance procedures
4. Introduce the student to the performance of various clinical procedures, simulations linked with treatment planning
5. Allow the student to perform under direct supervision more complex set-ups with treatment planning
6. Demonstrate an understanding of the basic clinical concepts of medical dosimetry.
7. Demonstrate an understanding of theory and principles of operation of treatment planning computers.
8. Demonstrate an understanding of the different types of radiation production.
9. Understand and calculate radiation attenuation and decay.
10. Demonstrate an understanding of the different types of radiation detectors.

11. Demonstrate a basic understanding of treatment planning.
12. Demonstrate an understanding of the role of a medical dosimetrist.

Required Text and Handout Materials

Handouts are designed to guide the student through the course.

Assessment

Clinical competencies 45%

Clinical evaluations 40%

At the end of each student rotation, the clinical instructor will complete a form evaluating the student's attitude, dependability, initiative, response to supervision, patient interactions, interpersonal skill, professional motivation, clinical applications, use of inactive clinical time and reactions to stressful situations.

Weekly Journal Reports 10%

Self evaluations 5%

Grades:

90-100	A
89-89	B
70-79	C

Competencies

The student must complete 15 competencies by the end of the second (spring) semester. Competencies are graded pass/fail. To complete a clinical competency is considered to be a numerical grade of 100.

Semester Clinical Competencies/Observation Requirements

During the time period from January 6, 2014 until May 1, 2014 (spring semester) in order to be granted permission to proceed to summer session the student must complete 15 competencies. The student is allowed four times to begin again or quit the competency without a grade being recorded.

During the time period from January 6, 2014 until May 1, 2014 (spring semester), the student must be part of 8 CT simulation procedures. These have to be documented in the student's log book

During the time period from January 6, 2014 until May 1, 2014 (spring semester), the student must observe two patient consults with a UNC medical resident. These have to be documented in the student's log book

During the time period from January 6, 2014 until May 1, 2014 (spring semester), the student must observe two brachytherapy procedures. These have to be documented in the student's log book

During the time period from January 6, 2014 until May 1, 2014 (spring semester), the student must run PLUNC one time during chart rounds.

During the time period from January 6, 2014 until May 1, 2014 (spring semester), the student must write up 5 case presentations from morning conference. This should be one page in length of the patient's description, treatment, and any special dosimetry problems.

During the time period from January 6, 2014 until May 1, 2014 (spring semester), the student must attend one Wednesday morning Quality Assurance/Lean meeting: 9:45 am – 11 am upstairs library. This must be recorded with the program director.

Attendance and Special Assistance

Course attendance is strongly recommended. Absence will not be considered a valid excuse for failure to obtain the necessary information, except under the most unusual of circumstances. Any student who feels the need for extra support for studying or test taking should notify the instructor as soon as possible.

Honor Code

The University of North Carolina's Honor Code is recognized and enforced in this course. The principles of academic honesty, integrity, and responsible citizenship govern the performance of all academic work and student conduct. Your acceptance of enrollment presupposes a commitment to the principles embodied in the code of student conduct.

Note: On clinical rotations the UNC Hospitals Medical Dosimetry student can only work under the direct supervision of a UNC medical dosimetrist or medical physicist. All medical dosimetry calculations and treatment plans must be approved by either a UNC medical dosimetrist or medical physicist prior to implementation on the treatment machine.

MD 508 Clinical Education III
Summer 2014

Course Instructors
UNC Medical Dosimetrists

Course Description

This is the third course of a three course sequence. During the three course sequence, students will complete including Brachytherapy, Cyber Knife, IMRT, External Beam, Physics, Special Measurements and QA. The length of these rotations varies from one to three weeks. While in the clinical setting students will observe and work directly with a medical dosimetrist. Emphasis is given on learning and understanding the role and responsibilities of a medical dosimetrist in the clinical setting. This course is 12 weeks in length.

Prerequisite: A grade of “C” or better in MD 507.

This is the equivalent of a 6 credit course.

Course Schedule

Mondays, Tuesday Wednesday, and Thursday 8:00 a.m. – 4:30 p.m.

Summer 2014

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 – 9:30	Clinic	Morning Conference & Sim Review	Sim Review	Morning Conference & Sim Review	Morning Conference & Sim Review
9:30 – 12:00		Clinic	Clinic	Clinic	Class
12:00 – 1:00	Lunch	Lunch	Lunch	Lunch	Lunch & Chart Rounds
1:00 – 4:30	Clinic	Clinic	Class	Clinic	Clinic

Course Objectives

The course is designed to do the following:

1. Introduce the student to advanced clinical operations
2. Teach the student advanced medical dosimetry procedures
3. Introduce the student to various quality assurance procedures

4. Introduce the student to the performance of various clinical procedures, simulations linked with treatment planning; CyberKnife, TomoTherapy, and brachytherapy
5. Allow the student to perform under direct supervision more complex set-ups with treatment planning
6. Demonstrate an understanding of the basic clinical concepts of medical dosimetry.
7. Demonstrate an understanding of theory and principles of operation of treatment planning computers.
8. Demonstrate an understanding of the different types of radiation production.
9. Understand and calculate radiation attenuation and decay.
10. Demonstrate an understanding of the different types of radiation detectors.
11. Demonstrate a basic understanding of treatment planning.
12. Demonstrate an understanding of the role of a medical dosimetrist.

Required Text and Handout Materials

Handouts are designed to guide the student through the course.

Assessment

Clinical competencies 45%

Clinical evaluations 50%

At the end of each student rotation, the clinical instructor will complete a form evaluating the student's attitude, dependability, initiative, response to supervision, patient interactions, interpersonal skill, professional motivation, clinical applications, use of inactive clinical time and reactions to stressful situations.

Self evaluations 5%

Grades:

90-100	A
89-89	B
70-79	C

Time Sheet

All clinical time has to be recorded on a clinical time sheet.

Competencies

In order to graduate, the student must have completed all required clinical competencies by August 1, 2014. The student is allowed four times to begin again or quit the competency without a grade being recorded.

Attendance and Special Assistance

Course attendance is strongly recommended. Absence will not be considered a valid excuse for failure to obtain the necessary information, except under the most unusual of circumstances. Any student who feels the need for extra support for studying or test taking should notify the instructor as soon as possible.

Honor Code

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Note: On clinical rotations the UNC Hospitals medical dosimetry student can only work under the direct supervision of a UNC medical dosimetrist or medical physicist. All medical dosimetry calculations and treatment plans must be approved by either a UNC medical dosimetrist or medical physicist prior to implementation on the treatment machine.

MD 509 Radiation Safety and Protection
Fall 2013

Course Instructors

Robert Adams, EdD, CMD, RT(R)(T)
Program Director, Assistant Professor
UNC Department of Radiation Oncology
UNC School of Medicine

NC Cancer Hospital, Radiation Oncology Administration, B Level Room Faculty 4

Phone: (919) 445-5210

Email: robert_adams@med.unc.edu

Course Description

This course is an introduction to the sources of radiation. Includes detection and measurements, source handling, surveys, maximum permissible doses, room design, and governmental regulations.

Prerequisite: Admission to the Medical Dosimetry Program.

This is the equivalent of a 1 credit course.

Required Text and Handout Materials

Kahn, The Physics of Radiotherapy

Course Objectives

The course is designed to do the following:

1. Describe various radiation safety and protection issues
2. Describe and solve various radiation safety and protection quantitative problems
3. Understand the basic governance structure of radiation safety and protection in the United States and internationally

Grading and Assignments

The course is graded A, B, C, D, or F. Students must satisfactorily complete each assignment. Each class assignment must be completed on the day specified.

Grading and Assignments

The course is graded A, B, C, D, or F. Students must satisfactorily complete each assignment. Each class assignment must be completed on the day specified.

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by:

Test Performance (1 test in class)	70%
Homework (questions)	30%

Course Sequence

Radiation Safety

- A. Concepts and Units
 1. Radiation Protection Standards
 2. Quality Factors
 3. Definitions for Radiation Protection
 4. Dose Equivalent
 - a) Units of Dose Equivalent
 5. Effective Dose Equivalent
- B. Types of Radiation Exposure
 1. Natural Background Radiation
 2. Man-Made Radiation
 3. NCRP #91 Recommendations on Exposure Limits

C. Protection Regulations

1. NRC Definitions
 - a) Recordable Event
 - b) Misadministration
2. NRC Administrative Requirements
 - a) Radiation Safety Program
 - b) Radiation Safety Officer
 - c) Radiation Safety Committee
 - d) Quality Management Program
3. NRC Regulatory Requirements

Radiation Shielding

A. Treatment Room Design

1. Controlled/Uncontrolled Areas
2. Types of Barriers
3. Factors in Shielding Calculations
 - a) Workload (W)
 - b) Use factor (U)
 - c) Occupancy factor (T)
 - d) Distance

B. Shielding Calculations

1. Primary Radiation Barrier
2. Scatter Radiation Barrier

3. Leakage Radiation Barrier
 4. Neutron Shielding for High Energy Photon and Electron Beams
- C. Sealed Source Storage
- D. Protection Equipment and Surveys
1. Operating Principles of Gas-filled Detectors
 2. Operating Characteristics
 3. Radiation Monitoring Equipment
 - a) Ionization chamber (Cutie Pie)
 - b) Geiger-Mueller Counters
 - c) Neutron Detectors
 4. Personnel Monitoring

Treatment Planning Evaluation and QA

- A. Plan Quality
1. ICRU Definitions (Max Dose)
 2. PTU Coverage
 3. OAR Evaluation
- B. Deliverability
1. Complexity
 2. Uncertainties
 3. Volatility
- C. TP – Quality Assurance
1. TG-53
 2. Review of Images & Targets

3. Review of Beam Data
4. VanDyk Recommendations
5. Data Transfer
6. TP Disasters

External Beam Quality Assurance

A. Overview of Quality Assurance in Radiation Therapy

Goals

Staffing

Roles, training, duties & responsibilities of individuals

Equipment Selection and Specifications

B. Linac and Imaging QA

Acceptance Testing – Linac

Commissioning – Linac

Data Required

Computer Commissioning

Routine Quality Assurance and Test Tolerance

Daily QA

Monthly QA

Yearly QA

C. Quality Assurance of Imaging Apparatus

Portal imagers

Linac mounted real-time fluoroscopy units

KVCT (cone beam) quality assurance testing

MVCT quality assurance (TomoTherapy)

D. Dosimetric Patient QA

1. Dosimetry based

Diodes

TLDs

MOFSET

Calibration of Dose Output

- A. Units of Radiation Dose, Dose Equivalent and RBE-Dose

- B. Calculation of Dose from Exposure

1. Converting Exposure to Absorbed Dose in Air

2. f-factor

3. Dose in Free Space

- C. Measurement of Absorbed Dose with an Ionization Chamber

1. Stopping Powers

- a) Unrestricted Stopping Power

- b) Collisional Stopping Power (S_c)

- c) Radiative Stopping Power (S_r)

- d) Restricted Stopping Power

2. Bragg-Gray Cavity Theory

3. Spencer-Attix Cavity Theory

- D. AAPM Calibration Protocols

1. TG-51 Protocol (Photons and Electrons)

2. TG-61 Protocol (Superficial x-rays)

Other Measurement Systems

- A. Film

1. Radiographic

2. Radiochromic

- B. TLD
 - 1. Phosphorescence
 - 2. Thermoluminescence
- C. Scintillation
- D. Calorimetry
- E. Gel/Chemical Dosimetry
- F. Diode Detectors

Attendance and Special Assistance

Course attendance is strongly recommended. Absence will not be considered a valid excuse for failure to obtain the necessary information, except under the most unusual of circumstances. Any student who feels the need for extra support for studying or test taking should notify the instructor as soon as possible.

Honor Code

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MD 510 Anatomy for Radiation Oncology
Fall 2013

Course Instructors

Robert Adams, EdD, CMD, RT(R)(T)
Program Director, Assistant Professor
UNC Department of Radiation Oncology
UNC School of Medicine

NC Cancer Hospital, Radiation Oncology Administration, B Level Room Faculty 4
Phone: (919) 445-5210
Email: robert_adams@med.unc.edu

Lecture Schedule

Fridays (August 30 – October 18), 3:00 p.m.

Course Description

This course teaches human anatomy with an emphasis on sectional anatomy and topography as it applies to radiation oncology. Identification of cross-sectional anatomy at different anatomical locations within the human body is also reviewed.

Prerequisite: Admission to the Medical Dosimetry Program.

This is the equivalent of a 1 hour credit course.

Required Text and Handout Materials

Textbook: Sectional Anatomy Review by M.E. Madden (Lippincott Williams & Wilkins, Philadelphia, 2001).

Grading and Assignments

The course is graded A, B, C, D, or F. Students must satisfactorily complete each assignment. Each class assignment must be completed on the day specified.

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by:

Test Performance (6 tests in class) 100%

Attendance and Special Assistance

Course attendance is strongly recommended. Absence will not be considered a valid excuse for failure to obtain the necessary information, except under the most unusual of circumstances. Any student who feels the need for extra support for studying or test taking should notify the instructor as soon as possible.

Honor Code

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MD 511 Radiation Oncology Pathology
Fall 2013

Course Instructor

Robert Adams, EdD, CMD, RT(R)(T)
Program Director, Assistant Professor
UNC Department of Radiation Oncology
UNC School of Medicine

NC Cancer Hospital, Radiation Oncology Administration, B Level Room Faculty 4

Phone: (919) 445-5210

Email: robert_adams@med.unc.edu

Course Description

This course is an introduction to bodily responses to injury, including neoplasia, carcinogenesis, and staging/grading of tumors.

This is the equivalent of a 1 credit course.

Required Text and Handout Materials

Handouts are designed to guide the student through the course.

Grading and Assignments

The course is graded A, B, C, D, or F. Students must satisfactorily complete each assignment. Each class assignment must be completed on the day specified.

Grading and Assignments

The course is graded A, B, C, D, or F. Students must satisfactorily complete each assignment. Each class assignment must be completed on the day specified.

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by:

Test Performance (1 test in class) 100%

Attendance and Special Assistance

Course attendance is strongly recommended. Absence will not be considered a valid excuse for failure to obtain the necessary information, except under the most unusual of circumstances. Any student who feels the need for extra support for studying or test taking should notify the instructor as soon as possible.

Honor Code

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MD 512 Special Topics in Radiation Oncology
Summer 2014

Course Instructor

Robert Adams, EdD, CMD, RT(R)(T)
Program Director, Assistant Professor
UNC Department of Radiation Oncology
UNC School of Medicine

NC Cancer Hospital, Radiation Oncology Administration, B Level Room Faculty 4
Phone: (919) 445-5210
Email: robert_adams@med.unc.edu

Course Description

This course consists of various seminars/literature reviews associated with radiation oncology. Topics include treatment techniques for various cancers, technological advances in cancer treatment, cancer

treatment trends, and the role of a medical dosimetrist. This course also covers the various quality assurance procedures performed in a radiation oncology department. Also included are various statistics topics to educate the student in becoming a good consumer of medical dosimetry research literature. Professional development, billing/coding, HIPAA, and professional service are also addressed. Students will have oral and written presentations (Goal 4, objective 3). This course is 6 weeks in length.

Prerequisite: A grade of a “C” in MD 502, Medical Physics.

Grading and Assignments

The course is graded A, B, C, D, or F. Students must satisfactorily complete each assignment. Each class assignment must be completed on the day specified.

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by:

Test Performance (6 tests in class)	100%
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Required Text and Handout Materials

Handouts are designed to guide the student through the course.

Attendance and Special Assistance

Course attendance is strongly recommended. Absence will not be considered a valid excuse for failure to obtain the necessary information, except under the most unusual of circumstances. Any student who feels the need for extra support for studying or test taking should notify the instructor as soon as possible.

Honor Code

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academic work and student conduct. Your acceptance of enrollment presupposes a commitment to the principles embodied in the code of student conduct.

MD 513 The Radiobiology of Radiotherapy
Spring 2014

This course covers the theories and concepts related to the molecular, cellular, tissue and organism-level effects of exposure to ionizing radiation, and how these relate to the practice of radiation therapy.

Course Credit: approximately 38 contact hours
(roughly equivalent to a 3 credit undergraduate level course)

Instructor: Elaine M. Zeman, Ph.D.
Research Associate Professor
Department of Radiation Oncology
UNC School of Medicine

Phone: 919-843-7590

E-mail: zeman@med.unc.edu
madam_curie@mac.com

Office: Room B127, Physicians Office Building
Hours Available: after class on Tuesdays, or Monday-Thursday afternoons with some advanced notice

Course Schedule:

One session per week: Tuesdays, 1:00 ~ 2:15 pm
Radiation Oncology Manning Level Classroom

Textbooks:

Dr. Zeman's class handout materials will be available digitally, and can be obtained from a cloud-based Dropbox. Dr. Zeman will e-mail participants direct links to download the handouts as they are made available.

These lecture materials are considered the intellectual property of the course instructor and should not be shared with ANYONE outside of class.

Recommended for Supplemental Reading:

Principles and Practice of Radiation Therapy, Third Edition by C.M. Washington and D. Leaver (Mosby, St. Louis, 2009). Sections on radiation biology and radiation protection.

Radiologic Science for Technologists: Physics, Biology and Protection, Seventh Edition by S.C. Bushong (Mosby, St. Louis, 2008). Sections on radiation protection (multiple chapters).

Radiobiology for the Radiologist, Seventh Edition by E.J. Hall and A.J. Giaccia (Lippincott, Williams & Wilkins, Philadelphia, 2011). Higher-level radiobiology textbook.

An Introduction to Radiobiology, Second Edition by A.H.W. Nias (John Wiley & Sons, Ltd., New York, 1998). Lower-level radiobiology textbook; somewhat outdated.

Primer of Medical Radiobiology, Second Edition by E.L. Travis (Year Book Medical Publishers, Inc., Chicago, 1989). Lower-level radiobiology textbook, but *way* outdated.

Exams and Grading:

Three quizzes and a final exam will be given during the course at approximately monthly intervals, with each quiz intended to test knowledge of the material presented since the previous quiz. The final exam will also largely emphasize the most recent material presented, however will also include a few questions related to earlier parts of the course. The final exam is also “weighted” to count as the equivalent of two quizzes, and accordingly, will be a longer test.

The lowest quiz score will be dropped when calculating the final grade. (And since the final counts as two quizzes, if the final exam score is the lowest, only one score will be dropped.)

Exam questions will consist of multiple-choice, true-false, “fill in the blank” and “short answer/brief definition” formats. In addition, two or three problem solving, graph interpretation, and/or essay-type questions will be included on each exam.

The grading scale will be as follows:

97 and up	A+
93 – 97	A
90 – 93	A-

87 – 90	B+
83 – 87	B
80 – 83	B-
77 – 80	C+
73 – 77	C
70 – 73	C-
67 – 70	D
Below 67	F

Please note that this course will NOT be graded “on a curve”. In other words, if a student with a 75 average just so happens to have the highest grade in the class, that by no means implies that said student will receive an “A” for the course!

Attendance and Special Assistance:

Course attendance is strongly recommended. Absence will not be considered a valid excuse for failure to obtain the necessary information, except under the most unusual of circumstances. Any student who feels the need for extra support for studying or test taking should notify the instructor as soon as possible.

Honor Code:

The University of North Carolina’s Honor Code is recognized and enforced in this course. The principles of academic honesty, integrity and responsible citizenship govern the performance of all academic work and student conduct at the University. Your acceptance of enrollment presupposes a commitment to the principles embodied in the Code of Student Conduct.

If you have any questions about your responsibility, or the responsibility of your faculty instructors under the Honor Code, please contact the office of the Student Attorney General (966-4084), or the Office of the Dean of Students (966-4041).

Course Outline and Objectives:

Introduction; Radiation Chemistry; Free Radical Reactions

1. What is radiobiology?
2. *Cell biology review.*
3. The interaction of ionizing radiation with biological materials.
 - a) sources of “background” radiation
 - b) high versus low LET radiations
 - c) the radiolysis of water
 - d) free radical chemistry
 - e) cellular targets for radiation damage
 - f) direct and indirect effects of radiation
 - g) radiation damage to DNA
 - h) the radiochemistry of the oxygen effect

The "Take Home" Messages:

1. Define what radiobiology is, and how it applies to the practice of radiation oncology.
2. Know the average amount of background radiation everybody (in the US) is exposed to annually, and what the contribution is from natural versus man-made sources.
3. Describe how free radicals are formed and identify some reactions of the free radicals derived from water radiolysis.
4. Describe the effect of LET on radiation interactions at the chemical level.
5. Understand the difference between the direct and indirect effects of ionizing radiation in biological systems.
6. Know the types of DNA damage caused by ionizing radiation and how these might be related to chromosomal damage.

Cellular Response to Radiation

1. Consequences of DNA damage.
 - a) enzymatic repair of damage vs. tolerance of damage

- b) human diseases related to DNA repair deficiencies
 - c) chromosome aberrations
2. Fate of irradiated cells.
 - a) reproductive or mitotic death
 - b) interphase death or apoptosis
 - c) division delay
 - d) mutation
 - e) neoplastic transformation and carcinogenesis
 3. Cell survival curves.
 - a) what is *really* meant by "cell death"?
 - b) survival curve models and parameters
 - c) partial response vs. complete response vs. tumor cure
 4. Tissue dose response curves.
 - a) are cell survival curves representative of what is going on in tissues?
 - b) dose response relationships for normal tissues
 - c) dose response relationships for tumors
 5. Cellular "repair".
 - a) sublethal damage recovery (SLDR)
 - d) potentially lethal damage recovery (PLDR)
 - c) repair and fractionation in radiotherapy
 - b) age response through the cell cycle
 - e) radiation-induced cell division delay

The "Take Home" Messages:

1. Know the possible fates of cells that have been irradiated with ionizing radiation.
2. Be able to recognize major types of chromosome aberrations and their possible consequences to the cell.
3. Understand the function of a cell survival curve and be able to recognize, label and explain major components of the curves.
4. Estimate the relative radiosensitivities of two different cell types from their cell survival curves.
5. Know the difference between a cell survival curve and a tissue dose response curve.

6. Know the difference between a clonogenic and non-clonogenic assay of tissue dose response, and be able to give examples of each for both tumors and normal tissues.
7. Identify and explain factors that affect cellular recovery from radiation damage.

Basic Tissue Response to Radiation

1. *A review of different cell and tissue types in the human body.*
2. Laws of Bergonié and Tribondeau.
3. Cell populations and normal tissue organization before and after irradiation.
4. *Cancer biology: Why and how does cancer develop?*
5. Growth patterns of tumors before and after irradiation.
6. *Cancer statistics.*

The "Take Home" Messages:

1. Be able to recite the laws of Bergonié and Tribondeau, and understand how these translate into the "VIM and DIM" and "hierarchical and flexible" tissue radiosensitivity classification systems.
2. Know the definition of a "target cell", along with the types of target cells that have been identified for different normal tissues.
3. Develop a basic understanding of what genetic events cause normal cells to become cancerous, what properties or "behaviors" are characteristic of cancer cells, how tumors grow and how this is measured clinically.
4. Understand the meaning of, and difference between, cancer prevalence and prognosis; be able to identify the most prevalent cancers and their relative prognoses.

Early and Late Effects in Normal Tissues

1. Which effects are "early" and which "late"?
2. The acute, whole-body radiation syndromes.

- a) prodromal syndrome
 - b) cerebrovascular syndrome
 - c) gastrointestinal syndrome
 - d) hematopoietic syndrome
3. Radiation effects on the embryo and fetus: teratogenesis.
 4. Radiation-induced cataracts.
 5. Carcinogenesis as a late effect.
 - a) second malignancies in radiotherapy patients
 - b) radiation carcinogenesis in non-radiotherapy patients
 7. Radiation protection: Terminology and exposure limits.
 - a) genetic vs. somatic effects
 - b) stochastic vs. non-stochastic ("deterministic")
 - c) doses, dose equivalents and weighting factors
 - d) cardinal rules of radiation protection
 - 1] ALARA
 - 2] GSD
 - 3] NIREL
 - e) exposure limits for radiation workers and the general public

The "Take Home" Messages:

1. Define the "mean lethal dose" (LD_{50/30}).
2. State the approximate LD_{50/30} for humans, both with and without medical intervention.
3. Describe the set of exposure conditions that would lead to a "total body" radiation syndrome.
4. Identify the clinical stages of response in the total body radiation syndrome.
5. Be able to discuss the major radiation syndromes and identify the dose ranges over which they occur.
6. Understand the effects of radiation on an embryo or fetus, the approximate dose range over which these effects occur, and the time during gestation when the embryo or fetus would be most susceptible to these effects.

7. Be able to describe the features of radiation-induced cataracts that make them unique among early and late effects.
8. Be able to describe, and give numerical risk estimates for, the relationship between radiation exposure and the induction of fatal cancer.
9. Understand what epidemiology is, and its strengths and weaknesses.
10. Be able to name some of the human populations who were studied in terms of the possible cancer risk following radiation exposure.
11. Compare and contrast somatic and genetic radiation effects.
12. Understand the difference between stochastic and non-stochastic effects.
13. Be able to define the terms absorbed dose, dose equivalent, effective dose equivalent, collective dose equivalent, and genetically significant dose.
14. Know the pertinent radiation exposure limits that apply to you, your patients, and members of the general public.

Radiation Histopathology

1. What is really meant by "tissue tolerance"?
2. Rubin and Casarett's tables of normal tissue complications and tolerance doses.
3. Radiation histopathology in major tissues and organs.
 - a) bone marrow
 - b) reproductive organs
 - c) intestinal mucosa
 - d) skin
 - e) kidney
 - f) lung
 - g) liver
 - h) vasculature
 - i) nervous system
 - j) miscellaneous
4. General guidelines for normal tissue tolerance and tumor cure.
5. New directions in our understanding of tissue tolerance in radiotherapy.
 - a) how early and late effects change with fractionation pattern
 - b) new clinical method for scoring early and late effects in normal tissues
 - c) normal tissue tolerance to re-irradiation

The "Take Home" Messages:

1. List the four major categories of cell populations as defined by Rubin and Casarett, and give examples of each.
2. Know what is meant by "TD_{5/5}" and "TD_{50/5}".
3. Know the different possible target cells in normal tissues, and the corresponding histological changes in the tissues caused by the loss of these cell types.
4. Be able to rank major organs by their relative radiosensitivities.
5. Be able to compare and contrast radiotherapy doses for tumor cure with those for normal tissue tolerance.
6. Develop a basic understanding of how normal tissue tolerances change with changes in dose fractionation patterns.
7. Be aware of some of the newer methods of predicting tissue tolerance and scoring tissue effects.

Radiobiology from a Clinical Radiotherapy Perspective

1. The concept of therapeutic ratio.
2. Modification of cell and tissue response to ionizing radiation.
 - a) Physical
 - 1] LET and RBE
 - 2] dose rate
 - 3] hyperthermia
 - b) Chemical
 - 1] radiosensitizers (including oxygen)
 - 2] radioprotectors
 - 3] bioreductive drugs
3. Time, dose, fractionation and isoeffect curves.
4. The problem of tumor hypoxia.

5. Radiation and chemotherapy interactions.
6. The "4 R's of Radiotherapy".
 - a) repair
 - b) repopulation
 - c) redistribution
 - d) reoxygenation

The "Take Home" Messages:

1. Understand the term therapeutic ratio, and be able to express it both verbally and graphically.
2. Be able to describe the effect that changing LET has on radiation response and explain the meaning of relative biological effectiveness (RBE).
3. Account for the effect that changing radiation dose rate has on cells and tissues.
4. Explain how oxygen and other radiosensitizers increase radiation damage to cells and tissues.
5. Define the oxygen enhancement ratio (OER), sensitizer enhancement ratio (SER), and dose reduction factor (DRF), and know how to calculate these factors from cell survival curves.
6. Explain how radioprotectors decrease damage to cells and tissues.
7. Rank the major cell cycle phases in terms of radiosensitivity.
8. Describe cellular repair phenomena as they relate to radiation therapy.
9. State the "4 R's of radiation therapy", and discuss each in terms of the biological effect on the tumor and normal tissues as far as radiation dose fractionation is concerned.
10. Discuss the use of chemical modifiers in radiation therapy.
11. Define NSD, and calculate NSD doses given total dose, time, and fractionation information.
12. Discuss the biological rationale underlying variations in treatment techniques such as altered dose rate, hyperfractionation, accelerated fractionation, hyperthermia, use of high LET radiation, etc.

MD 514 Clinical Radiation Oncology
Fall 2013/Spring 2014

Course Instructors

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Course Description

This course covers the biological underpinnings, pathological and clinical characteristics, and management of benign and malignant tumors commonly treated with radiation therapy. Tumor epidemiology, presenting symptoms, diagnosis, staging, survival rates, and modes of spread will also be discussed.

The first section will be devoted to the most common malignancies seen at UNC Radiation Oncology, and be taught principally by Dr. Elaine Zeman from the Radiation and Cancer Biology Division. As such, special emphasis will be placed on the biological underpinnings of these cancers, and cutting-edge “molecular” diagnostic methods and therapies. In addition, the dosimetry students will have written and oral professional presentations about the roles of medical dosimetrists for this course (Goal 4, Objective 3).

The second section will cover the remaining benign and malignant tumors, and will be taught principally by Dr. Robert Adams.

This is the equivalent of a 3 credit course.

Required Text and Handout Materials

Textbook: Principles and Practice of Radiation Therapy, Third Edition by C.M. Washington and D. Leaver (Mosby, St. Louis, 2009).

Dr. Zeman's class handout materials will be available digitally, and can be obtained from a cloud-based "dropbox". Dr. Zeman will e-mail participants direct links to download the handouts as they are made available. These lecture materials are considered the intellectual property of the course instructor and should not be shared with ANYONE outside of class.

Lecture Schedule

Tuesdays and Thursdays, 1:00 – 2:30 p.m.

Section 1 (Zeman) CANCER BIOLOGY

Introduction and Cell Biology Review

Normal Tissue Biology/Cell Types in Various Tissues

Cancer Biology

Cancer Phenotypes

Cancer Staging and Grading

Cancer Epidemiology

Readings: Handout

Quiz #1 – Cell, Tissue, and Cancer Biology

Section 2 (Zeman) LUNG CANCER

Introduction/Epidemiology/Socioeconomic Impacts

Tobacco, Asbestos, and Other Risk Factors

Small Cell Lung Cancer (SCLC)

Non Small Cell Lung Cancer (NSCLC)

Mesothelioma

Carcinoid Tumors

Readings: Handout; Chapter 32, pgs. 665-681

Quiz #2 – Lung Cancer

Section 3 (Adams) BREAST CANCER

Introduction and History of Breast Cancer Treatment

Epidemiology/Risk Factors/Advocacy

Breast Cancer Types and Subtypes

Breast Cancer (cont., including male breast cancer)

Readings: Chapter 38, pgs. 866 – 892

Quiz #3 – Breast Cancer

Section 4 (Zeman) HEAD AND NECK CANCER

Introduction/Epidemiology/Risk Factors

Nasal Cavity/Paranasal Sinuses

Nasopharynx

Oral Cavity/Oropharynx

Salivary Glands

Salivary Glands (cont.)/Larynx

Larynx (cont.)/Hypopharynx

Hypopharynx

Readings: Handout; Chapter 33, pgs. 693 – 743

Quiz #4 – Head and Neck Cancer

Section 5 (Zeman) FEMALE REPRODUCTIVE SYSTEM CANCERS

Introduction/Epidemiology/Risk Factors

Cervix

Endometrium

Vagina/Vulva

Ovaries

Readings: Handout; Chapter 36, pgs. 803 – 820; Chapter 37, pgs. 823 – 839

Quiz #5 – Reproductive System Cancers

Section 6 (Adams) Hodgkin lymphoma, Non-Hodgkin lymphoma, Leukemias, Endocrine, CNS, GI, Male Reproductive, Pediatric, Skin, Benign, Metastatic, and Primary Bone/Soft Tissue.

Readings: Respective Chapters, Washington and Leaver, Gunderson and Tepper.

Grading and Assignments

The course is graded A, B, C, D, or F. Students must satisfactorily complete each assignment. Each class assignment must be completed on the day specified.

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by:

Test Performance (tests in class)	80%
Oral Presentations (3 per semester)	20%

Three oral presentations on interesting clinical cases (case studies) will be assigned and critiqued and graded by the course instructors.

Attendance and Special Assistance

Course attendance is strongly recommended. Absence will not be considered a valid excuse for failure to obtain the necessary information, except under the most unusual of circumstances. Any student who feels the need for extra support for studying or test taking should notify the instructor(s) as soon as possible.

Honor Code

The University of North Carolina's Honor Code is recognized and enforced in this course. The principles of academic honesty, integrity, and responsible citizenship govern the performance of all academic work and student conduct. Your acceptance of enrollment presupposes a commitment to the principles embodied in the code of student conduct.

Student's Clinical Environment Assessment Tool

Rotation :

Dates:

Clinical Instructor (First AND Last Name):

Please evaluate your clinical environment considering the following criteria:

CLINICAL STAFF

	<u>Never</u>	<u>Rarely</u>	<u>Sometimes</u>	<u>Often</u>	<u>Always</u>
Maintains a friendly, professional attitude towards students	1	2	3	4	5
Maintains a professional attitude towards his/her career, speaks positively about students entering the profession	1	2	3	4	5
Demonstrates and explains software/equip	1	2	3	4	5
Demonstrates and explains plans/techniques	1	2	3	4	5
Encourages students to ask questions					
Encourages students to attempt plans	1	2	3	4	5

with supervision

Points out items of importance, assists in correcting errors 1 2 3 4 5

Encourages an environment conducive to learning, is patient, considerate, and helpful 1 2 3 4 5

CLINICAL ENVIRONMENT

	<u>Never</u>	<u>Rarely</u>	<u>Sometimes</u>	<u>Often</u>	<u>Always</u>
The clinical area had a steady patient flow.	1	2	3	4	5
I was exposed to a variety of plans/techniques.	1	2	3	4	5
My assigned area was consistently staffed with clinical personnel.	1	2	3	4	5
My clinical environment was conducive to learning 1 (organized, efficient, resourceful).		2	3	4	5

Student Self Evaluation Form

Considering your level of experience, evaluate yourself according to the following criteria. Comments and suggestions are very important components of evaluation feedback, so please include when possible.

	Weak		Strong		
	1	2	3	4	5
PATIENT CARE SKILLS					
patient safety, patient comfort, awareness of patient condition, patient radiation protection					

COMMENTS:

TREATMENT PLANNING SKILLS	1	2	3	4	5
psychomotor skills, use of treatment planning software					
COMMENTS:					

CHART SKILLS	1	2	3	4	5
chart interpretation, documentation					

COMMENTS

ORGANIZATIONAL SKILLS

1 2 3 4 5

preparation for patients, prioritizing plans/patients, following through with all aspects of treatment planning

COMMENTS:

TEAMWORK SKILLS

1 2 3 4 5

communication skills, motivation, dependability, assists staff and other students
COMMENTS:

Student Signature/Date: _____

Medical Dosimetry Educational Program
Quality Assurance Guidelines
Treatment Machine and Simulator

Student participates in treatment machine quality assurance throughout the Dosimetry Program. Each month the student should participate in a QA procedure.

1. For the following QA assignments, student submits a report to the program director following review and signature of assigned dosimetrist, physicist or therapist. Most of these QA assignments should be completed during their respective rotation. The report should include the test being performed, recommended frequency, how the test is performed, and what to do if the test is out of tolerance.

QA	Date Participated	Date Report Turned In
Brachytherapy Tx Machine		
Conventional Simulator- monthly (most likely will be through review with physics staff)		
CT Simulator- daily or perform warm-up procedures		
Varian Dual Energy Linear Accelerator- monthly		
Elekta Linear Accelerator- monthly (or 2 nd linac in dept)		

IMRT		
Cyberknife		
Tomotherapy QA- if available		
Daily Constancy Check to include Electron Constancy Check		
IGRT QA		
Laser/ODI		
Brachytherapy QAs		

- During his/her external beam treatment planning rotation, the student will:
 1. Observe and participate with all dosimetrists and physicists in monthly QA of all treatment machines.
 2. Perform successfully, on own, with supervision of dosimetrist and physicist, one treatment machine QA for the following treatment machines:
 1. Varian dual energy linear accelerator
 2. Elekta linear accelerator or a 2nd linear accelerator QA in department
 3. Superficial machine- if available
 4. Daily constancy check to include electron constancy check
 3. Write a report for QA completed on own and have clinical instructor verify and sign report. The report must include the test performed, tolerance, and the recommend frequency of completing the test. The report must be posted to Desire2Learn.
 4. To achieve normal progress in QA, one must complete 3 QAs by the end of the Fall semester.

UNC HOSPITALS
Medical Dosimetry Program

Competency Attempt			
1	2	3	4

Quality Assurance
Competency Form

The student must participate in and demonstrate an understanding of the test being performed, recommended frequency, how the test is performed, and what to do if the test is out of tolerance.

Please specify the QA task participated in:

Comments: _____

Student Signature / Date

Medical Physicist Signature / Date

UNC Hospitals Medical Dosimetry Educational Program

Objectives – Brachytherapy Clinical Rotation

Intracavitary and Interstitial Implants

SKILL	RELATED CONCEPT
Preparation	
Identify site of treatment	Determine possible applicators used for specific site
Indicate radioactive source to be used	Describe the properties of sources
Identify applicators specific to case	Distinguish between applicators as they are used clinically. Explain how applicator affects surface dose and percent depth dose and discuss shielding. Determine appropriate treatment system for patient (Fletcher, Manchester, MIR).
Know the difference between LDR and HDR	Explain the similarities and differences between LDR and HDR with regard to applicators, quality assurance, treatment preparation, dose prescription, planning, completion of treatment (paperwork)
Know the difference between manual and remote	Describe the similarities and differences between afterloading
Prepare applicators for treatment	Know implication of time and type of sterilization for applicator preparation

Prepare equipment for treatment	Discuss reason for all aspects of equipment preparation
Perform QA on applicators, isotopes, and treatment machines	<p>Analyze logbook and reports for annual applicator QA and write analysis.</p> <p>Write an organized report discussing the process of source QA to include locating source, measuring activity, and inputting into treatment planning system.</p> <p>Refer to T.G. 59 in evaluating treatment machine QA, and analyze data, process and results.</p>
Check in sources	Measure activity of sources and calculate the appropriate decay for the time of use
Know decay modes of radioisotopes and Appropriate shielding	
Know emergency procedures in case of	Evaluate each specific situation in determining
Radioisotope spill, lost source etc.	appropriate action in case of emergency

SKILL
Planning

RELATED CONCEPT

Acquire localization films or proper imaging studies.

Critique film for effective use in computer treatment planning with respect to ease and accuracy of dummy source identification.

Recognize when necessary to contact dosimetrist to be involved with filming or to review films.

Understand process physician uses in preparing

Determine dose prescription through use of the prescription sheet following dosimetry concepts: decay constant, half-life, source strength, build-up factors

Calculate dose around a point source

Understand the use of “away-long” tables and when point source approximation is valid.

Perform radioactive decay calculations

Prepare treatment form
LDR

Apply rules for treatment system (for ca cervix) -

Determine dwell positions and dwell times - HDR

Identify sources and interest points on films

Explain how orthogonal film coordinates are related and determined

Or on appropriate imaging studies.

Know significance of source and point location

Generate treatment plan giving dose distribution in three dimensions

Determine which views provide the most useful information to the physician

Verify input information for accuracy

Analyze treatment plan for accuracy

Treatment

Identify patient for treatment

Discuss implications of incorrect patient identification, including NRC regulations. Review Code of Federal Regulations, chapter 10, Parts 20 & 35, and discuss with radiation safety officer

Explain procedure to patient

Determine patient's knowledge level and explain procedure that's comprehensible to them

Assist physician in positioning applicators

Select and validate correct source for treatment

Differentiate among sources according to their properties

Perform treatment time calculations

Explain relationships among dose specification and prescription reference points, mg-hrs, mgRaeq-hrs, total reference air-kerma, 60 Gy reference volume dimensions

Identify various survey meters

Evaluate use of appropriate survey meter for specific situations. Determine if meter reading is adequate.

Complete paperwork, measurements, counts, and return seeds

UNC Hospitals

Medical Dosimetry Educational Program

Objectives –Brachytherapy Clinical Rotation
Radiopharmaceutical Administration

Objectives for radiopharmaceutical administration are similar to those used for intracavitary and interstitial implants, with the following exceptions:

- Radiopharmaceutical replaces radioactive source
- Preparation for treatment includes the patient's hospital room
- Isodose distributions not generated

UNC Hospitals

Medical Dosimetry Educational Program

Brachytherapy Clinical Competency

Instructions to Evaluator and Student

Listed below are instructions describing the process used for evaluators to assess the student's clinical competence, using the attached Clinical Competency Form and Objectives.

1. The Evaluators for Brachytherapy
 - Brachytherapy Technologist
 - Medical Dosimetrist
 - Medical Physicist
2. A list of required competencies is attached to the student's information packet for the brachytherapy clinical rotation.
3. The student will inform the evaluators when he/she is ready to perform a specific competency.

4. Evaluators(s) will sign the competency form only if the student has successfully completed all aspects of the designated case as described in the brachytherapy objectives.
5. In the event the student is unable to successfully complete the specified competency, the clinical instructor will write a comment describing areas for improvement, and indicate this is a failed competency by checking the appropriate box. The CI and student should inform program staff of the failed competency. The student must prepare and make a second attempt at the competency.
6. Upon approval from all clinical instructors for each aspect of the competency, the student will submit the competency form to the dosimetry program director. As stated above, failed competency attempts must also be turned in.

UNC Hospitals

Medical Dosimetry Program

Brachytherapy Clinical Competencies
Evaluators, Required Treatment Sites, Guidelines

Evaluators/Clinical Instructors

- Physics staff, brachytherapy technologists, and medical dosimetrists
-

Required Competencies- one of each

GYN

- Cylinder- Ir-192 or Gynsite applicator
- Tandem and Ovoids – Ir-192 (HDR)
- Ir-192 temporary interstitial implant

Prostate

- I-125 or Pd-103 permanent seed implant

Thyroid

- I-131 radiopharmaceutical administration

Breast and Sarcomas

- Ir-192 HDR – observe, assist and explain all aspects of procedure

Guidelines

Student will complete on his/her own, the six brachytherapy cases listed above, from start to finish by demonstrating skills necessary to prepare, plan and treat patient as described by the brachytherapy clinical objectives.

Successful completion of competency is determined by adherence to the attached clinical objectives and the summarized guidelines listed below. Also, see “Instructions to Evaluator and Student”.

- Participate in pre-plan if applicable
- Explain dose prescription and participate in calculation
- Localize implant using films or CT/MRI data set
- Run isodose plan, review plan with physician
- Order sources or radiopharmaceutical
- Record information once radioisotope arrives
- Verify quantity and measure activity
- Prepare seeds, catheters, and I-131
- Participate in implant administration
- Complete paperwork
- Conduct appropriate surveys
- Run post-plan and review with physician
- Unload patient
- Complete paperwork, measurements, counts, and return seeds

Written Report Guidelines

Purpose

Student will write a short report for each brachytherapy treatment site. The purpose of writing the reports is to supplement the required competencies of which the student will be tested, based on a

selected patient's case. Each site's competency grade will be determined from competency form and written report content.

Instructions

For each brachytherapy comp, write a one to two page typed report describing the patient's case that you selected for use in testing your competency. Include the following information using this format: Content under numbers 1-7 should be written using a listing format, and content for numbers 8-10 should be written as an explanation in essay format. Number 11 should be answered in a step by step bullet format.

Report Content

- Treatment site
- Diagnosis
- Stage
- Concomitant modes of therapy
- Radiation dose prescription
- Critical structures and their limiting doses
- Brachytherapy modality
- Why are the above radiation therapy parameters (5-7) used to treat this patient?
- How do you evaluate the tumor dose and critical structure doses? Discuss both methods of evaluation.
- What special considerations exist and how are they applied when planning this patient's treatment?
- Student will also include a step by step written outline on how to perform the procedure for future reference.

Due Date

Student must submit each report to the Clinical Instructor within one week after completing the brachytherapy competency.

Grade based on

- How accurate the student represents content from the patient's chart and treatment plan
- Use of correct grammar
- How clear is the student's reasoning in explanations

Brachytherapy Competency List

Required Competencies- one of each and a competency form must be filled out for each site

Anatomical Site	Competency Date	Date Competency Report Posted
Gyn		
Cylinder – Ir-192 or Gynsite		
Tandem and Ovoids – Ir-192 (HDR)		
Ir-192 temporary interstitial implant		
Prostate		
I-125 or Pd-103 permanent seed implant		
Thyroid		
I-131 radiopharmaceutical administration		
Breast and Sarcomas		
Ir-192 HDR – observe, assist and explain all aspects of procedure		

At the end of the brachytherapy rotation the student must also turn in the QA project.

Date QA Projects Completed and Posted _____

All failed competency attempts must be turned in. If a student fails 7 competency attempts (any combination from all rotations) at any time throughout the program or 4 competency attempts (one specific competency), the student will be removed from the program.

To achieve normal progress in brachytherapy, two competencies must be completed by the end of week three of the rotation.

University of North Carolina Hospitals
Medical Dosimetry Program

Competency Attempt			
1	2	3	4

Brachytherapy Competency Form
Tandem and Ovoids

Refer to the instructions for performing clinical assessment. The student must complete the competency by meeting the related objectives specified for each portion of the implant: preparation, planning, treatment.

Preparation/Calculation Sheet

Comments:

Student Signature/Date

Brachytherapy Technologist Signature/Date

Planning

Comments:

Student Signature/Date

Dosimetrist Signature/Date

Treatment

Comments:

Student Signature/Date

Brachytherapy Technologist Signature/Date

Physicist Signature

UNC Hospitals
Medical Dosimetry Program
Brachytherapy Competency Form
Cylinder/GYN site

Competency Attempt			
1	2	3	4

Refer to the instructions for performing clinical assessment. The student must complete the competency by meeting the related objectives specified for each portion of the implant: preparation, planning, treatment.

Preparation/Calculation Sheet

Comments:

Student Signature/Date

Brachytherapy Technologist Signature/Date

Planning

Comments:

Student Signature/Date

Dosimetrist Signature/Date

Physicist Signature/Date

UNC Hospitals
Medical Dosimetry Program

Competency Attempt			
1	2	3	4

Brachytherapy Competency Form
HDR Iridium-192 GYN Interstitial Implant

Refer to the instructions for performing clinical assessment. The student must complete the competency by meeting the related objectives specified for each portion of the implant: preparation, planning, treatment.

Preparation/ Calculation Sheet

Comments:

Student Signature/Date

Brachytherapy Technologist Signature/Date

Planning

Comments:

Student Signature/Date

Dosimetrist Signature/Date

Treatment

Comments:

Student Signature/Date

Brachytherapy Technologist Signature/Date

Physicist Signature

UNC Hospitals

Medical Dosimetry Program

Brachytherapy Rotation

Quality Assurance Project

Assignment Date/Instructions

A written report in bullet format stating the process of applicator QA, Source QA, and HDR QA is due at the end of the brachytherapy rotation. This report must also include the tolerances of acceptance, frequency and what to do if test is not within limits.

Clinical Instructors

Brachytherapy Physicists and technologists.

Applicator QA

- Review TG 56
 - 1) Review HDR Commissioning Report and radiographs found in Physics area
 - 2) Discuss with clinical instructor
 - 3) Review objectives provided by clinical instructor
 - 4) State the test, what is being tested, frequency, tolerance, and how performed.

Source QA

- A) Refer to TG 56
 - a) Measure source activity and calculate decayed value
 - b) Input source parameters and verify information in treatment planning system
 - c) Determine accuracy of dose calculation
 - d) State the test, what is being tested, frequency, tolerance, and how performed.

HDR Machine QA

- 1. Take part in QA including source exchange and morning QA
 - e) Refer to TG59 and TG56
 - f) State the test, what is being tested, frequency, tolerance, and how performed.

UNC HOSPITALS MEDICAL DOSIMETRY PROGRAM
STUDENT CLINICAL COMPETENCY FORM

Student Name: _____ Date: _____

Treatment Site: _____

Clinical Preceptor: _____ Grade: _____

Date reviewed with student: _____

Student Signature: _____

The Medical Dosimetry student must demonstrate the ability to navigate within the treatment planning system and complete the following task independently. Student must have 100% to pass the competency.

Task	Pass	Fail	N/A	Comments
Contouring				
Treatment tech. correctly applied				
Beam Energy/Modality/Machine correct				
Correct placement of Norm point				
Total dose/Dose per fraction/Rx isodose correct				
Beam weighting utilized appropriately				
Field blocking applied correctly				
Plan done according to direction and in a timely fashion				
Beam modifiers used where applicable (wedges/bolus,etc.)				
Imported Flds/documents/images to Mosaiq correctly				
Rad Rx correct & approved in Mosaiq				
Review/discuss plan with Physician				
Tx calendar/billing/QCL correct				

Comments: _____

UNC Hospitals
 Medical Dosimetry Program
 Competency Checklist:

Date:

Evaluator Signature

Brain

Whole Brain

3/5 fld Brain

Breast

3D Tang Breast (wedges)

3D Tang Breast (Fld-n-Fld)

3D Tang ChestWall (Fld-n-Fld)

4fld Breast /ChestWall (Tang, Sclav, & IMN)

Mini Tang Photon Boost

Electron Tumor Boost

Electron Chestwall Scar Boost		
<u>Thorax</u>		
Ap/Pa Lung with Offcords		
IMRT Lung		
Mantle		
3/ 4 fld Esophagus		
<u>Abdomen</u>		
3D Conformal (pancreas, stomach)		
IMRT Abdomen/Esophagus		
PAN_Pelvis		

Date:

Evaluator Signature

Pelvis

4Fld Pelvis

3Fld Prone Rectum

IMRT Prostate with Nodes

IMRT Prostate + SV

Diamond with Inguinals

Skeletal

AP/PA Spine

Extremity

Ribs

	Date	Signature
<u>Electrons</u> Single Fld		
Abutting Flds		
CranioSpinal Fld		
<u>Head&Neck</u>		
3D H&N (Lats, LAN, PEB)		
IMRT		
Larynx		
Wedge Pair (any anatomical site)		
<u>Brachytherapy</u>		

<u>Blockroom:</u>		
Electron cutout		
Photon Block		
<u>Special Procedures:</u>		

Pre-Comp Assessments:

The student is designed to as a guide for each medical dosimetry student to have an idea of how competencies will be assessed and evaluated. Pre-Comp Assessments should be completed prior to attempting a competency.

1. Xirreg Calc / Clinical Set-up
2. Contouring
 1. How & what to contour for each anatomical site
3. Photons
 1. Hand calculation
 2. Making a New Beam
 3. Different Energies (6x vs 15x)
 4. Norm point placement
 5. Weighting
 6. Isodose lines (coverage/hotspots)
 7. Explain Spreadsheet
4. Electrons
 1. Hand Calculation
 2. Making a New Beam/drawing the field
 3. Different Energies
 4. Normed to different Isodose lines/depths
 5. Bolus vs No Bolus
 6. Isodose Lines (coverage)
 7. Spreadsheet
 - 8.
5. Single Photon Field
 1. Placing the Beam
 2. Different Energies
 3. Calc'd to different depths
 4. Why would you use a single field
 5. When would you not use a single field
6. Parallel Opposed Fields

1. Place beams
2. Norm point
3. Energy
4. Weighting
5. Isodose lines (cold spots & hotspots)

7. **Whole Brain**

1. Place Beams & draw blocks
2. Norm point
3. Weighting
4. Spreadsheet

8. **Wedge Pair**

1. Place Beams
2. Norm point
3. Different Wedge angles (15, 30, 45, 60)
4. Isodose lines (Hotspots)
5. Use of wedges w/ different beam angles

UNC Hospitals
Medical Dosimetry Education Program
Clinical Log Sheet

Student Name

Semester

Procedure

UNC Hospitals Medical Dosimetry Educational Program
2013 - 2014 Program Calendars

Fall Semester, 2013 (Semester I)

July 15-30 Registration & Orientation (Semester I)
August 1 Thursday First Day of Class
August 2 Friday First Day of Classes
September 2 Monday Labor Day Holiday
October 3, 4 Fall Break
November 26 - 29 Tuesday - Friday Thanksgiving Holiday
December 19 Thursday Last Day of Classes
December 20 Friday Last Day of Clinical
December 23 – January 3 Monday- Friday Winter Break

Spring Semester, 2014 (Semester II)

January 6 Monday Semester Orientation
January 7 Tuesday First Day of Classes
January 8 Wednesday First Day of Clinical
January 20 Monday Holiday, MLK (observed)
March 17 – March 21 Monday-Friday Spring Break
May 1 Thursday Last Day of Classes
May 2 Friday Last Day of Clinical

Summer Sessions I and II, 2014 (Semester III)

May 5 Monday First Day of Clinical (Semester III- Session I)
May 6 Tuesday First Day of Class (Semester III-Session I)
May 26 Monday Holiday, Memorial Day
June 19 Thursday Last Day of Class (Semester III-Session I)
June 20 Friday Last Day of Clinical (Semester III- Session I)
June 23 Monday First Day of Clinical (Semester III-Session II)
June 24 Tuesday First Day of Class (Semester III-Session II)
July 4 Friday Independence Day
August 7 Thursday Last Day of Class (Semester III-Session II)
August 8 Friday Last Day of Clinical (Semester III-Session II)
August 10 Sunday: Graduation G Level UNC Cancer Hospital

Course Sequence: UNC Hospitals Medical Dosimetry Educational Program

Semester 1: Fall

<u>Course No.</u>	<u>Course Title</u>	<u>Hrs.</u>
MD 500	Orientation to Radiation Oncology	1.0
MD 501	Introduction to Medical Dosimetry	1.0
MD 509	Radiation Safety and Protection	1.0
MD 510	Anatomy for Radiation Oncology	1.0
MD 511	Radiation Oncology Pathology	1.0
MD 504	Research Methodology and Design Statistics I	3.0
MD 506	Clinical Education I	6.0

Semester 2: Spring

<u>Course No.</u>	<u>Course Title</u>	<u>Hrs.</u>
MD 502	Medical Dosimetry Physics	3.0
MD 505	Research Methodology and Design Statistics II	3.0
MD 507	Clinical Education II	6.0
MD 513	Radiation Biology	3.0
MD 514	Clinical Radiation Oncology	3.0

Semester 3: Summer 1 & 2

<u>Course No.</u>	<u>Course Title</u>	<u>Hrs.</u>
MD 508	Clinical Education III	6.0
MD 512	Special Topics of Radiation Oncology	3.0
MD 503	Brachytherapy Dosimetry	2.0

Program Physical Requirements

1. The physical activity of this position requires the student be able to: climb, push, talk, stand, hear, walk, reach, grasp, kneel, feel, balance, pull, stoop, lift, use fingers, crawl, crouch, and perform repetitive motion.
2. The physical requirements of this position require the student be able to perform heavy work involving the exertion of up to 100 lbs. of force occasionally and/or 50 lbs. of force frequently.
3. The visual requirements, including color, depth perception, and field of vision are that the student's visual acuity is required to determine the accuracy, neatness, and thoroughness of the work assigned (i.e., custodial, food services, general labor, etc.) or to make general observations of facilities or structures (i.e., security guard, inspection, etc.).
4. The conditions to which the student will be subject in this position include, but are not limited to:
 - a. Inside environmental conditions: protection from weather conditions, but not necessarily from temperature changes.
 - b. Hazards: includes physical conditions such as proximity to moving parts, moving vehicles, electrical current, working in scaffolding or high places, exposure to high heat or exposure to chemicals.
 - c. He or she will be required to wear a respirator.
 - d. He or she may be exposed to infectious diseases.
 - e. He or she will have to interact with prisoners and mental patients.

Health Program

The Medical Dosimetry Student is required to provide his/her own health insurance throughout the entire program. Proof of personal health insurance coverage will be required.

All immunization records should be forwarded to the Program Director at the time of Orientation.

UNC Department of Radiation Oncology: Staff and Facilities

The UNC Department of Radiation Oncology is located on the Basement and Manning levels of the University of North Carolina Cancer Hospital. The primary teaching classroom is located within the UNC Department of Radiation Oncology. Students will train clinically in the UNC Department of Radiation Oncology all three semesters. All didactic work will occur in the UNC Department of Radiation Oncology classroom.

1. Students are invited and encouraged to attend as many divisional functions as possible, such as Annual fall picnic, Winter party, or other departmental happenings.
2. Procedure and policy manuals are posted within the Division in their respective areas. All schedules, meeting fliers, memos, etc., are posted either on the bulletin boards located in the large central hallway, the cardiac room, just outside the lounge or on the refrigerator door.
3. Radiation reports are posted in the Manning Level breakroom (just down the hallway from both the classroom and clinical medical dosimetry).
4. UNC Medical Dosimetry Students have two dedicated workstations on B Level and also in the medical dosimetry work areas.
5. The students can use the UNC Library system, pay for the health club (approximately \$100 dollars per year), and pay to attend UNC athletic events like any other hospital employee.

All problems relating to the Department, staff, faculty or students should be taken directly to the Program Director, Dr. Robert Adams.

Equipment

The UNC Department of Radiation Oncology is composed of approximately 50,000 square feet of work space within the UNC Cancer Hospital. Equipment includes four linear accelerators, a brachytherapy suite, a cyberknife, and a tomotherapy unit. The current treatment planning software system is PLUNC, which stands for PLANUNC. The Department is state of the art and is part of only one of 36 recognized comprehensive cancer centers in the United States.

UNC Department of Radiation Oncology

Faculty and Staff

1. 12 Board Certified Radiation Oncologists
2. 6 Medical Residents
3. 10 Medical Physicists
4. 5 Computer Programmers
5. 6 Certified Medical Dosimetrists

6. 17 Radiation Therapists
7. 7 nurses
8. 15 Administrative Assistants
9. 6 Supervisors/Administrators
10. 2 Medical Dosimetry Students
11. 4 Radiation Therapy Students
12. 2 Medical Physics Residents
13. Numerous visiting medical, physics, nursing, radiography students

How to Apply

Application forms can be downloaded from the UNC Department of Radiation Oncology website and are also available on request from Robert D Adams, Program Director, UNC Department of Radiation Oncology, 101 Manning Drive, Chapel Hill, N.C., 27599. Completed applications must be submitted no later than MARCH 1 preceding fall (August) enrollment. Specific information required for a complete application includes:

- 1) Official transcript from high school (if less than five (5) years since graduation).
- 2) Official transcripts of all academic work, college or other academic institutions attended.
- 3) As appropriate, official transcripts from Radiation Therapy Program attended.

4) Three personal references using the UNC Hospitals Medical Dosimetry Program official reference forms.

5) Additional information as requested by program admissions.

A personal interview and visit to the UNC Department of Radiation Oncology facility is normally a required part of the application process. April 1 will be our target date for returning admissions committee decisions.

A maximum of two students may be admitted into the program each year. This may vary, as program needs change. Orientation will take place usually during the last two weeks of July and classes and clinical will begin immediately following.

Tuition and Fees

There is no application fee. The computer laboratory fee is \$1,500 and is to be paid during orientation. There are also costs for books (approximately \$300), labcoat, and other types of school supplies. Housing, health insurance, and parking are the responsibility of the student. The dress code for UNC medical dosimetry students is professional business casual with a white laboratory coat. There are also costs for the incoming accepted student to have a certified drug test and provide the program director with documentation. The program does not participate in Title IV financial aid.

Transfer Credits/Students

The UNC Hospitals Medical Dosimetry Education Program does not accept any transfer credits or transfer students. It is up to the program our student is applying for to determine if any credit hours will be accepted at a different educational program.

Fall semester Weekly Writing Assignment

Due by e-mail to Dr Adams (Robert_adams@med.unc.edu) no later than 5 p.m. each Monday.

In one double-spaced page (Times New Roman, 12 pt, 1 inch margins), please respond to the following:

Week 1 (August 30)

As you begin your first week of clinical, of what are you most scared? To what are you most looking forward?

Week 2 (September 6)

As you begin your first week of (actual) class, of what are you most scared? To what are you most looking forward?

Week 3 (September 13)

Get to know a radiation therapist. Where is he/she from? Where did he/she attend school (medical imaging and/or radiation therapy)? What does he/she do for fun? Why did he/she pursue a career in radiation therapy? How long has he/she been a radiation therapist? In his/her opinion, what is the most rewarding part of his/her job?

Week 4 (September 20)

In your opinion, what are the most important qualities for a radiation therapist to possess? Which will be the hardest for you to develop?

Week 5 (September 27)

Pick a patient (male or female). Describe his/her tumor(s) (location, stage, grade). Describe his/her set-up. Describe his/her treatment plan. Why is this plan the best for him/her?

Week 6 (October 4)

Describe your most interesting case this week. The patient must be male.

Week 7 (October 11)

Describe your most interesting case this week. The patient must be female.

Week 8 (October 18)

What is the most significant problem you have seen a radiation therapist overcome? What was the problem? How did he/she handle the situation? What was the outcome?

Week 9 (October 25)

It has been a busy day in the clinic. The radiation therapist you are working with is tired and ready to go home. You see that he/she is about to insert the wrong compensator. What should you, as a student, do? Explain the importance of effective communication in this situation.

Week 10 (November 1)

You are approached by a radiologic science student, interested in applying to a radiation therapy program. Sell him/her the experience.

Week 11 (November 8)

Make the most of your clinical rotation this week. Do something you have never done before. Describe this experience and how it made you feel. Will you include this in your daily/weekly/rotational routine? Why or why not?

Week 12 (November 15)

Describe your most favorite and your least favorite aspects of your current clinical rotation. Are there things you can do to make your experience a more positive one? Are there things others can do?

Week 13 (November 22)

Explain the roles of compassion, advocacy, and presence in radiation therapy. Tell about times when you or the radiation therapist(s) you were working with showed compassion, advocated for a patient/cause, and exhibited presence in the workplace.

Week 14 (November 29)

What were your misconceptions about the program? About the work of a radiation therapist? About the field of radiation therapy?

Week 15 (December 6)

Looking back on this semester, of what are you most proud? What do you hope to accomplish next semester?

Spring 2nd semester Weekly Writing Assignment

Due by e-mail to Dr. Adams (robert_adams@med.unc.edu) no later than 8 a.m. each Monday.

In one double-spaced page (Times New Roman, 12pt, 1 inch margins), please respond to the following:

Week 1 (January 13)

As you begin your second semester, of what are you most scared? To what are you most looking forward?

Week 2 (January 20)

You are a radiation therapy patient. Describe your experience from diagnosis to the end of treatment.

Week 3 (January 27)

Pick a patient (male or female). Describe his/her tumor(s) (location, stage, grade). Describe his/her set-up. Describe his/her treatment plan. Why is this plan the best for him/her?

Week 4 (February 3)

Describe your most interesting case this week. The patient must be male.

Week 5 (February 10)

Describe your most interesting case this week. The patient must be female.

Week 6 (February 17)

Describe your most difficult patient to date. Why was he/she and/or his/her set-up so difficult? What did you do to make his/her treatment easier?

Week 7 (February 24)

Describe one or more potential errors. Did you/would you report this/these errors? To whom? What did/could you do to prevent this/these errors?

Week 8 (March 3)

Now that you are well into your second semester, how has your confidence changed? Are you comfortable in the clinical setting? What is something you feel you do well?

Week 9 (March 10)

Describe your most embarrassing clinical experience. What did you learn?

Week 10 (March 17)

When performing a competency, what makes you most nervous? What competency was hardest for you to complete?

Week 11 (March 24)

How has your empathy for cancer patients changed? For patients' families?

Week 12 (March 31)

Get to know a radiation therapist (not the one you interviewed last semester. Where is he/she from? Where did he/she attend school (medical imaging and/or radiation therapy)? What does he/she do for fun? Why did he/she pursue a career in radiation therapy? How long has he/she been a radiation therapist? In his/her opinion, what is the most rewarding part of his/her job?

Week 13 (April 7)

What are the advantages and disadvantages of your current clinical site (i.e. UNC, Duke, Rex)? What do you like most? What do you like least?

Week 14 (April 14)

Which therapist has been most beneficial to your learning experience? Why?

Week 15 (April 21)

Looking back on this semester, of what are you most proud? What do you hope to accomplish next semester?

University of North Carolina (UNC) Hospitals

Medical Dosimetry Program

Assessment Plan

Fall (1st semester) 2013 – Summer (3rd semester) 2014

Mission Statement: The UNC Hospitals Medical Dosimetry Program prepares outstanding entry-level medical dosimetrists with an ability to evaluate treatment processes to enhance patient safety.

Goal 1: The student will be clinically competent in the planning of treatment.

Outcome	Measurement Tool	Benchmark	Timeframe	Responsible Party	Results
The student will demonstrate clinical adaptability.	1) Overall Evaluation Form (1,4) 2) Overall Evaluation Form (3)	1,2) At least a 4 on a 5 point scale in the 1 st and 2 nd semesters, and a 5 on a 5 point scale in the 3 rd semester	Formative: 1 st and 2 nd semesters Summative: 3 rd semester	Program Director (reported annually to the advisory committee)	(Fall) 2013: (1) 4.8 out of 5 (3) 4.7 out of 5 (4) 4.6 out of 5
	3) Graduate survey (IIF)	3) At least a 4 on a 5 point scale	Annually		2009-2012: 4.2 out of 5
	4) Employer survey (IIG,H)	4) At least a 4 on a 5 point scale	Annually		2009-2012: 4.3 out of 5
The student will demonstrate treatment planning skills.	1) Overall Evaluation Form (4) 2) Competency Evaluation	1) At least a 4 on a 5 point scale in the 1 st and 2 nd semesters, and a 5 on a 5 point scale in the 3 rd semester 2) 5 completed competencies in the 1 st semester, 10 (15 total) in the 2 nd semester, (31 total) in the 3 rd semester	1) Formative: 1 st and 2 nd semesters Summative: 3 rd semester 2) 1 st , 2 nd , and 3 rd semesters	Program Director (reported annually to the advisory committee)	(Fall) 2013: 1) (4) 4.6 out of 5 2) 100%
	3) Graduate survey (IC,D)	3) At least a 4 on a 5 point scale	Annually		(Fall) 2013: (IC) 4.6 out of 5 (ID) 4.8 out of 5

					5
	4) Employer survey (IC,D)	4) At least a 4 on a 5 point scale	Annually		(Fall) 2013: (IC) 4.8 out of 5 (ID) 4.8 out of 5

Goal 2: The student will communicate effectively with patients, faculty, and staff.

Outcome	Measurement Tool	Benchmark	Timeframe	Responsible Party	Results
The student will demonstrate oral communication.	1) Competency Evaluation (12)	1) 100% pass rate	Formative: 1 st and 2 nd semesters Summative: 3 rd semester	Program Director (reported annually to the advisory committee)	(Fall) 2013: 100%
	2) Graduate survey (IIK)	2) At least a 4 on a 5 point scale	Annually		2009-2012: 4.1 out of 5
	3) Employer survey (IIK)	3) At least a 4 on a 5 point scale	Annually		2009-2012: 4.2 out of 5
The student will demonstrate written communication.	1) Independent Research Project Rubric	1) At least a 3 on a 5 point scale in the 1 st and 2 nd semesters, and a 4 on a 5 point scale in the 3 rd semester	Formative: 1 st and 2 nd semesters Summative: 3 rd semester	Program Director (reported annually to the advisory committee)	(Fall) 2013: 3.3 out of 5
	2) Graduate survey (IIK)	2) At least a 4 on a 5 point scale	Annually		2009-2012: 4.2 out of 5
	3) Employer survey (IIK)	3) At least a 4 on a 5 point scale	Annually		2009-2012: 4.2 out of 5

Goal 3: The student will develop critical thinking skills to enhance patient safety.

Outcome	Measurement Tool	Benchmark	Timeframe	Responsible Party	Results
The student will develop patient safety skills.	1) Completion of a Lean CQI class on “good catches,” A3s, and kaizens	1) Completion of training during orientation	Annually	Program Director (reported annually to the advisory committee)	(Fall) 2013: 100%
	2) Graduate survey (IIH)	2) At least a 4 on a 5 point scale	Annually		2009-2012: 4.2 out of 5
	3) Employer survey (IIH)	3) At least a 4 on a 5 point scale	Annually		2009-2012: 4.0 out of 5

Goal 4: The student will demonstrate professionalism.

Outcome	Measurement Tool	Benchmark	Timeframe	Responsible Party	Results
The student will behave and act professionally (on time, reliable, dressed professionally)	1) Overall Evaluation Form (2)	1) At least a total 4 on a 5 point scale in the 1 st and 2 nd semesters, and a 5 on a 5 point scale in the 3 rd semester	Formative: 1 st and 2 nd semesters Summative: 3 rd semester	Program Director (reported annually to the advisory committee)	(Fall) 2013: (2) 4.1 out of 5
	2) Graduate survey (IIIL)	2) At least a 4 on a 5 point scale	Annually		2009-2012: 4.1 out of 5
	3) Employer survey (IIIL)	3) At least a 4 on a 5 point scale	Annually		2009-2012: 4.2 out of 5
The student will participate in continuing education.	4) Graduate survey (IVA,B,C,D)	4) At least a 4 on a 5 point scale	Annually		2009-2012: 4.7 out of 5
	5) Employer survey (IIIP)	5) At least a 4 on a 5 point scale	Annually		2009-2012: 4.8 out of 5
The student will communicate professionalism both orally and through the written word.	6) Written and oral presentations based on professional questions	6) At least a grade of 80 in the presentations	1 st semester MD500, 2 nd semester MD 514, 3 rd semester MD 512	Dr. Adams 1 st , 2 nd , 3 rd semesters (teaches each class)	1 st semester Fall 2013: 92 out of 100

