Self-Study

Radiation Oncology
Physics Residency Program

Department of Radiation Oncology
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Prepared for:
Commission on Accreditation of Medical Physics Education Programs, Inc.

by

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I. PROGRAM OVERVIEW

I.A Program Objectives

The program is intended to provide comprehensive training and experience in radiation oncology physics to candidates with Ph.D. degrees in physics, medical physics or a closely related field. The training involves full participation of the physics resident in the clinical routine, under the supervision of the Program Director and the program faculty. Comprehensive training and experience are provided in the broad areas of equipment calibration, radiation dosimetry, treatment planning, radiation shielding, facility design, radiation protection and quality assurance. The program is designed in accordance with the essentials and guidelines contained in the residency document of the American Association of Physicists in Medicine (AAPM Report No. 90 (Revision of TG-36): Essentials and Guidelines for Hospital Based Medical Physics Residency Training Programs, 2006). After successful completion of this training program, the candidate should have covered the essential curricula for the board certification examination in radiation oncology physics.

The Medical Physics Program is fully integrated into the day-to-day operations of the Clinical Radiation Oncology Department. There is constant interaction between the medical physics residents and the staff radiation oncologists. In addition, medical physics residents have ample opportunities to interact with other departments, especially Diagnostic Radiology and members of the medical staff in the Neurosurgery Department, Ophthalmology and other clinics as they relate to patient care. Interaction between medical physics residents and radiation oncologists is such as to provide both instruction and clinically relevant information necessary for proper patient care.

I.B Organizational Structure

The Department of Radiation Oncology is part of the Medical School and the University of Minnesota Medical Center - Fairview (UMMC). The University of Minnesota Medical Center Hospital is responsible for the clinical support of radiation oncology, including the facility, equipment and technical staff (radiation therapists, dosimetrists, nurses and hospital clerical staff). The professional and academic component is under the University of Minnesota Medical School. The staff physicians and medical physicists are on the faculty of the Medical School. Both Staff and Residents (medical and medical physics) are supported by the medical school and through contracts between Fairview and the University Medical Center (Appendix 1).

The Department of Radiation Oncology is divided into three sections: Clinical Radiation Oncology, Radiation Physics and Radiobiology. It occupies over 25,000 sq. ft. of hospital space for clinical, research and teaching purposes and 2,850 sq. ft. of laboratory space for Radiobiology in the Academic Health Center (Medical School). Both the Hospital and Academic Health Center are located in adjoining buildings.

The Department is staffed at UMMC with 5 radiation oncologists, 4 FTE medical physicists, 6 radiation therapists, 3 dosimetrists, 2 radiation oncology nurses, 1 department manager, 1 radiobiologist, 1 maintenance engineer, 6 medical residents, 2 medical physics residents, 1 department administrator and secretarial personnel, including 1 Executive Secretary for the Radiation Physics Section. Medical Physicists and medical physics residents are administratively under the University of Minnesota Medical School and receive funding through contract with Fairview for providing clinical physics support to the Department of Radiation Oncology. (Appendix 2)

The staff (radiation oncologists and medical physicists) provide clinical service to University of Minnesota Medical Center (about 700 new patients/year), the VA Medical Center, Radiation Therapy Department, Hennepin County Medical Center and the Radiation Therapy centers in Wyoming, and Maple Grove Minnesota. Medical physics residents receive their training at the University of Minnesota Medical Center. (Appendix 3)

The support of the department and the administration for the CAMPEP accreditation is evidenced by the letters attached in (Appendix 4).

I.C. History of Program Development

The Department of Radiation Oncology has participated in graduate programs in Radiation Oncology (M.S. degree for radiation oncologists) and Biophysics/Medical Physics (M.S. and Ph.D. degrees for medical physicists) since the early 1960's. The latter degree program continues to be an active program with an average of about 30 graduate students enrolled in Biophysics and Medical Physics, University-wide, at any given time.

From the early 1960's to 1992, clinical training of medical physicists was primarily offered through on-the-job-experience, supervised by staff medical physicists. Although not structured according to any national guidelines, the department provided the opportunity and environment for graduate students and physics graduates to obtain clinical experience through employment, eventually enabling them to get board certification. About 15 medical physicists obtained their clinical training from this department during this period.

With the introduction of AAPM residency training guidelines, the Department started a formal Medical Physics Residency Program with the first resident enrolled in 1991. Since then we have conducted the program in accordance with the AAPM guidelines with 2 medical physics residents at any given time.

Since 1991, twelve medical physicists have successfully completed our residency program and are currently employed in various institutions as staff medical physicists. Eleven of our residency graduates have achieved board certification. One dropped out of the program, one failed to complete the program and two are currently enrolled. This information is provided in (Appendix 5). Our program has received AAPM residency fellowships three times during the past 5 years.

After the retirement of Dr. Khan in the beginning of 2002, a revision of the structure of the medical physics residency program was undertaken. The rotation objectives, their description and the means by which to keep track of the topics covered by the residents were all more clearly defined. In addition, we have instituted a computerized evaluation system (E-Value) that automatically reminds the rotation mentor at the end of the rotation to perform the evaluation of the resident. Additionally, this system reminds the resident to perform the evaluation of the mentor. That way we have cross review of both the mentor and the resident. The computerized reminders continue until the evaluations are completed. This data is stored electronically and is printed for review by the mentors, the residents and the Program Director.

The process associated with the resident reports has also been formalized. A prospective report schedule is given to the resident upon their arrival into the program. The schedule details when the report is to be handed to the report reviewers, and when the report is to be presented formally to the staff. A description of the expected report content was also developed, along with formal report evaluation sheets.

Finally, several other short rotations in the CT simulator, the treatment machines, through nursing and with the radiation protection division of the University of Minnesota have been added to the program. This was done to broaden the resident's view of radiation therapy and radiation protection as a whole. The residents also travel to the ADCL in Madison, WI to see the formal calibration of chambers and electrometers along with other ADCL functions. This trip is coordinated with the faculty of the University of Wisconsin before departure of the resident.

II. TRAINING REQUIREMENTS

II.A Requirements for Program Completion

In order to complete our residency program, the physics resident must:

1. Successfully complete rotations through all clinical areas of the program. The physics resident is assigned to a staff physicist by rotation to perform clinical tasks under his/her supervision. These tasks are part of the routine clinical service that the Physics Section provides. Clinical duties and responsibilities of the staff physicists are listed in Appendix 2.
2. Successfully pass didactic courses listed in Section II B.1. A medical physics graduate is exempted from taking all the coursework except the two courses in radiation oncology physics (TRAD 7170 and TRAD 7173).
3. Prepare, present and successfully complete special reports on topics which are selected to cover major categories of medical physics practicum (e.g. categories of a board certification exam). These selected projects which can be revised as needed, are listed in Section II.B.3.
4. Participate/attend various department conferences, lectures and meetings that are considered relevant to the resident's training listed in Section II.B.4.
5. Obtain evaluations given at the end of each quarterly rotation with the staff physicists and complete assignments, if given, to make up any deficiencies.
6. Pass Oral Examination after first year.
7. Pass final Oral Examination at the end of residency.

A certificate is awarded on completion of the residency program (Appendix 6).

II.B. Training Essentials - Design and content

II.B.1 Didactic Training

Starting with the fall quarter, the physics resident receives didactic instruction in the radiation oncology physics, diagnostic radiology physics, nuclear medicine physics, radiation biology, radiation oncology, anatomy and physiology. The following courses offered at the University of Minnesota cover these areas:

TRAD 7170	Basic Radiological Physics
TRAD 7172	Radiation Biology
TRAD 7173	Physics of Radiation Therapy
BPHY 5171	Medical and Health Physics of Imaging I
BPHY 5174	Medical and Health Physics of Imaging II
RT 411	Principles and Practices of Radiation Oncology I
RT 412	Principles and Practices of Radiation Oncology II
	Seminars: Fundamentals of Clinical Oncology

Course outlines are given in (Appendix 7). A record of successful completion of didactic courses based on grades is kept on file for individual residents.

The resident is given time to attend the above classes and must pass the examinations associated with these courses. The results of these exams are placed on record in the resident's file.

II.B.2 Practical Experience

In parallel to the didactic course work, the physics resident is assigned to a staff physicist by rotation to perform clinical tasks under his/her supervision. At the end of each rotation (3 months), the staff physicist holds a review session with the resident. Additional literature reading assignments may be given at this time to strengthen theoretical understanding of various clinical procedures. A resident evaluation form is completed for that rotation and put in the resident's file.

The following broad areas are covered during the two years of residency period. Specific areas of concentration are listed in the "Calendar of Activities" and the following rotation expectations and checklists. (Appendix 8) At the end of two years, the resident should be competent in the following areas:

a. Treatment Equipment (Teletherapy)

- Calibration: calibration according to protocol, acceptance testing, commissioning, beam data input into treatment planning computers, verification of computer isodose distributions, surface dose measurement, buildup dose determination, determination of parameters for monitor unit calculations.
- Radiation Protection: head leakage, neutron contamination, area survey, design specifications, facility shielding design.

- Quality assurance: daily, monthly and annual checks of all equipment.

b. CT Simulator

- Testing: acceptance testing and commissioning.
- Radiation Protection: beam quality, head leakage, and area survey.
- Quality assurance: mechanical, radiation dose, beam representation, and processor.

c. Dosimetric Equipment

- Ion chambers: use of Farmer Chamber, plane-parallel chambers, survey meters (calibration and use), radiation field scanner (computerized water phantom), dose calibrator and deep-well ionization chambers (brachytherapy).
- TLD: annealing procedures, calibration, use of TLD powder capsules, chips, in-vivo dosimetry.
- Film: film dosimetry for electrons and photons, sensitometric curve determination.
- Quality Assurance: Chamber calibration and intercomparisons, TLD quality control, and survey meter calibration checks.

d. Treatment Planning

- Equipment: Acceptance testing and commissioning of treatment planning computer, digitizer, plotter and other auxiliary devices.
- Software: Check of computer algorithms for isodose generation, blocking, inhomogeneity and other benchmark tests.
- Imaging: Check of CT and MRI images for accuracy of contour delineation, magnifications; CT numbers vs. electron density curve.
- Isodose Plans: Treatment technique design and optimization, plan display and evaluation; conventional, 3-D conformal and IMRT treatment planning.
- Quality Assurance: Point dose verification by manual calculation.

e. Treatment aids

- Field Shaping: custom blocking, multileaf collimators, half-value thickness blocks, gonadal shields, eye shields, internal shields with electrons.

- Bolus: material and thickness.
- Compensators: design of missing tissue compensators and dosimetry check.
- In-vivo Dosimetry: use of TLD chips, diodes.
- Patient Positioning: immobilization devices, body position, leveling, anatomic landmarks registration.
- On-line Imaging: verification of electronic portal images in comparison with simulation images.

f. Special techniques

- TBI: Establishing dosimetry protocol for total body irradiation technique including dose calculation formalism, compensation and dosimetric verification.
- TSI: Establishing total skin irradiation technique including treatment parameters, dosimetry and in-vivo checks.
- Electron Arc Therapy: Treatment planning and technique for electron arc therapy, and special dosimetry.
- Intraoperative Electron Therapy (if available): Acceptance testing, commissioning, and complete dosimetry of applicators and other treatment conditions specific to IORT.
- IMRT: Intensity modulated radiation therapy, theory, practice, and program initiation.
- Gamma Knife: Licensing, training and training requirements, radiation protection considerations, shielding calculations, acceptance testing, commissioning, treatment planning, continuing quality assurance, control of radioactive materials and security issues.
- TomoTherapy: theory, practice, and program initiation and commissioning.

g. Stereotactic Radiosurgery

- Specifications: Acceptance testing and commissioning of radiosurgery apparatus, beam data acquisition for small fields, data input into the treatment planning computer, and testing of dose calculation algorithm by head-phantom dosimetry.

- Treatment Planning: Acquisition of CT, MRI, angiographics data; planning of isodose distributions in 3-D, plan evaluation, generation of treatment parameters.
- Quality Assurance: QA checks before each case.

h. Patient Dose Calculations

- Dosimetric Quantities: Percent depth dose, TPR, TMR, TAR, etc. and their relationship.
- Monitor Unit Calculation: Calculations for different treatment conditions and techniques, verification of calculation formalism using bench mark problems.

i. Brachytherapy (conventional low dose rate and high dose rate)

- Calibration: Acceptance testing and commissioning of brachytherapy sources and applicators.
- Source Preparation: Preparation of sources and applicators for implantation.
- Radiation Protection: Radiation surveys, leak testing and other requirements of regulatory agencies.
- Treatment Planning: Computer isodose distributions, check of dose calculation algorithm, implant system rules and dose specification.
- NRC-Mandated Quality Management Program: Detailed Review of QMP document, implementation and audit.

j. Quality Assurance Program

- Design or review of physical quality assurance program for the department, including the NRC mandated Quality Management Program, AAPM Report (TG-40), JCAHO guidelines, etc.

II.B.3 Special Reports

In addition to the above practicum as part of the routine clinical work, the physics resident will be required to prepare a report on selected practical projects which will include the following as a minimum:

a. Radiation Detectors: ion chamber, triax cable, electrometer, (2) Film: XV2, EDR2, Radiochromic, (3) TLDs, and (4) Diodes;

b. Calibration of treatment units: orthovoltage X-ray units; full calibration of linear accelerators: photon and electron beams;

c. Operation, acceptance testing and commissioning of linear accelerator (x rays and electrons);

d. Acceptance testing and commissioning of treatment planning computer, explanation of algorithm;

e. Room shielding design for simulator, CT, orthovoltage and megavoltage facility and radioisotope storage, radiation protection survey-linac;

f. Special Procedure: IMRT, TomoTherapy;

g. Acceptance testing and commissioning of brachytherapy apparatus and sources (LDR and HDR).

II.B.4 Conferences

The medical physics residents participate in all departmental educational conferences which the staff medical physicists are required to attend. Presently these include:

- New patient (1 conference/week): brief medical histories, diagnostic studies and initial plan of treatment of new patients are discussed. The conference is attended by radiation oncologists, medical physicists, dosimetrists, residents, chief therapist and a nurse.
- Treatment planning (1 conference/week): Detailed medical histories, diagnostic workup, treatment plans and treatment ports are discussed for new patients that have started treatments. Attended by all personnel, as above.
- Complications (1 conference/month): Patients who have been treated in the past and have developed any treatment complications are reviewed and discussed in detail to determine possible causes of complications. Attended by Radiation Oncologists, medical physicists and residents.
- Special lectures and Seminars (as scheduled by the department, 1 presentation/week during Fall & Spring semesters

II.B.5 Educational Training

Residents are required to teach in the radiation therapy school. Medical and physics residents attend common physics classes. Physics residents do not teach medical residents because of the department policy/restriction which stipulates that medical residents must be taught by board certified physicists.

II.C Program Length

The length of training will be two years. The training calendar will normally start on July 1. During the first three months, the physics resident will receive orientation lectures and demonstrations in the clinic. The resident will work with a staff physicist to observe and participate in treatment planning, treatment simulations, patient dosage calculations, calibrations, clinical dosimetry, quality assurance, and other physical and technical tasks performed in the clinic. During this time the resident should develop an overall understanding of the physicist's role in the clinic.

Residents with non-medical physics degrees are required to take didactic courses in medical physics, in parallel with their practical training.

II.D Sample Training Plan

The resident will follow a "Calendar of Activities" which includes staff rotations and special reports (Appendix 8). Staff physicists provide clinical service to the department which includes all aspects of clinical physics (see Appendix 3 for staff responsibilities). The resident is assigned to staff physicists by rotation every three months The resident performs clinical work under direct supervision of the staff physicist and thus gets full experience in performing all clinical physics tasks.

II.E Training Administration

The Medical Physics Residency Training Committee, which includes the medical physics staff and a radiation oncologist, is responsible for reviewing the training program. Continuing review of the program is done as needed through monthly physics meetings which are held on a regular basis to discuss all departmental medical physics matters including the residency program and the resident performances. Formal review of the program including training essentials and clinical rotations is done once a year.

III. RESIDENTS

III.A Admissions

III.A.1 Entry requirements

Candidate must have completed their Ph.D. degree in Physics, Medical Physics, or a closely related discipline before acceptance into the program. The applicant's undergraduate and graduate education should demonstrate knowledge acquired in the following areas:

a. Fundamental physics
b. Advanced mathematics
c. Advanced atomic and nuclear physics
d. Electronics
e. Computers
f. Physical chemistry

III.A.2 Applications and Selections

Prospective candidates are directed to our website at www.trad.umn.edu where they will find information about the department, the medical physics residency program, the application procedure and the application form. (Appendix 9).

At the end of applications' closing deadline, all applications are reviewed by the Physics Section Secretary for completeness. The Medical Physics Residency Training Committee reviews and grades all applications which are then discussed in a special meeting to finalize the ratings for interview. Scores are averaged to select 2-3 top candidates for interview. The evaluation forms are attached. (Appendix 10).

Selected candidates are invited for interview at their own expense. The interview grades are discussed and averaged at a special meeting of the Medical Physics Residency Training Committee. The residency position is offered to the top rated candidate or the next in line, depending upon the availability of the candidate.

Admission Records are available for the site visit.

III.B Recruitment Efforts

The Department advertises the residency positions in the AAPM Placement Service, Medical Physics list server (INTERNET) and occasionally in Physics Today. A sample is enclosed in (Appendix 11).

III.C Number of Residents

The program is approved for two residents. Normally, the appointments to residency positions are staggered so that one resident is in the second year of residency while the other is in the first year, however, due to one resident dropping out this could not be maintained in 1998. The current two residents and their status are as follows:

1. Guangwei Mu, Ph.D.:

Second year resident: start date July 27, 2007. The position is supported through contract with Fairview.

2. Summer Chadari, Ph.D.:

First year resident: start date July 1, 2008. The position is supported through a commitment from the Dean of the Medical School.

III.D Evaluation of Resident Progress

At the completion of each rotation with the faculty staff (quarterly), the staff meets with the resident to review the rotation and evaluate the resident's knowledge and understanding of the rotation objectives. An evaluation using E-Value is then prepared, shared with the resident and placed in the resident's file (Appendix 12). If the average score at the end of the rotation as shown on the E-Value system is less than 3, then the resident will have failed this rotation. The progress report is then reviewed by the Program Director who discusses the report with the resident. If there are questions regarding the resident's progress, they are reviewed with the rotation mentor. If the evaluation seems to be a fair evaluation of the performance of the resident, a plan will be formulated for the resident to overcome the deficiencies of the rotation. The resident will be expected to both overcome the deficiencies of the failed rotation and meet the expectations of the current rotation. If two rotations are failed it will be decided by the physics staff if the resident is to be terminated at this time. If the resident is allowed to continue in the program, they will be on probation status and a program for overcoming these severe deficiencies will be outlined.

Grades received by the resident in the didactic course exams are reviewed by the Program Director as they are received and filed in the office. A grade of B or greater is required to fulfill the grade requirement of satisfactory completion of the course.

Any complaints or concerns about the resident's work in the clinic is brought to the attention of the Program Director who would investigate the matter using due process (interviews, written evaluations, etc.).

A yearly oral exam is given by the faculty examining panel to evaluate the resident's progress and the state of his/her knowledge of the field. For the first year exam, if the average score obtained by the resident is less than or equal to1.5, then the resident is automatically terminated from the program. If the average score obtained by the resident is greater than 1.5 but less than 3, then remedial action will be defined for the residents, and a second exam will be scheduled within the next two months. If the performance of the resident on the make-up exam is less than 3, then the resident will be terminated from the program. If the resident attains an average score of greater than or equal to 3, then they will be allowed to continue in the program.

The second year exam will be given in the 22nd month of the medical physics resident's rotation after all didactic coursework is completed. Their performance in required classes will be taken into account in the scoring of the second year exam. For each course that cannot be retaken where a grade of B or greater is not obtained (the requirement for satisfactory completion, Section III. D, paragraph 2), a 1/2 point reduction will be made in the average score obtained on the final examination. The requirement for passing the second year exam will be an average grade of greater than or equal to 3 on this second year exam taking the reductions mentioned above into account in deriving the final average score. If the average score is less than or equal to 1.5 for this final exam, then the resident will not complete the program and no certificate will be awarded. If the average final exam grade is greater than 1.5 but less than 3, then a remedial course of action will be defined, and a second exam will be given in the remaining two months of the program. If their performance on the retest results in an average score that is less than 3, then the resident will not graduate from the program. If an average score of greater than or equal to 3 is attained on this retest, then the resident will have successfully completed this requirement of the program.

III.E New Resident's Orientation

The new resident first goes through an orientation program of the Fairview-University Medical Center and then a two week orientation in the department consisting of lectures and a detailed tour of the department (Appendix 13). A special lecture is given on radiation protection, as required by the Department of any new employee working in the radiation designated or "controlled" areas. In addition, they are required to view a series of radiation protection lectures on tape and pass a test to show proficiency.

IV. PROGRAM ADMINISTRATION

IV.A Structure within the Medical Center

Residents obtain their clinical training in the Department of Radiation Oncology of the University of Minnesota Medical Center. The faculty responsible for training of the residents consists of radiation oncologists and medical physicists who are on staff of this Department. The medical physics faculty and a selected radiation oncologist constitute the Medical Physics Residency Training Committee. The Head of the Radiation Physics Section, Dr. Bruce J. Gerbi, is the Program Director who is responsible to the Medical Director, Dr. Kathryn Dusenbery, who is in turn responsible to the Dean of the Medical School. The program is administered by the Program Director and the Medical Physics Residency Training Committee.

IV.B. Role of Program Director

The Program Director is responsible for coordinating the staff, advising the residents, and evaluating and promoting the program. Being also the Head of the Radiation Physics Section, the Program Director is responsible for the medical physics program of the Department, including the administration of clinical service. The Program Director works with the Residency Committee in formulating and instituting policies and conducting the residency training. In regard to administrative aspects of the residency program, the Program Director is assisted by Connie Blasing who is the Executive Assistant to Dr. Gerbi. Administrative liaison to the Medical Director and the Dean of the Medical School is provided by Ms. Linda Kenny. The Program Director also works closely with Ms. Val Harshe, who is the Department Manager and Ms. Jane Klein, Sr. Director of Radiology for the University of Minnesota Medical Center.

IV.C. Committee Meetings

The medical physics section evaluates the effectiveness of the program, suggests changes and improvements, and implements these changes in the program. Meetings are held monthly at the end of the physics section meeting. This meeting is attended by the medical physics staff, the dosimetry staff, and the medical physics residents. The residency education committee is ultimately responsible for the medical physics residency program. All changes to the program's structure, function or content shall be reviewed and approved by the committee on either an annual basis or as needed. Resident progress is reviewed and evaluated at these meetings. Minutes of the two above meetings are kept for review. In addition, ad hoc meetings are held to informally discuss aspects of the program or resident progress. Every effort is made to provide enough information for the committees to make meaningful decisions about the progress of the resident while protecting their privacy.

IV.D Records Available for Review.

The following records pertaining to medical physics residency program are available for review: 1) application records, transcripts and candidates CVs 2) application evaluations and interview ratings; 3) quarterly rotation evaluations; 4) didactic course exam records; 5) quarterly conferences and meetings (attendance and/or minutes). Residency program and candidates files are located in the Physics office.

V. RESOURCES

V.A. Staff

The department is staffed with seven radiation oncology physicists. Ms. Jane Johnson works at the Wyoming Lakes Clinic and Dr. Lihong Qin works at the Minneapolis VA Radiation Therapy Department. About 20 hrs per week of coverage is given to the Hennepin County Therapeutic Radiology Clinic and the rest of the physicists work at the University of Minnesota Medical Center - Fairview (UMMC). The residents receive their training at the UMMC clinic with visits to HCMC and Wyoming Lakes. All staff physicists participate in teaching and research but most of their time is spent in providing clinical service. The residents to physics faculty ratio is about 1:3. All staff physicists are board certified in radiation oncology physics and are directly involved in teaching and training of medical and physics residents.

V.B Staff Medical Physics Specialties

Biographical sketches of medical physicists involved with the residency training enclosed in the (Appendix 14).

V.C Financial

V.C.1 Financial Burden

The typical financial burden of a physics resident, based on data provided by residents, are as follows: *

- Rent for housing $1200/month
- Food $200/month

- Car Insurance $70/month
- Gas $40/month
- Utilities $40/month
- Books $200/semester

*****Annual cost of living index for Minneapolis is 114, according to MN Dept. of Trade and Economic Development.

V.C.2. Resident Funding

The following funding levels are in effect for physics residents:

Year	Salary	Fringe Benefits
1	$41,000	18.12% plus medical insurance for employee and their dependents, 22 days of vacation per year, tuition benefits, and workers compensation.
2	$43,000	18.12% plus medical insurance for employee and their dependents, 22 days of vacation per year, tuition benefits, and workers compensation.

Fringe benefits include Social Security, Medicare, tuition and health insurance.

Note: Salaries of medical physics residents are currently less than those of medical residents (~ 75-80% level) since they have two more weeks per year of vacation and a larger professional allowance.

The department will reimburse the resident for professional expenses incurred up to $3,000 during the course of their residency (accrued at $1,500.00 per year including books, travel and professional membership fees). Books are reimbursable in $200 increments. Receipts for reimbursement for these items must be submitted to the Physics Section Administrator. The University of Minnesota is tax exempt and therefore will not reimburse Sales Tax nor will the University of Minnesota reimburse any liquor expense. If the expenses exceed $3,000 over the course of the two-year residency, then the resident would be responsible for any additional expenses.

V.D Facilities

V.D.1 Resident Offices, Classrooms, and Conference Rooms

Residents have an assigned office. They have access to personal computers both in their office and in the computer treatment planning room (where they spend most of their working hours in the clinic), office supplies, copying and faxing equipment, etc.

Department conference and classrooms have adequate capacity and are well equipped for conferences and meeting functions. Classes are held in the departmental conference room.

V.D.2 Clinical Facilities, Laboratories, Shops, Library

a. Treatment Machines: Currently the department has:

   Philips Orthovoltage

   Varian Clinac 2300 CD, with multileaf collimators, x-ray beams of 6 MV and 25 MV and electron beams of 6, 9, 12, 15, 19, and 22 MeV.

   Elekta Synergy with x-ray beams of 6, 10 and 18 MV and electron beams of 6, 9, 12, 15, and 18 MeV.

   Tomotherapy Unit with 6MV x rays

b. CT Simulator: Philips Big Bore CT simulator

c. Brachytherapy: ^{137}Cs for GYN implants, ^{192}Ir and ^{125}I for COMS eye plaques and a Varian HDR unit

d. Stereotactic Radiosurgery Unit: Philips system with BRW frame, SRS apparatus and Radionics XKnife-4 treatment planning system. Gamma Knife unit operational April, 2005.

e. Dosimetry Equipment: Wellhofer and Scanditronix water phantom, calibration water phantom, plastic phantoms, Rando phantom, electron arc dosimetry phantoms; three Farmer type 0.6 cc ion chambers, extrapolation chamber, four plane-parallel chambers, three Keithley electrometers; diodes, LiF-TLD system, RIT and Wellhofer film dosimetry systems; ion chamber survey meter, BF_3 neutron meter, GM counter, two deep-well ionization chambers, aneroid barometer, digital barometer, thermometers, diode constancy and patient monitoring system.

f. Electronics lab, treatment aid and machine shop; hospital scientific apparatus shop.

g. Well equipped radiation oncology clinic with 7 exam rooms.

h. Well equipped radiation biology and immunology labs.

i. Treatment planning computer systems:

3-D treatment planning system: Philips Pinnacle, Eclipse planning system with IMRT and electronic compensation, TomoTherapy treatment planning system, Brachyvision HDR and LDR planning system. All computers are networked with on-line access to Internet.

j. Access to imaging equipment (CT, MRI, PET/CT, US, etc.) through Diagnostic Radiology Department. Images available for treatment planning or as PACS images.

k. IMPAC record/verify/scheduling system.

l. Library: Books and journals related to medical physics are available in the department library, medical school library and other University libraries on campus.

m. On-line access to the University Of Minnesota – TC library system and their affiliates.

VI. SUMMARY OF STRENGTHS AND NEEDS

VI.A. Strengths

The physics residency program is in the sixteenth year of its existence. Particular strengths of the program are its experienced staff that have been involved in medical physics residency training for many years. In addition, the physics staff is intimately involved in the day to day clinical operations of the department. There is strong acceptance by the physicians and other personnel of the role of the medical physics residents and equality of status with the medical residents in the department. All of this is predicated by the strong support by the Department Chairman and other physician faculty members.

VI.B. Needs

The current needs of the medical physics residency program are primarily associated with the needs of the department. Specifically, there is a need to upgrade the linear accelerator components of the department to more modern units.

VI. C. Further Developments and Improvements

Since the structure of the program has been changed significantly at this particular point the primary means of strengthening the program would be to streamline the evaluation, feedback and documentation process associated with the program. In addition, the checklists for clinical rotation expectations need further evaluation for adequacy.

Appendix 1: Radiation Therapy Physics Contract

EXHIBIT 1.2

SERVICES TO BE PROVIDED
BY UMPHYSICIANS MEDICAL PHYSICIST PERSONNEL

Incorporated herein as though fully set forth at length are the Duties and Responsibilities of Medical Physicists providing services to Fairview-University Medical Center.

Medical physicists at Fairview-University Medical Center are "qualified medical physicists" in accordance with the definitions provided by the American Association of Physicists in Medicine ("AAPM") and the American College of Medical Physics ("ACMP"). They have Ph.D. or M.S. degrees in Physics, Medical Physics or within biophysical sciences and specialty clinical training in radiation oncology physics. They are all board-certified or board-eligible in the subspecialty of radiation oncology physics. They hold a faculty appointment in the Department of Therapeutic Radiology at the University of Minnesota Medical School. The roles and responsibilities of medical physicists are well established and are generally described in the AAPM literature and other publications, such as the American College of Radiology.

The duties and responsibilities of medical physicists are listed below:

Acceptance testing, calibration, commissioning and quality assurance of radiation oncology equipment: linear accelerators, simulator, treatment planning computers, brachytherapy equipment and radioisotopes, radiosurgery apparatus, and hyperthermia.

State and federal agencies have mandated quality assurance programs for all of the above equipment. Physicists are to follow the most up-to-date national protocols for a comprehensive quality assurance program. Quality assurance checks are conducted prior to the use of equipment, daily, monthly and annually.

Re-commissioning or re-calibration of the above equipment after major servicing and repairs.

Physics consultation sought by physicians for treatment techniques, patient set-up and treatment planning.

Participation as consultant for each patient simulation and CT data acquisition.

Computer treatment planning of patients using contours, CT and MRI, optimal beam geometries and optimal beam energies.

Providing physics support for stereotactic radiosurgery program: CT and MRI data processing, computer treatment planning, set-up and accuracy check, fabrication and custom immobilization devices for fractionated stereotactic radiosurgery.

Three-Dimensional Conformal Radiotherapy: CT and MRI data processing, computer treatment planning, beams-eye-portal design and verification, multileaf collimator design and verification.

Total Body Irradiation ("TBI"): Treatment planning, dosimetry, TBI compensator design, patient set-up checks.

Implementation of national protocols in treatment planning and quality assurance.

Commissioning of special treatment techniques, such as total body irradiation, total skin irradiation, stereotactic radiosurgery, 3-D conformal therapy, dynamic multileaf and wedges, etc.

Establishment and management of dosimetry and monitor unit calculation formalism for patient treatments.

Design and quality assurance of treatment aid (compensators, boluses, eye-shields, internal shielding, beam modifiers, etc., and their testing.

Special dosimetry and dose calculations for complex treatments (small electron fields, intra-oral cones, total body irradiation, total skin irradiation).

In-vivo dose measurements (TLD, film, diodes).

Weekly patient chart review.

Final review of the treatment plan for each patient.

Physics coverage at Hibbing shall consist of a one day per week visit, video conference interaction or other interaction deemed suitable to ensure that patient treatment accuracy is being maintained and that radiation producing equipment is operating properly. Perform chart review, equipment calibration and weekly quality assurance. Five days per week availability for the review of all physics work done by dosimetrists through faxes and telephone, and installation of equipment as well as the annual complete calibration of equipment as mandated by regulatory agencies. Fairview will continue to pay for actual costs incurred and documented in accordance with Fairview travel policies for travel and related expenses for physics services in Hibbing.

PERSONAL SERVICE AGREEMENT

THIS AGREEMENT, is made and entered into as of July 1,2001 ("Effective Date"), by and between University of Minnesota Physicians, a Minnesota nonprofit corporation ("UMPhysicians"), and Fairview Health Services, doing business as Fairview-University Medical Center, a Minnesota nonprofit corporation ("Purchaser") (the "Parties" or "Party").

PREAMBLES

WHEREAS, UMPhysicians is organized to operate outpatient health care clinics and to provide medical services and services ancillary thereto, including administrative, management, and billing services to medical services professionals;

WHEREAS, Purchaser operates a hospital and clinics and desires to contract with UMPhysicians Department of Therapeutic Radiology to render certain services to inpatients and outpatients at Fairview-University Medical Center, hereafter referred to as "Service Site."

NOW THEREFORE, in consideration of the premises, the mutual covenants and agreements contained herein, the Parties agree as follows:

ARTICLE 1

Duties of UMPhysicians

1.1 <u>Provision of Services of UMPhvsicians Medical Physicist Personnel.</u> UMPhysicians shall provide Purchaser with the services of Medical Physicist personnel as set forth herein at Service Site, and if applicable approved through the Assistant Professional Staff credentialing process as outlined in the Medical Staff Bylaws.

1.2 <u>Professional Services.</u> UMPhysicians Medical Physicist Personnel shall provide those services described in <u>Exhibit 1.2</u> which is incorporated herein by this reference. The roles and responsibilities of medical physicists are well established and are generally described in American Association of Physicists in Medicine literature and other well known publications, such as the American College of Radiology.

1.3 <u>Schedule.</u> Each UMPhysicians Medical Physicist Personnel shall devote such attention and time to the performance of his or her duties as shall be mutually agreed upon from time to time by the Parties.

1.4 <u>Licenses and Credentials.</u> Each Medical Physicist Personnel shall be and, at all times that this Agreement is in effect, (1) be "qualified medical physicists" in accordance with the definitions provided by the professional organizations, the American Association of Physicists m Medicine (AAPM) and the American College of Medical Physics (ACMP) and have their Ph.D. or M.S. degree in Physics, Medical Physics or within biophysical sciences and specialty clinical training in radiation oncology physics; (2) be Board Eligible or Certified in the subspecialty of radiation oncology physics, and if applicable, be registered or licensed by the Minnesota

Department of Health; 3) hold a faculty appointment in the Department of Therapeutic Radiology at the University of Minnesota Medical School; 4) never have had their Board Certification or registration restricted, suspended or revoked because of improper practice, nor never been convicted, reprimanded or otherwise sanctioned for fraud under any state or federal tax laws, or under any state or federal health care reimbursement program, including, but not limited to, Medicare and Medicaid; (4) be credentialed under FUMC's Allied Health Staffs Credentials Policy, if applicable; (5) never have been convicted of any crime punishable as a felony or involving moral turpitude or immoral conduct; UMPhysicians shall notify Purchaser immediately if any of the above occur and any such UMPhysicians Medical Physicist shall immediately cease to be a UMPhysicians Medical Physicist Personnel hereunder. UMPhysicians shall immediately initiate a search to replace such UMPhysicians Medical Physicist Personnel with another Medical Physicist Personnel, acceptable to Purchaser. UMPhysicians represents and warrants that each UMPhysicians Medical Physicist presently complies with the requirements of this Section 1.4.

1.5 <u>Compliance with Purchaser Policies,</u> UMPhysicians Medical Physicist Personnel shall comply with any standards and policies of Purchaser or its agents related to the operation of Service Site, including, but not limited to, standards applicable to billing for services rendered, standards related to maintenance of medical and business records, and service standards for patients and referring physicians. UMPhysicians agrees (at no cost to Purchaser) that all Medical Physicist Personnel provide evidence of immunity to measles, mumps and rubella either by titer, vaccination or doctor's diagnosed history of the disease; current immunity Status regarding varicella (chicken pox) and document completion of current T.B. skin test (Mantoux) and/or follow-up if required, m addition, per OSHA (July 6,1992) each Medical Physicist Personnel shall have documentation regarding receiving or declining of the Hepatitis B vaccination series if potentially exposed to blood and body fluids.

1.6 <u>Payments for Professional Services.</u> All rights to payment from patients or third party payers for services provided by UMPhysicians Medical Physicist Personnel under the terms of this Agreement shall be the property of Purchaser. All rights to payment from patients or third party payers for services provided by UMPhysicians Medical Physicist Personnel that are outside the scope of this Agreement shall be the property of UMPhysicians.

1.7 Confidentiality of Patient Records. All medical information and/or data concerning specific patients (including, but not limited to, the identity of the patients), derived from or obtained during the course of the UMPhysicians Medical Physicist Personnel duties under this Agreement, shall be treated by the UMPhysicians Medical Physicist Personnel and Purchaser as confidential so as to comply with all applicable state and federal laws and regulations regarding confidentiality of patient records, and shall not be released, disclosed, or published to any party other than as required or permitted under applicable laws. The Parties shall to the extent applicable, comply with the Health Insurance Portability and Accountability Act of 1996 ("HEPAA"), and the regulations thereunder as amended to ensure the protection of "protected health information" as defined therein. The Parties further agree to amend this Agreement as necessary to comply with HIPAA, and if an agreement cannot be reached then this Agreement will immediately terminate. This provision shall survive termination of this Agreement.

1.8 Other Confidential Information. During the course of providing services, Purchaser, UMPhysicians and UMPhysicians Medical Physicist Personnel may have access to or become acquainted with confidential information relating to the other's business. The Parties on their own behalf acknowledge and understand the importance of maintaining such information confidential and agree to never use or disclose such information. Upon termination of this Agreement, the Parties agree to immediately return to the other Parties all records or other tangible documents which contain, embody or disclose, in whole or in part any confidential information. This provision shall survive the termination of this Agreement.

1.9 Control Over Medical Physicist Personnel Services. UMPhysicians is solely responsible for professional services rendered by UMPhysicians Medical Physicist Personnel at Service Site. Purchaser shall not exercise any control or direction in the provision of professional services rendered by UMPhysicians Medical Physicist Personnel.

1.10 Equipment. Purchaser shall provide all usual and customary equipment and supplies necessary for UMPhysicians Medical Physicist Personnel to provide the services required under this Agreement. All radiation equipment provided by Purchaser shall remain the sole and exclusive property of Purchaser, and UMPhysicians shall have no rights as to such radiation equipment. Purchaser shall be responsible for all maintenance and repair of such radiation equipment provided hereunder.

ARTICLE 2
Insurance

2.1 UMPhvsicians's Insurance. UMPhysicians shall maintain professional liability insurance in me amount of at least One Million Dollars ($1,000,000) per occurrence and Three Million Dollars (S3,000,000) in the aggregate on behalf of each UMPhysicians Medical Physicist Personnel. Such insurance shall be either occurrence or claims made with an extended period reporting option under such terms and conditions as may be reasonably required by Purchaser. Such insurance shall provide coverage for liability arising from an oral/written contractual indemnification clause. UMPhysicians shall authorize the insurance carrier to issue to Purchaser a certificate of insurance upon the request of Purchaser. UMPhysicians shall provide Purchaser with notice, as soon as possible (but in no event later than ten (10) days) of any cancellation, termination or material alteration of any such insurance policies. Prior to the expiration or cancellation of any such policies, UMPhysicians shall secure replacement of such insurance coverage upon the same terms and shall furnish Purchaser with a certificate as described above.

Failure of UMPhysicians to secure replacement coverage in the event of such cancellation, termination or material alteration of any such insurance policies shall be a default hereunder and Purchaser shall have the option to terminate this Agreement pursuant to Section 6.2.4.

2.2 Notice **Required.** UMPhysicians shall notify Purchaser as soon as possible but in no event later than ten (10) days of any actual or threatened claim, action, suit or proceeding related to activities undertaken pursuant to this Agreement and shall cooperate in all respects with Purchaser in the defense of any such claim, suit or proceeding.

2.3 **Purchaser's Insurance.** Purchaser shall maintain professional liability insurance in the amount of at least One Million Dollars ($1,000,000) per occurrence and Three Million Dollars ($3,000,000) in the aggregate. Such insurance shall be either occurrence or claims made with an extended period reporting option under such terms and conditions as may be reasonably required by Purchaser. Such insurance shall provide coverage for liability arising from an oraVwritten contractual indemnification clause. Purchaser shall authorize the insurance carrier to issue to UMPhysicians a certificate of insurance upon the request ofUMPhysicians. Purchaser shall provide UMPhysicians with notice, as soon as possible (but in no event later than ten (10) days) of any cancellation, termination or material alteration of any such insurance policies. Prior to the expiration or cancellation of any such policies. Purchaser shall secure replacement of such insurance coverage upon the same terms and. shall furnish UMPhysicians with a certificate as described above. Failure of Purchaser to secure replacement coverage in the event of such cancellation, termination or material alteration of any such insurance policies shall be a default hereunder and UMPhysicians shall have the option to terminate this Agreement pursuant to Section 6.2.4.

2.4 **Notice Required.** Purchaser shall notify UMPhysicians as soon as possible but in no event later than ten (10) days of any actual or threatened claim, action, suit or proceeding related to activities undertaken pursuant to this Agreement and shall cooperate in all respects with UMPhysicians in the defense of any such claim, action, suit or proceeding.

2.5 **Survival.** The provisions of Article 2 shall survive the termination of the Agreement with respect to any claim, action, or proceeding relating to actions or omissions alleged to have occurred during the term of this Agreement.

ARTICLE 3
Mutual Indemnification

Each Party to this Agreement shall defend, hold harmless and indemnify the other Party hereto against any and all claims, liabilities, damages, judgments, costs and expenses (including reasonable attorney's fees and costs) asserted against, imposed upon or incurred by a Party that arises out of, or in connection with, the Party's default under or failure to perform any contractual or other obligations, commitment or undertaking under this Agreement, or the malpractice or negligence of the Party or its employees, agents, or representatives in the discharge of its or their professional responsibilities, or any other act or omission of a Party or its employees, agents or representatives. The provision of this Article 3 shall survive termination of the Agreement with respect to any claim, action, or proceeding that relates to acts or omissions occurring during the term of this Agreement.

ARTICLE 4
Responsibilities of Purchaser

Purchaser shall provide and maintain (or cause to be provided and maintained) such facilities and supplies as Purchaser reasonably deems necessary for UMPhysicians Medical

Physicist Personnel' performance of duties under this Agreement. Purchaser shall regularly consult with UMPhysicians Medical Physicist Personnel regarding supply needs.

ARTICLE 5
Compensation and Terms of Payment

5.1 **Professional** Services. As of the Effective Date, the rates and total aggregate payment are specified in Exhibit 5.1 which is incorporated herein by this reference. These rates reflect fair market value rates arrived at through arm's length negotiations between the Parties. These fees are not intended to relate to and do not, in fact, reflect the volume of referrals, if any, between the Parties. These rates may be modified no more than once every^twelve (12) months by the written agreement of the Parties.

5.2 Payment Schedule. Purchaser shall pay UMPhysicians the amount due pursuant to Section 5.1 on the 15th day of the month following the month in which services were rendered.

ARTICLE 6
Term and Termination

6.1 Term. The term of this Agreement shall be for an initial three years from the Effective Date. This Agreement shall automatically renew for additional one (1) year terms unless terminated as provided for hereinafter.

6.2 Termination. Subject to the continuing obligations of UMPhysicians and Purchaser set forth in Articles 2 and 3:

6.2.1 Without Cause. This Agreement may be terminated at the end of any one (1) year term for any reason or no reason by either Party upon ninety days (90) (or a lesser amount if mutually agreed to by the Parties) advance written notice to the other Party of such intention to terminate.

6.2.2 With Cause. This Agreement may be terminated by either party with cause upon default by the other party under any material term of this Agreement and failure to cure such default within sixty (60) days after receipt of written notice specifying the precise nature of such default. Upon failure to cure such default, the Agreement shall be deemed terminated without further action.

6.2.3 Bankruptcy or Insolvency. This Agreement may be terminated upon the bankruptcy or dissolution ofUMPhysicians or Purchaser.

6.2.4 Automatic. This Agreement shall terminate automatically if either Party fails to maintain insurance as required under Article 2.

6.2.5 Mutual Agreement. This Agreement may be terminated at any time by the mutual agreement of the Parties. If this Agreement is terminated under this provision during any one (1) year term, the Parties may only enter into a new agreement during the remaining term if the financial terms of the new agreement do not vary from this Agreement.

ARTICLE 7
Arbitration

7.1 Arbitration Required. If a dispute arises between UMPhysicians and Purchaser regarding any of the provisions of this Agreement except Article 5 or Article 6, hereof, such dispute(s) shall be referred in writing, to a Board of Arbitration, whose decision shall be final and binding in all respects. Each party shall select one (1) member of the Board and the persons so selected shall nominate a neutral member, who shall be a member in good standing with the American Arbitration Association, and who shall act as chair. Each party shall bear the expense of his or its own arbitrator. The expense of the neutral arbitrator shall be borne equally by UMPhysicians and Purchaser. The arbitrators shall consider the matter in controversy and may hold hearings regarding the same, and their decision shall be entered in writing within ten (10) days after the matter is finally submitted to them. Arbitration proceedings initiated pursuant to this Agreement shall be conducted in accordance with the Rules of the American Arbitration Association.

ARTICLE 8
Miscellaneous

8.1 **Amendments.** This Agreement and the Exhibits may be amended only upon the mutual written consent of the Parties.

8.2 **Independent Contractors.** UMPhysicians and UMPhysicians Medical Physicist Personnel are at all times serving as an independent contractors to Purchaser. Nothing in this Agreement shall be, construed to make or render either Party or any of its officers, agents, or employees an employee of, or joint venturer of or with the other for any purpose whatsoever, including without limitation, participation in any benefits or privileges given or extended by Purchaser to its employees. No right or authority is granted to UMPhysicians or UMPhysicians Medical Physicist Personnel to assume or to create any obligation or responsibility, express or implied, on behalf of or in the name of Purchaser.

8.3 **Responsibility for Payment of Taxes.** Purchaser shall not treat UMPhysicians or UMPhysicians Medical Physicist Personnel as an employee for any reason, including, but not limited to, the Federal Unemployment Tax Act, the Social Security Act, the Workers' Compensation Act and any federal or state income tax laws or regulations mandating the withholding of income taxes at the source of compensation payment. UMPhysicians shall be solely responsible for payment of all self-employment and/or applicable federal and state income taxes.

8.4 **Notices.** All notices hereunder by either party to the other shall be in writing. All notices, demands and requests shall be deemed given when mailed, postage prepaid, registered or certified mail, return receipt requested:

If to UMPhysicians at:

Associate Director, Contracting
2550 University Avenue West
Suite 401-South.
St.Paul.MN 55114

If to Purchaser at:

Fairview-University Medical Center
Attn: Vice President, Professional Services
2450 Riverside Avenue South
Minneapolis, MN 55454

or to such other address or to such other person as may be designated by written notice given from time to time during the term of this Agreement by one party to the other.

8.5 **Entire Agreement** This Agreement represents the entire agreement and understanding of the Parties hereto with respect to the subject matter hereof, and all prior and concurrent agreements, understandings, representations and warranties with respect to such subject matter, whether written or oral, are and have been merged herein and superseded hereby. This Agreement shall govern all services performed prior to the signing of the Agreement.

8.6 Compliance With Terms. Failure to insist upon strict compliance with any of the terms herein (by way of waiver or breach) by either Party hereto shall not be deemed to be a continuous waiver in the event of any future breach or waiver of any condition hereunder.

8.7 Rights of Parties. Nothing in this Agreement, whether expressed or implied, is intended to confer any rights or remedies under or by reason of this Agreement on any persons other than the Parties to this Agreement and to their respective successors and assigns.

8.8 Assignment. This Agreement may not be assigned by either Party without the express written consent of the other Party.

EXHIBIT 5.1
PAYMENT FOR SERVICES

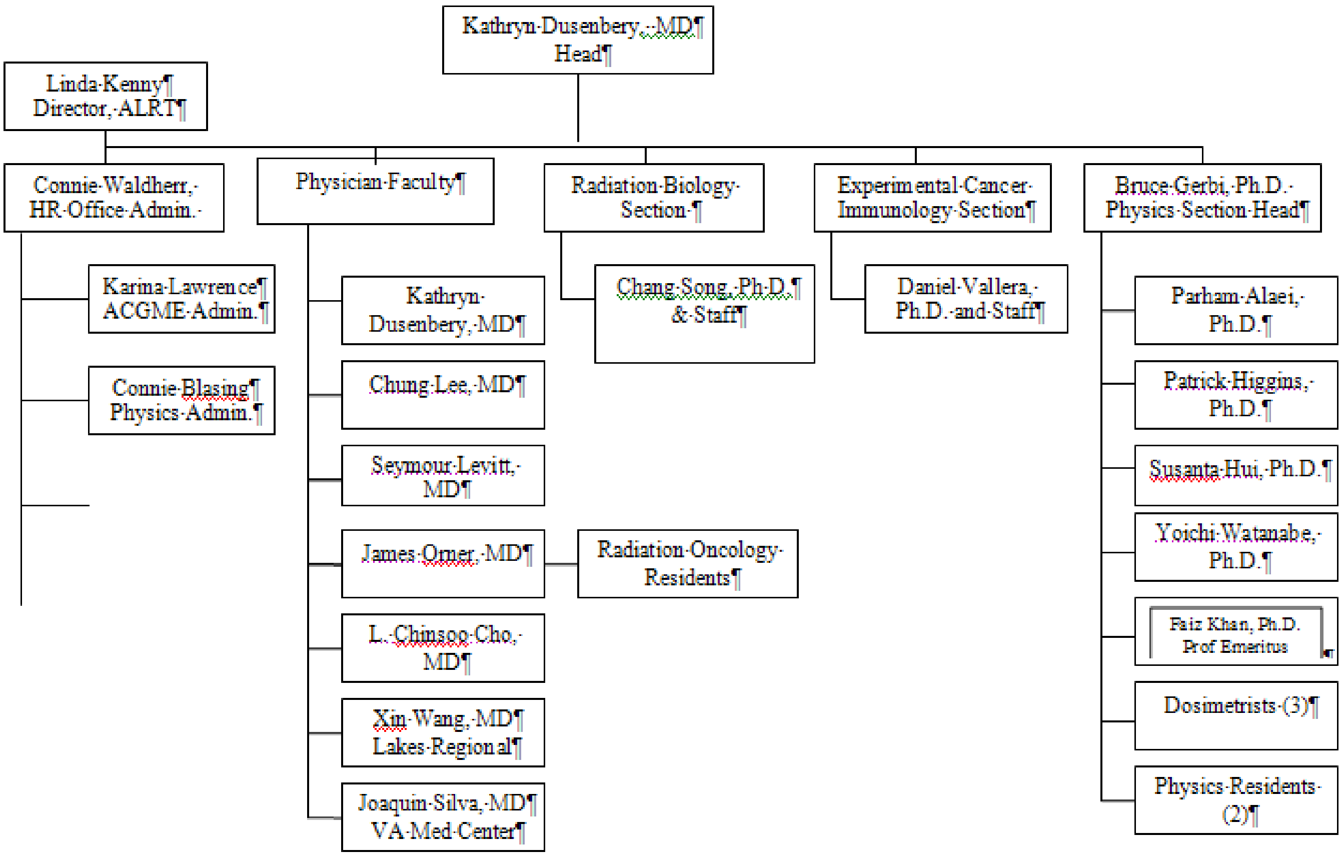
Total Monthly Compensation for Medical Physicist Personnel:

Routine installation of equipment is considered part of the baseline service Agreement If unique installation requirements for the Multi-leaf Collimator ("MLC") system or future equipment such as VARIS or IMRT necessitate weekend or evening physicist presence, payment will be $154.00 per hour. Fairview will pay for actual costs incurred in accordance with Fairview travel policies for travel and related expenses. Proper documentation of dates and hours worked is required for payment.

Appendix 2: Organization Chart

University of Minnesota Medical School

Department of Therapeutic Radiology-Radiation Oncology



Appendix 3: Clinical Physics Services*

Duties and Responsibilities

(Phys=Physicist; Phys Res=Physics resident; Dos=Dosimetrist; Th=therapist)

Task	Primary	Assistance	Direction/ Supervision
Calibration (accelerators, brachytherapy sources, HDR unit, etc.)	Phys	Phys Res/Dos	Phys
Acceptance and Commissioning (accelerators, simulators, brachytherapy equipment, HDR unit, radiosurgery apparatus, treatment planning systems, and special procedures, etc.)	Phys	Phys Res/Dos	Phys
QA Equipment (accelerators, simulators, brachytherapy equipment, HDR unit, radiosurgery apparatus, treatment planning systems, etc.	Phys	Phys Res/Dos	Phys
Computer Treatment Planning (2D, 3D, Stereotactic, HDR, etc.)	Phys	Dos/Phys Res	Phys
Monitor Unit Calculations (HDR, accelerators, etc.)	Phys	Dos/Phys Res	Phys
Treatment aids (compensators, blocks, MLC, immobilization devices)	Dos/Th	Phys Res	Phys
Patient data for Treatment Planning (wire contours, CT, MRI, measurements)	Dos/Th	Phys Res	Phys
QA Chart Review	Phys	Phys Res/Dos	Phys
Medical Phys consultation (complex cases)	Phys	Phys Res/Dos	Phys
Dosimetry verification (TLD, special dosimetry)	Phys Res/Phys	Dos	Phys
Radioisotope Curator (brachytherapy source preparation, inventory, radioisotope purchase order, etc.)	Dos/Phys Res	Phys	Phys
Radiation Protection (Personnel, environment surveys, NRC regs, state regs, etc.)	Phys	Phys Res	Phys
Shielding design and evaluation (accelerator rooms, simulator room, HDR rooms, etc.)	Phys	Phys Res	Phys

***Note:**

1. Physics tasks include varying degrees of complexity and sophistication. Many routine but time consuming procedures, such as routine computer treatment planning and dose calculations can be performed by dosimetrists or physics residents provided their work is checked by physicists. Physicist's time is best spent in supervising or checking

the final results, establishing dosimetry and QA protocols, calibrating and testing equipment, commissioning new procedures, researching optimal treatment techniques and providing consultation to physicians in the treatment planning of complex cases.

Appendix 4: Letters

UNIVERSITY OF MINNESOTA

Twin Cities Campus

Department Therapeutic Radiology-Radiation Oncology
Medical School

Box 494
420 Delaware Street S.E.
Minneapolis, MN 55455-0110
612-626-6146
Fax: 612-624-5445

1/30/2005

Eric E. Klein, M.S.
Chair, Residency Education Program Review Committee
American Association of Physicists in Medicine
Radiation Oncology Department
Mallinckrodt Inst of Radiology
4921 Parkview Place
Campus Box 8224
St. Louis, MO 63110

Dear Mr. Klein,

We formally invite the Commission on Accreditation of Medical Physics Education Programs (CAMPEP) to visit and review the University of Minnesota Radiation Oncology Physics Residency Program. Attached you will find the self-study prepared by Dr. Bruce J. Gerbi, the Program Director.

We applaud your efforts to set standards for quality training in medical physics programs and are willing to assist you in whatever you need to review the University of Minnesota Physics Residency Program. Please let us know if we can help in any way.

Sincerely,

Kathryn E Dusenbery

Kathryn Dusenbery, MD
Department Head

cc: Bruce J. Gerbi, Ph.D.

1851 150 YEARS 2001

FAIRVIEW
Fairview-University Medical Center

December 14, 2004

University Campus
420 Delaware Street Southeast
Minneapolis, MN 55455
Tel 612-273-3000

Riverside Campus
2450 Riverside Avenue
Minneapolis, MN 55454
Tel 612-672-6000

Richard G. Lane, Ph.D.
CAMPEP
MD Anderson
1515 Holcombe Boulevard
Houston, Texas 77030

Dear Dr. Lane:

On behalf of Fairview-University Medical Center, I would like to formally request the Commission of Medical Physics Education Program to schedule and conduct a review of the University of Minnesota's Medical Physics Residency Program based at Fairview-University Medical Center's Radiation Oncology Department.

Fairview-University Medical Center is proud of our Radiation Oncology department and related programs. We appreciate your efforts to set standards for training in medical physics programs.

Please let us know if we can be of any assistance to you in completing a review of this Residency Program. If you have any questions or require assistance, you can contact Carol Wilcox, Director of Radiation Oncology, at 612-273-6817. Thank you.

Sincerely,

Bonnie O'Connor

Bonnie O'Connor
Vice President,
Professional Services & Operations

BC/maa

Fairview-University Medical Center

Minneapolis, MN

has been Accredited by the

Joint Commission

on Accreditation of Healthcare Organizations

Which has surveyed this organization and
found it to meet the requirements for accreditation.

2003-2006

Bernard L. Hengesbaugh
Chairman of the Board of Commissioners

Dennis S. O'Leary, M.D.
President

The Joint Commission on Accreditation of Healthcare Organizations is an independent, not-for-profit, national body that oversees the safety and quality of health care and other services provided in accredited organizations. Information about accredited organizations may be provided directly to the Joint Commission at 1-800-994-6610. Information regarding accreditation and the accreditation performance of individual organizations can be obtained through the Joint Commission's web site at www.jcaho.org.

Appendix 5: Current and former Medical Physics Residents:

Resident	Start Date	Completion Date	Length of Time in Program	Medical Physics Specialty	Current Status/ Occupation	Board Certification
Guangwei Mu, Ph.D.	7/27/07		Planned 2 years	Therapeutic Radiology	Resident	
David Ellerbusch, Ph.D.	4/1/06		Planned 2 years	Therapeutic Radiology	Resident	
EunYoung Han, Ph.D.	7/1/05	6/30/07	Planned 2 years	Therapeutic Radiology	Resident	
Virginia Lockamy, Ph.D	7/1/04	Not Completed	Planned 2 years	Therapeutic Radiology	Staff Physicist	Unknown
Dickerson Moreno, Ph.D.	5/1/03	4/30/05	2 years	Therapeutic Radiology	Staff Physicist	Unknown
Dimitri Dimitroyannis, Ph.D.	7/1/02	Not Completed	Planned 2 years	Therapeutic Radiology	Staff Physicist	Unknown
Lai Leong, Ph.D.	11/1/00	11/17/02	2 years	Therapeutic Radiology	Staff Physicist	ABR
Nina Nguyen, M.S.	7/1/00	6/30/02	2 years	Therapeutic Radiology	Staff Physicist	ABR
Mazin Alkhafaji, Ph.D.	7/1/98	1/15/01	Planned 2.5 years	Therapeutic Radiology	Staff Physicist	ABR
Paul Medin, Ph.D.	8/2/98	8/1/00	2 years	Therapeutic Radiology	Resident	ABR
Ravi Kumar, Ph.D.	1/15/98	Not Competed	1/5/98 – 9/26/98	Therapeutic Radiology	Unknown	Unknown
Hassan Alkhatib, Ph.D.	10/1/96	9/30/98	2 years	Therapeutic Radiology	Staff Physicist	ABR
Loretta Lewandowski, Ph.D.	11/6/95	12/31/97	2 years	Therapeutic Radiology	Staff Physicist	ABR
Dimitrius Mihiazidis, Ph.D.	8/1/94	7/31/96	2 years	Therapeutic Radiology	Staff Physicist	ABMP Rad-Onc
Anil Sethi, Ph.D.	8/2/93	8/1/95	2 years	Therapeutic Radiology	Staff Physicist	ABMP Rad-Onc
Don Roback, Ph.D.	9/1/92	8/31/94	2 years	Therapeutic Radiology	Staff Physicist	ABMP Rad-Onc
John Gibbons, Ph.D.	7/15/91	6/30/93	2 years	Therapeutic Radiology	Staff Physicist	ABMP Rad-Onc

Appendix 6: Certificate of Program Completion

University of Minnesota

This certifies that

Has successfully completed and met all the requirements of the

Medical Physics Residency Program

In the Department of

Therapeutic Radiology-Radiation Oncology

At the University of Minnesota from

July 1, 2002 to June 30, 2004

In witness whereof, we have hereunto subscribed our names and affixed the seal of the University of Minnesota this

30th of the June, 2004

Bruce J. Gerbi, PhD Physics Section Director	Kathryn E. Dusenbery, M.D. Department Head

Appendix 7 Course Descriptions

Date	Day	Chapter		
9/4	**M**			**Labor Day**
9/6	W	1	BG	Structure of Matter
9/11	M	2	YW	Nuclear Transformations I
9/13	W	2	YW	Nuclear Transformations II
9/18	M	2	YW	Nuclear Transformations III
9/20	W	3	FK	Production of X-rays
9/25	M	3	FK	Production of X-rays
9/27	W	4	FK	Clinical Radiation Generators
10/2	M	4	FK	Clinical Radiation Generators
10/4	W	4	FK	Clinical Radiation Generators
10/9	M	5	PH	Interactions of X and γ Radiation
10/11	W	5	PH	Interactions of X and γ Radiation
10/16	M	5	PH	Interactions of Charged Particles and Neutrons
10/18	W	5	PH	Interactions of Charged Particles and Neutrons
10/23	M	6	SH	Measurement of Ionizing Radiation
10/25	W	6	SH	Measurement of Ionizing Radiation
10/30	M	7	SH	Quality of X-ray Beams
11/1	W			Mid-Term Exam 8:00 a.m. (M10 Masonic Library)
11/6	M	8	PH	Measurement and Calculation of Absorbed Dose I
11/8	W	8	PH	Measurement and Calculation of Absorbed Dose II
11/13	M	8	PH	Measurement and Calculation of Absorbed Dose III
11/15	W	8	PH	Measurement and Calculation of Absorbed Dose IV
11/20	M	9	BG	Dose Distribution and Scatter Analysis
11/22	W	9	BG	Dose Distribution and Scatter Analysis
11/27	M	9	BG	Dose Distribution and Scatter Analysis
11/29	W	16	PA	Radiation Protection I
12/4	M	16	PA	Radiation Protection II
12/6	W	16	PA	Radiation Protection III
12/11	M	17	PA	Quality Assurance
12/13	W	17	PA	Quality Assurance
12/18	M			FINAL EXAM: 8:00 a.m.-11:00 a.m., Department Library (M10 Masonic). Alternate individual times have to be approved in advance by Dr. Gerbi

Lecturers: Bruce J. Gerbi, Ph.D. (BG) • Faiz M. Khan, Ph.D. (FK) • Patrick Higgins, Ph.D. (PH)
Susanta Hui, Ph.D. (SH) • Parham Alaei, Ph.D. (PA) • Yoichi Watanabe (YW)

Text: • THE PHYSICS OF RADIATION THERAPY by Faiz M. Khan, Ph.D., Williams & Wilkins, 3rd Edition, 2003.

Supplementary Text: • THE PHYSICS OF RADIOLOGY by H.E. Johns & J.R. Cunningham 4th Edition, 1983.

RADIATION BIOLOGY (BPhy 5172, TRad 5-172)
Fall Semester, 2004
DEPARTMENT OF THERAPEUTIC RADIOLOGY
LIBRARY - M-10 MASONIC CANCER CENTER
4:00-5:15 p.m. (**WED**), 7:30-8:45 a.m. (**FRI)**

TEXT: **Radiobiology for the Radiologist, 5th. Ed.,** Eric J. Hall, Ph.D.
(Order from Barnes & Noble, www.bn.com)

9/8	(W)	Chapter 1: The Physics and Chemistry of Radiation Absorption
9/10	(F)	Chapter 2: DNA Strand Breaks and Chromosomal Aberrations
9/15	(W)	Chapter 3: Cell Survival Curves
9/17	(F)	Chapter 3: Finish-Cell Survival Curves
9/22	(W)	Chapter 4: Radiosensitivity and Cell Age in the Mitotic Cycle
9/24	(F)	Chapter 5: Repair of Radiation Damage and the Dose-Rate Effect
9/29	(W)	Chapter 5: Repair of Radiation Damage and the Dose-Rate Effect
10/1	(F)	Chapter 6: The Oxygen Effect and Reoxygenation
10/6	(W)	NO CLASS (ASTRO meeting)
10/8	(F)	Chapter 7: Linear Energy Transfer and Relative Biological Effectiveness
10/13	(W)	Chapter 8: Acute Effects of Total-Body Irradiation Chapter 9: Radioprotectors
10/15	(F)	Chapter 10: Radiation Carcinogenesis
10/20	(W)	Exam 1
10/22	(F)	Chapter 11: Hereditary Effects of Radiation Chapter 12: Effects of Radiation on the Embryo and Fetus
10/27	(W)	Chapter 13: Radiation Cataractogenesis Chapter 14: Doses and Risks in Diagnostic Radiology, Interventional Radiology and Cardiology, and Nuclear Medicine
10/29	(F)	Chapter 15: Radiation Protection begin Chapter 16: Molecular Techniques in Radiobiology
11/3	(W)	Chapter 16: Molecular Techniques in Radiobiology begin Chapter 17: Cancer Biology
11/5	(F)	Chapter 17: Finish Cancer Biology

11/10	(W)	Chapter 18: Dose-Response Relationships for Model Normal Tissues
11/12	(F)	Chapter 19: Clinical Response of Normal Tissues Chapter 20: Model Tumor Systems

RADIATION BIOLOGY (BPhy 5172, TRad 5-172)
Fall Semester, 2004

11/17	(W)	Chapter 21: Cell, Tissue, and Tumor Kinetics Chapter 22: Time, Dose, and Fractionation in Radiotherapy
11/19	(F)	Chapter 23: Predictive Assays Chapter 24: Alternative Radiation Modalities
11/24	(W)	NO CLASS
11/26	(F)	NO CLASS- Thanksgiving Holiday
12/1	(W)	Chapter 25: Radiosensitizers and Bioreductive Drugs Chapter 26: Gene Therapy
12/3	(F)	Chapter 27: Chemotherapeutic Agents from the Perspective of the Radiation Biologist
12/8	(W)	Chapter 28: Hyperthermia
12/10	(F)	Reading day/Review
12/15	(W)	Final Exam

Instructors: Chang W. Song, Ph.D., 626-6852; Office: K119 Diehl Hall
songx001@umn.edu

Robert Griffin, Ph.D., 626-6064; Office: K128 Diehl Hall
griff007@umn.edu

BPHY 5171 Medical and Health Physics of Imaging I

Fall Semester 2004

Tuesdays and Thursdays: 4:00 p.m. to 5:15 p.m.
B216 Mayo Building – Leo Rigler Conference Center

Week	Date	Lecturer	Topic	Chapter
1	7-Sep	Hasselquist	Interactions of Radiation	4
	9-Sep	Hasselquist	Generation of X-rays	5
2	14-Sep	Hasselquist	Generation of X-rays	5
	16-Sep	Hasselquist	Radiation Exposure and Absorbed Dose	6, 7
3	21-Sep	Hasselquist	Radiography: Screen-Film Technology	13
	23-Sep	Hasselquist	Radiography: Digital Imaging Technology	10, 13
4	28-Sep	Hasselquist	Radiography: Image Quality Descriptors	7, 16, 17
	30-Sep	Hasselquist	Fluoroscopy	14
5	5-Oct	Hasselquist	Fluorography	14
	7-Oct	Hasselquist	Radiographic/Fluoroscopic Performance Evaluation	
6	**12-Oct**	**Staff**	**Exam 1**	
	14-Oct	Hasselquist	Mammography: Basics	
7	19-Oct	Hasselquist	Mammography: Quality Control - Physicist	
	21-Oct	Hasselquist	Mammography: Quality Control - Technologist	
8	26-Oct	Ritenour	Ultrasound: Beam Formation	19
	28-Oct	Ritenour	Ultrasound: Properties of Materials	20
9	2-Nov	Ritenour	Ultrasound: Timing of Image Formation	21
	4-Nov	Ritenour	Ultrasound: Doppler	22
10	9-Nov	Ritenour	Ultrasound	22
	11-Nov	Ritenour	Ultrasound	
	16-Nov	Ritenour	Ultrasound (makeup date)	
11	**18-Nov**	**Staff**	**Exam 2**	
12	23-Nov	Hasselquist	Structural Radiation Shielding	28
	25-Nov	THANKSGIVING	No Class	
13	30-Nov	RSNA	No Class	
	2-Dec	RSNA	No Class	
14	7-Dec	Ritenour (2 hours)	Visual Perception / ROC & PACS	10
	9-Dec	Hasselquist (2 hours)	Computed Tomography: Basics & Helical CT	15
15	14-Dec	Hasselquist	Managing Patient Doses	28
	16-Dec	Hasselquist	Radiation Safety & Health Physics	26, 27, 28
	21-Dec	**Staff**	**FINAL**	

Lecturers
Bruce E. Hasselquist, Ph.D. **e-mail: hasse002@tc.umn.edu Phone: (612) 624-8183**
E. Russell Ritenour, Ph.D. **e-mail: riten001@tc.umn.edu Phone: (612) 626-0131**

BPHY 5174 Medical and Health Physics of Imaging I

Fall Semester 2004

Tuesdays and Thursdays: 4:00 p.m. to 5:15 p.m.
B216 Mayo Building – Leo Rigler Conference Center

Grading:
There will be three exams during the semester, including the final. Each exam will count toward 20% of your total grade. There will be no quizzes. Homework problems will be handed out periodically and will count toward 35% of your grade.. Solutions to the assigned problems must be handed in on or before the due date except in the case of an excused absence. Solutions will be discussed in class at the beginning of class on the due date. The remaining 5% of your grade will be based on class participation.

Exams:
All exams will be closed book. No additional materials will be allowed during the test. Calculators will be necessary for some parts of the exams. The programmable features of your calculator may not be used to store equations, constants, etc. If you are unable to make a scheduled exam time, let the instructor know as soon as possible. If you fail to notify the instructor that you will miss an exam time prior to the exam, any make-up exam will be at the discretion of the course director. Exams may cover any material prior to the exam but will concentrate on material covered since the last exam.

Demonstrations:
Classes identified as “Demonstration” will be held during the normal class time and either in the Rigler Conference Center or other location announced in advance by the instructor.

Texts:
The required textbook for this course is "Medical Imaging Physics", Hendee and Ritenour, 4th Edition. Additional reading material and references will be handed out in class. Students will be responsible for all information provided during the course unless told otherwise.

Availability of Lecturers:
Both lecturers for this course are listed on the syllabus and are generally available for questions. Off-site commitments, however, are such that it may be in your best interest to schedule an appointment through the section secretary, Pam Hansen, if you wish to discuss the course. You may also contact the lecturers via e-mail at the address provided or at their office phone number.

BPHY
Tuesd
ays
B216
Mayo

5174 Medical and Health Physics of Imaging II
Spring Semester 2004
and Thursdays: 4:45 p.m. to 6:00 p.m.
Building - Leo Rigler Conference Center

Week		Lecturer	Topic
1	20-Jan	R	Atomic and Nuclear Physics
	22-Jan	R	Radioactive Decay Modes and Production of
2	27-Jan	R	Mathematics of Decay
	29-Jan	H	Radiation Detectors
3	3-Feb	H	Electronic Instrumentation
	5-Feb	H	Spectrometry
4	10-Feb	H	Counting Systems
	12-Feb	R	Nuclear Counting Statistics
5	17-Feb	R	Nuclear Counting Statistics
	19-Feb	H	Demonstration - Radiation Detection

26-Feb 2-Mar 4-Mar

8 9-Mar 11-Mar 16-Mar 18-Mar 23-Mar 25-Mar 30-Mar
6-Apr

8-Apr H 13 13-Apr.
15-Apr 14 20-Apr H 22-Apr R 15 27-Apr R 29-Apr R 16 4-May R 6-May R

Gamma Camera H Gamma Camera. H Single Photon Emission Computed Tomography (SPECT) H Single Photon Emission Computed Tomography (SPECT) H Image Quality

SPRING BREAK SPRING BREAK Positron Emission Tomography (PET) Positron Emission Tomography (PET) Demonstration - Clinical Nuclear Medicine

Cam* Radiation Safety Radiation Safety Demonstration - Radiation Safety Internal Radiation Dosimetry Internal Radiation Dosimetry Magnetic Resonance Imaging Magnetic Resonance Imaging Magnetic Resonance Imaging Magnetic Resonance Imaging Magnetic Resonance Imaging

<u>Lecturers</u>

Bruce E. Hasselquist, Ph.D. (H)- e-mail: hasse002i4tc.umn.edn Phone: (612) 624-8183

E. Russell Ritenour, Ph.D. (R) e-mail: riten001ntc.urnn.edu Phone: (612) 626-0131

UNIVERSITY OF MINNESOTA
MEDICAL CENTER

Radiation Therapy Program
Course Syllabus
Principles & Practices of Radiation Oncology I
RT 411

(updated 5/08)

COURSE DESCRIPTION

This course examines concepts related to specifically to cancer treatment with a focus on methods of improving therapeutic advantage. Technical aspects of of simulation and treatment delivery are expanded upon. Treatment related side effects and their management as well as issues relative to caring for the cancer patient.

PREREQUISITES

- Acceptance into the Radiation Therapy Major

REQUIRED TEXT AND MATERIALS

- **Principles and Practice of Radiation Therapy, Second Edition,** Washington and Leaver, Mosby, 2004.

COURSE PLAN

Radiation therapists must be knowledgeable and technically competent in order to function effectively in the clinic environment. The radiation therapist must be knowledgeable in the concepts important to the practice of radiation therapy. These include the cancer process and radiation therapy interventions. The mechanism of radiation damage is related to clinical applications and methods to improve radiation effectiveness. The human basis of cancer care is also addressed. This course builds upon previous course requirements as well as introduction to radiation therapy and is preliminary to Principles and Practice of Radiation Therapy II.

COURSE OBJECTIVES

- ✓ List situations in radiation therapy, which make use of radiographic or cross sectional images.
- ✓ Discuss epidemiological trends in cancer incidence and mortality.

- ✓ Name the most common cancers in the US and the world in incidence and mortality.
- ✓ Explain the multi-stage theory of cancer development.
- ✓ List common risk factors and carcinogens associated with cancer in the US.
- ✓ Explain how cancers are named and interpret the location and type of cancer from its name.
- ✓ Describe the natural history of tumor without treatment.
- ✓ Define staging and grading in regard to tumors and define the TNM system.
- ✓ Explain the importance of accurate staging in treatment decision.
- ✓ Identify the most effective methods of detection and diagnosis for common cancers.

COURSE POLICIES

In this course the objectives will be met through class discussions, group exercises, assigned readings, writing exercises, student presentations, homework assignments, guest presentations, and through individual contributions each students will bring to this class.

Time Investment
With enrollment you will be expected to spend time (possibly 4-8 hours a week) *outside* of class reading, studying, writing, and preparing.

Required and recommended course materials

Principles and Practice in Radiation Therapy, 2 ed., Charles Washington and Dennis Leaver. Students will be required to use the web and internet for this course.

Bring you book to class.

Course Requirements

Expectation	Points	Percent of Course Grade
Assignments	**Varies**	**20**
Tests/Quizzes	**Varies**	**45**
Final Exam	**Varies**	**35**

Assignments/Tests/Quizzes/Final Comprehensive Exam:

- Students are responsible for reading assignments prior to class lecture.
- All assignments must be turned in. Some may simply be checked off as received.
- Late assignments will receive "zero" credit, no exceptions.
- All tests and exams must be taken on the day and time scheduled. *There will be a 5 % deduction from the test score for any test/exam taken at any other time.* This deduction may be raised to 10% for tests taken at any other time without adequate notice and/or adequate reason.
- Quizzes may be unannounced and missed quizzes may not be made up (zero credit given. No exceptions)
- Material covered in class, in the readings or handouts may appear on tests

Evaluation of assignments will include these considerations:

- ❑ Have the guidelines for the assignment been followed? Has the purpose of the assignment been completely fulfilled? Have you completely and thoroughly answered the question?
- ❑ How well have you integrated and expanded on the course related material? Does your work reflect an understanding of the assignment and course material? Did you show a complete understanding of the concepts, thought processes and to what level did you convey that in through your work on the assignment.
- ❑ Your ability to communicate your thoughts using careful, clear language, and compositional accuracy. Do grammar and spelling problems interfere with your communication of ideas?

Be prepared to review your assignment in class discussion on the assignment due date.

Grade Distribution

Grade Scale:

Percentage Achieved	Course Grade
93-100	A
90-92.9	A-
87-89.9	B+
83-86.9	B
80-82.9	B-
77-79.9	C+
73-76.9	C
70-72.9	C-
67-69.9	D+
60-66.9	D

0-59.9	**F**

Class schedule

a. When a student is not in class the student is expected to be in clinical. Exceptions to this are limited to those, which were approved in advance by the radiation therapy program officials.

b. When a student is not in clinical the student is expected to be in class. Exceptions to this are limited to those, which were approved in advance by the radiation therapy program officials.

Class Days: **Tuesdays and Thursdays** (subject to change)

Attendance and Make-up policy

Attendance is mandatory.

Additional class guidelines

Students are responsible for the class guidelines as written in the Radiation Therapy student handbook.

Conduct code

Students in the UMMC Radiation Therapy Program are responsible for their conduct. The Fairview Radiation Therapy Student Handbook and Radiation Therapy Program Officials govern students admitted to the Radiation Therapy Program.

Scholastic dishonesty

The University of Minnesota Medical Center –Fairview Radiation Therapy Program defines scholastic dishonesty as “submission of false records of academic achievement; cheating on assignments or examinations; plagiarizing; altering, forging, or misusing a academic record; taking, acquiring, or using test materials without permission; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement."

If you submit any other person's work as your own without proper acknowledgment, you are guilty of plagiarism. Plagiarism includes borrowing any concepts, words, sentences, paragraphs, or entire articles or chapters from books, periodicals, or speeches. In these cases, quotation marks and citations must be used in order to properly acknowledge your sources. If you have any questions about proper acknowledgment, consult any writing handbook.

Plagiarism also refers to copying another student's assignment or paper and submitting it for grading as if it were your own. If you allow another student to copy your assignment, you are equally guilty of scholastic dishonesty. Plagiarism is a violation of the handbook for the UMMC radiation therapy student and will be dealt with by Radiation Therapy Program faculty

Suspected cases of scholastic dishonesty will be taken seriously.

Diversity

University of Minnesota Medical Center-Fairview is committed to the policy that all persons shall have equal access to its programs, facilities and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation. All UMMC-Fairview faculty members, students, or staff members, and other individual engaged in any UMMC-Fairview activity or programs are expected to respect diversity at all times. Report any suspected incident to the Radiation Therapy program director Patricia Fountinelle (pfounti1@fairview.org , 612-273-5107) Complaints will be investigated and resolved in coordination with the Fairview Human Resources department.

University of Minnesota Medical Center-Fairview policy on diversity can be found in the UMMC-Fairview student Handbook as well as the UMMC-Fairview policy manual.

This syllabus may change at the discretion of the instructor and at any time as needed to support the learning objectives of this course.

COURSE CONTENT			
Date/Module	**Topic**	**Reading**	**Assignment**
9/9	**Treatment of Benign Disease**		**Read Ch 37 W/L** **Ch 37 WS** **Due:**
9/11	**Skin & Melanoma**	**Quiz: Benign Disease** **Ch 37 W/L**	
9/16	**Skin & Melanoma**	**Skin Article Handout**	**Skin Article WS** **Due:**
9/18	**Skin Article**		
9/23	**TEST** **Ch 37/Skin**		**Read Ch 25 W/L** **Ch 25 WS** **Due:**
9/25	**Bone & Soft Tissue Sarcoma**	**Ch 25 W/L**	
9/30	**Bone & Soft Tissue Sarcoma**		
10/2	**TEST** **Ch 25**		**Read Ch 26 W/L** **Lymphoma assignment** (32pts) **Ch 26 WS** (30pts) **Due:**
10/7	**Lymphoreticular** (GO OVER WS after P-P)	**Ch 26 W/L**	
10/9	**Lymphoreticular** (GO OVER WS after P-P)		**Read Ch 27 W/L** **BMT Research** **Ch 27 WS** **Due:**

10/14	**Leukemia**	**Ch 27 W/L**	
10/16	**Leukemia** (COLLECT Ch 27 WS/BMT)	**Ch 27 W/L**	
10/21	**Lymphoma/BMT** **(Michael Tomblyn, M.D.)**		
10/23	(HANDBACK WS Ch27/BMT) **Discuss Research**		
10/28	**TEST Ch 27/26**		**Read Ch 28 W/L** **For 10/30 class**
10/30	**Endocrine System**	**Ch 28 W/L**	**In Class Assignment Due:**
11/4	**Endocrine**		
11/6	**TEST Ch 28**		**Read Ch 36 W/L** (NEED WS- Due:)
11/11	**Pediatric Solid Tumors** (PF)	(Astrocytoma, Medulloblastoma, Ependymoma, Glioma, Retinoblastoma, STS, Unusual tumors)	
11/13	(Collect WS Ch 36) **Pediatric Solid Tumors** (PF)	**Ch 36 W/L**	**TBA**
11/18	**Pediatric Solid Tumors** **(Troy Adolfson, M.D.)**	Wilms/ Neuroblastoma	
11/20	**TEST Ch 36** (PED ST)		
11/25	**Paraneoplastic Syndromes**		
11/27	**Thanksgiving- No Class**		
12/2	**Oncologic Emergencies**	**Quiz- (Paraneoplastic syndromes)**	
12/4		**Quiz (Oncologic Emergencies)**	**Review**
12/9	**Final Comprehensive Exam**		

University of Minnesota-Fairview

Principles of Oncology II Syllabus

RT 412

(4/08)

Class Syllabus

Principles of Oncology II: RT 412

Spring Semester 2008

About the instructor

Instructor's name: Patricia Fountinelle, M.S., R.T. (R) (T), CMD

Office location: Mayo B165-2

Office hours: Tuesdays/Thursdays 9:00-9:30 AM & 3:15PM

Phone number(s): 612-273-5107
Fax number: 612-273-3589

Email address: pfounti1@fairview.org
Preferred method of contact (phone, email, fax, etc.): email

About the course

Course description: A continuation of the Principles and Practice of Radiation Oncology I, this class explores cancers of the respiratory system, central nervous system, head and neck, digestive system, female and male reproductive systems, genitourinary system, breast and ocular cancers. Field design, treatment prescription, side effects and management of neoplastic disease will be presented, discussed and evaluated. The epidemiology, etiology, detection, diagnosis, patient condition, treatment and prognosis of these diseases will be discussed relative to anatomy, histology and patterns of spread. The radiation therapist's responsibilities of education, assessment, and communication in the management of neoplastic disease will be presented and discussed.

Credits: 3

Course prerequisites: Acceptance into the Radiation Therapy Program, RT 401, RT 411

Course objectives:

- Examine the role of surgical, radiation, and medical oncology in the management of neoplastic disease\
- Discuss epidemiology and etiologic information pertinent to each neoplastic site.
- Identify dose limiting structures and their tolerances
- Discuss clinical presentation for each anatomic neoplastic site
- Explain A&P, detection, diagnosis, grading, and staging systems, Treatment options, side effects, and prognosis for each neoplastic site

Required and recommended course materials

Principles and Practice of Radiation Therapy 2nd ed., Washington and Leaver, Mosby, 2004.

Radiation Therapy Planning 2nd ed., Gunilla C. Bentel, R.N., R.T.T., McGraw Hill, 1996
Handouts and other materials may be utilized as well

Course Requirements

Tests/Quizzes/Final Comprehensive Exam:

- All tests and exams must be taken on the day and time scheduled.
- All tests and exams must be taken on the day and time scheduled. *There will be a 5 % deduction from the test score for any test/exam taken at any other time.* This deduction may be raised to 10% for tests taken at any other time without adequate notice and/or adequate reason.
- Quizzes may be unannounced and missed quizzes may not be made up (zero credit given)
- Material covered in class, in the readings or handouts may appear on tests

Assignments

- Readings- students are responsible for reading assigned readings prior to class. Although the Washington Leaver text will be the main textbook used, students will be responsible for reading the corresponding pages in Bentel &/or any handouts supplied.
- Chapter worksheets (W/L text)
- Critical thinking worksheets (Bentel text)
- End of Chapter Problems (Bentel text)
- Case studies & presentations
- Research Paper

Evaluation of assignments will include these considerations:

- ❖ Have the guidelines for the assignment been followed? Has the purpose of the assignment been completely fulfilled?
- ❖ How well have you integrated and expanded on the course related material? Does your work reflect an understanding of the assignment and course material?
- ❖ Your ability to communicate your thoughts using careful, clear language, and compositional accuracy. Do grammar and spelling problems interfere with your communication of ideas?
- ❖ All work must be typed, except note cards and other specified work.

Do not PLAGIARIZE other work. Students are expected to do their own work. Students who engage in any form of scholastic dishonesty may be subject to disciplinary actions including program dismissal.

Course Requirements

Expectation	*Points*	Percent of Grade
Psychomotor (40%)		
Assignments	**Varies**	**15**
Case Study & Presentation	**30 points**	**10**
Cancer Research Paper	**Varies**	**15**
Cognitive (60%)		
Tests/Quizzes	**Varies**	**35**
Comprehensive Final Exam	**Varies**	**25**

Grade Distribution

Your grade for this course will be determined as follows:

Percentage Achieved	Course Grade
93-100	A
90-92	A-
87-89	B+
83-86	B
80-82	B-
77-79	C+
73-76	C
70-72	C-
67-69	D+
60-66	D
0-59	F

Class schedule

b. When a student is not in class the student is expected to be in clinical. Exceptions to this are limited to those, which were approved in advance by the radiation therapy program officials.

c. When a student is not in clinical the student is expected to be in class or engaged in a learning activity related to clinical or didactic course work. Exceptions to this are limited to those, which were approved in advance by the radiation therapy program officials.

Additional class guidelines

Students are responsible for the class guidelines as written in the Radiation Therapy student handbook.

Conduct code

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If you submit any other person’s work as your own without proper acknowledgment, you are guilty of plagiarism. Plagiarism includes borrowing any concepts, words, sentences, paragraphs, or entire articles or chapters from books, periodicals, or speeches. In these cases, quotation marks and citations must be used in order to properly acknowledge your sources. If you have any questions about proper acknowledgment, consult any writing handbook.

Plagiarism also refers to copying another student’s assignment or paper and submitting it for grading as if it were your own. If you allow another student to copy your assignment, you are equally guilty of scholastic dishonesty. Plagiarism is a violation of the handbook for the UMMC radiation therapy student and will be dealt with by Radiation Therapy Program faculty

Suspected cases of scholastic dishonesty will be taken seriously.

Students are expected to do their own work.

Syllabus subject to change

This syllabus may change at any time as needed to support the learning objectives of this course.

Class schedule 4/1/08

COURSE CONTENT			
Date/Module	**Topic**	**Reading**	**Assignment**
Tuesday 1/8	Head & Neck (W/L 683-699)	W/L CH 30 (H&N) Bentel CH 9 (H&N) (268-286)(291-303)(307-313)	**#1 assignment** -W/L: Ch 30 WS -Bentel: Critical thinking & Ch 9 problems: 1,3,4,5,6,7,8,11 12,13,14,17,18 and 20 *** Due 1/15**
Thursday 1/10	Head & Neck (705-710) (712-717)		
	Oral Cavity		

Tuesday 1/15	**Dr. Yuan Jianling (699-705)**		#1 Assignment due
Thursday 1/17	Larynx (710-712) **Dr. Jay McAfee**		
Tuesday 1/22	Head & Neck (717-720)		
Thursday 1/24	**TEST #1 Head & Neck**		
Tuesday 1/29	Respiratory (W/L 653-678)	W/L Ch 29 (Respiratory) Bentel Ch 11 (Thorax) (367-377)	**# 2 assignment** -W/L: Ch.29 WS -Bentel: Critical thinking & Ch11 problems: 1 through 9 ***Due: 1/31**
Thursday 1/31	Lung Ca **Dr. Stephen Thatcher**		# 2 Assignment due
Tuesday 2/5	Respiratory		
Thursday 2/7	**TEST #2 Respiratory**		
Tuesday 2/12	Breast (W/L 843-860)	W/L Ch 35 (Breast) Bentel Ch 11 (Breast)(383-414)(584-585)	**# 3 assignment** -W/L: Ch 35 WS -Sentinel Node Mapping directed reading/WS *** Due: 12/14**
Thursday 2/14	Breast (860-872)		# 3 Assignment due
Tuesday 2/19	**TEST # 3 Breast**		
Thursday 2/21	Mock Exam # 2 for Topics starts at 12:15	No Onc II class	Onc II CASE STUDY DUE today

Tuesday 2/26	CNS **Dr. Mike Tomblyn**		**# 4 assignment** W/L: Ch 31 WS Bentel Ch10 problems 1,3,4,6,7,8, 9,13,14,15,16,17,18,20 *** Due 2/28**-
Thursday 2/28	**TEST # 4 CNS**		# 4 Assignment due/CNS Give # 5 assign
Tuesday 3/4	Digestive (Colorectal/Anal) (W/L 743-760) (760-770)	W/L: Ch 32 (Digestive) Bentel: Ch 12 (Abd) (420-426)(426-429) Ch 13 (Pelvis) (471-473)(439-445)	**# 5 assignment** -W/L: Ch 32 WS -Bentel Critical thinking & Ch 12 problems: 1,3,4,5,6,8,9,10,11,12 Ch 13 problems: 1,2,3,4,13,and 14 *** Due 3/12**
Thursday 3/6	Digestive (Esophagus/Pancreas) (770-774)	**Topics-Benign Disease**	
Tuesday 3/11	Upper GI **Dr. Jay McAfee 1:30**		
Wed. 3/12 **(NO class Thurs. 3/13 Interviews)**	**TEST # 5 (7:30 AM) Digestive**	**<u>7:30</u>** ONC II Dige TEST **<u>9:30</u>**- Dosi **<u>12:15</u>** Rad Phy **<u>2:00</u>** Topics Test/Op Issues	**Collect GI assignment # 5 due**
Week of March 17th Spring Break	**No classes**	**No classes**	**No classes**
Tuesday 3/25 1:30 after David Berg Diversity	**Topics 12:00 David Berg ALL STUDENTS** Male Reproductive & GU Prostate only	W/L: Ch 34 Bentel: Ch 13 (Pelvis) (461-470)(473-481)	**# 6 assignment** GU WS *** Due: 4/1**
Thursday 3/27	Prostate Ca/PET **Dr. Wong @ UMP-Lakes**	****Must be at the Wyoming Clinic before 11:30 AM**	
Tuesday 4/1	**TEST # 6** (Prostate only)		# 6 Assignment due GU WS
Thursday 4/3	**Roy Erickson 12-1:00 Oncologic Emergencies (1:15-2:00)**		***Give Ocular handout & GYN STUDENT ASSIGNMENT**
			#7 assignment:

Tuesday 4/8	GYN **(Students)**	W/L Ch 33	W/L: Ch 33 GYN WS *** Due: 4/17**
Thursday 4/10	No Class	**TCRT Sat. 2/12**	
Tuesday 4/15	**GYN** **Dr. Troy Adolfson**		
Thursday 4/17	**# 8 Test** (GYN)	finish W/L Ch 34 (821-826) & (830-838) & Directed Reading	**GU/Bladder Directed Reading** & **Take home test (due 4/22)** **# 7Assign CH33due**
Tuesday 4/22	Male GU (finish) (Kidneys & Bladder Urethra & Testes and Directed Reading)	Reminder**: Be prepared to give a summary of your research paper on 4/24 in class.**	Collect Take Home Test and Grade after we go over in class
Thursday 4/24	**Final Review list** **Discuss Reasearch Papers**		**Research Paper Due** **Students give Summary to Class**
Tuesday 4/29	Final Review		
Thursday 5/1/08	**Comprehensive Final Exam**		
This syllabus may change at any time as needed to support the learning objectives of this course.			

Case Studies

* Each student is to pick a topic for completion of comprehensive case study. Choose from these:

Nasopharynx ______________________________
Larynx ____________________________________
Anal cancer _______________________________
Colon cancer ______________________________
Vaginal Cancer ____________________________
Cervical Cancer ___________________________
Lung Cancer ______________________________
Prostate Cancer ___________________________
Breast Cancer _____________________________
Testicular Cancer __________________________

Include: Patient information- age, sex, geographic/ethnic background (NOT NAME)
Medical history- risk factors-symptoms/signs
Diagnostic tests and findings that support the diagnosis
Pathological findings- stage/grade

What the anticipated method of spread or metastases would be- be specific
Treatment- for radiation therapy be specific regarding method, dose and field borders
Include critical tissue/organs at risk with the radiation therapy and there dose limits
Side effects expected and/or seen
Results of treatment
Your evaluation of this patient and the treatment

Research Paper

Subject:

- Any *specific* cancer and the radiation treatment modality utilized for the cancer.

Format:

- This paper should be at least 12 pages in length (not counting the title page, reference/bibliography page or illustrations) and should not exceed 18 pages.

- The research paper must be typed, double-spaced, 12 font, in AMA reference style guidelines on one side of good grade white paper 8 ½ x 11 inches with 1-inch margins and numbered pages; fastened securely on the left side. Do not submit in folders or binders. A document protector without a spine may be used.

- Do not forget endnotes or footnotes.

- Any illustrations used that include faces or identifiers must have these blocked out and all illustrations must be labeled and numbered.

- Works cited/Bibliography page must be included.

- Do not plagiarize.

Criteria for Grading:

A. Originality
Evidence of original work performed by the author(s), originality, new approach.

B. Educational or technical value
Relevancy, contributes to higher radiological standards, updates, expands or enhances existing knowledge

C. Scholarship
Mastery of the subject matter
Research of literature

D. Development of an orderly, logical sequence

E. Mechanical: neatness, grammar, spelling, punctuation, use of correct terms

*** Research paper component deadlines**:

1) Topic- Due by February 1, 2008
2) Outline- Due by March 7th, 2008
3) Final copy – Due by April 24th, 2008

If a deadline for one or more of the research components is missed, the student's final research paper grade will be decreased by 2% for each of the late components.

A

Appendix 8
Didactic Courses

Didactic Training

Starting with the fall quarter, the physics resident will receive didactic instruction (regardless of educational background) in the radiation oncology physics, diagnostic radiology physics, nuclear medicine physics, radiation biology, radiation oncology, anatomy and physiology. The following courses offered at the University of Minnesota will cover these areas:

TRAD 7170	Basic Radiological Physics
TRAD 7172	Radiation Biology
TRAD 7173	Physics of Radiation Therapy
BPHY 5171	Medical and Health Physics of Imaging I
BPHY 5174	Medical and Health Physics of Imaging II
RT 411	Principles and Practices of Radiation Therapy I
RT 412	Principles and Practices of Radiation Therapy II

The resident will be given time to attend the above classes and must pass the examinations associated with these courses. The results of these exams will be placed on record in the resident's file.

a. Practical Experience

In parallel to the didactic course work, the physics resident will be assigned to a staff physicist by rotation to perform clinical tasks under his/her supervision. At the end of each rotation (e.g. 2 months), the staff physicist will hold a review session with the resident. The resident will identify and list procedures or tasks performed during the previous rotation and will be given a mock oral test in those areas. Additional literature reading assignments may be given at this time to strengthen theoretical understanding of various clinical procedures. A resident evaluation form will be completed and put in the resident's file.

The following broad areas will be covered during the two years of residency period. Normally, most of these procedures are encountered routinely in the clinic and the resident will perform these tasks repeatedly as the need arises for patients. However, the Program Director will augment training in areas which may not be practiced with sufficient frequency in the department. Also, additional areas may be added to the list if deemed essential to the professional needs of the resident. At the end of two years, the resident should be competent in the following areas:

b. Treatment Equipment (Teletherapy)

Calibration: calibration according to protocol, acceptance testing, commissioning, beam data input into the computer, verification of computer isodose distributions, surface doses, buildup dose distributions, determination of parameters for monitor set calculations.

Radiation Protection: head leakage, neutron contamination, area survey, design specifications, facility design.

Quality assurance: daily, weekly, monthly and annual checks.

c. CT Simulator

Testing: acceptance testing and commissioning.

Radiation Protection: beam quality, head leakage, and area survey.

Quality assurance: mechanical, radiation, imaging, and processor.

d. Dosimetric Equipment

Ion chambers: use of Farmer Chamber, plane parallel chamber, survey meter (calibration and use), radiation field scanner (water phantom).

TLD: annealing procedures, calibration, use of capsules, chips, in vivo dosimetry.

Film: film dosimetry for electrons and photons, sensitometric curve, and film badges.

Quality Assurance: Chamber calibration and intercomparisons, TLD quality control, and survey meter calibration checks.

e. Treatment Planning

Equipment: Acceptance testing and commissioning of treatment planning computer, digitizer, plotter and other auxiliary devices.

Software: Check of computer algorithms for isodose generation, blocking, inhomogeneity and other benchmark tests.

Imaging: Check of CT and MRI images for accuracy of contour delineation, magnifications; CT numbers vs. electron density curve.

Isodose Plans: Treatment technique design and optimization, plan display and evaluation.

Quality Assurance: Point dose verification by manual calculation.

f. Treatment Aids

Field Shaping: Custom blocking, multileaf collimators, half-value thickness blocks, gonadal shields, eye shields, internal shields with electrons.

Bolus: Material and thickness.

Compensators: Design of missing tissue compensators and dosimetry check.

In vivo Dosimetry: Use of TLD chips, diodes

(if available).

Patient Positioning: Immobilization devices, body position, leveling, and anatomic landmarks.

On-line Imaging: Verification of portal images in comparison with simulation images.

g. Special Techniques

TBI: Establishing dosimetry protocol for total body irradiation technique including dose calculation formalism, compensation and dosimetric verification.

TSI*:* Establishing total skin irradiation technique including treatment parameters, dosimetry and in vivo checks.

Electron Arc Therapy: Treatment planning and technique for electron arc therapy, and special dosimetry.

Intraoperative Electron Therapy (if available): Acceptance testing, commissioning, and complete dosimetry of applicators and other treatment conditions specific to IORT.

h. Stereotactic Radiosurgery

Specifications: Acceptance testing and commissioning of radiosurgery apparatus, beam data acquisition for small fields, data input into the treatment planning computer, and testing of dose calculation algorithm by head-phantom dosimetry.

Treatment Planning: Acquisition of CT, MRI, angiographics data; planning of isodose distributions in 3-D, plan evaluation, generation of treatment parameters.

Quality Assurance: QA checks before each case.

i. Patient Dose Calculations

Dosimetric Quantities: Percent depth dose, TPR, TMR, TAR, etc. and their relationship.

Monitor Unit Calculation: Calculations for different treatment conditions and techniques, verification of calculation formalism using bench mark problems.

j. Brachytherapy

Calibration: Acceptance testing and commissioning of brachytherapy sources and applicators.

Source Preparation: Preparation of sources and applicators for implantation.

Radiation Protection: Radiation surveys, leak testing and other requirements of regulatory agencies.

Treatment Planning: Computer isodose distributions, check of dose calculation algorithm, implant system rules and dose specification.

NRC-Mandated Quality Management Program: Detailed Review of QMP document, implementation and audit.

k. Quality Assurance Program

Design or review of physical quality assurance program for the department, including the NRC mandated Quality Management Program, AAPM Report (TG-40), JCAHO guidelines, etc.

TUESDAY NIGHT CONFERENCE SCHEDULE

Department of Therapeutic Radiology-Radiation Oncology
2007-2008

DATE 2007	LECTURE 4:30-5:30	SPEAKER	Discussion 5:30-6:00	NOTES
September 4	Brain Mets	Dr. Yuan		Resident Meeting
September 11	Journal Club	Willson/McAfee		
September 18	To be determined	Dr. Orner		
September 25	Complication	Willson		
October 2	To be determined	Dr. Orner		
October 9	Journal Club	Yuan/Adolfson		
October 16				
October 23	Complication	Willson		
October 30	ASTRO			
November 6	To be determined	Willson		
November 13	Journal Club	Tomblyn/Thatcher		
November 20	Prostate Hypofractionation	Dr. Cho		
November 27	Complication	Yuan		
December 4	Breast	Dr. Lee		
December 11	Endometrial Cancer	Dr. Dusenbery		
December 18	Complication	Yuan		
December 25	Holiday			

TUESDAY NIGHT CONFERENCE SCHEDULE

Department of Therapeutic Radiology-Radiation Oncology
2007-2008

DATE 2008	LECTURE 4:30-5:30	SPEAKER	Discussion 5:30-6:00	NOTES
January 1	Holiday			
January 8	Journal Club	Willson/Adolfson		
January 15				
January 22	Complication	Adolfson		
January 29				
February 5	GI or H & N	Dr. Lee		
February 12	Journal Club	Yuan/Thatcher		
February 19				
February 26	Complication	Adolfson		
March 4	Rhablomyosarcoma	Dr. Dusenbery		
March 11	Journal Club	Tomblyn/McAfee		
March 18	Combined Modality Lung cancer	Dr. Cho		
March 25	Complication	Tomblyn		

Department of Therapeutic Radiology-Radiation Oncology
2007-2008

DATE 2008	LECTURE 4:30-5:30	SPEAKER	Discussion 5:30-6:30	NOTES
April 1				
April 8	Journal Club	Willson/Thatcher		
April 15				
April 22	Complication	Tomblyn		
April 29				
May 6				
May 16	Journal Club	Yuan/Tomblyn		
May 20				
May 22	Complication	McAfee		
May 27	To be determined	Dr. Thatcher		
June 3				
June 10	Journal Club	Adolfson/McAfee		
June 17				
June 24	Complication	McAfee		
July 1				
July 8	Journal Club	?		
July 15				
July 22				
July 29	Complication	?		

BPHY 5174 Medical and Health Physics of Imaging II
Spring Semester 2004 Tuesdays and Thursdays: 4:45 p.m.
to 6:00 p.m. B216 Mayo Building - Leo Rigler Conference
Center

Grading:

There will be three exams during the semester, including the final. Each exam will count toward 20% of your total grade. There will be no quizzes. Homework problems will be handed out periodically and will count toward 35% of your grade.. Solutions to the assigned problems must be handed in on or before the due date except in the case of an excused absence. Solutions will be discussed in class at the beginning of class on the due date. The remaining S% of your grade will be based on class participation.

Exams:

All exams will be closed book. No additional materials will be allowed during the test. Calculators will be necessary for some parts of the exams. The programmable features of your calculator may not be used to store equations, constants, etc. If you are unable to make a scheduled exam time, let the instructor know as soon as possible. If you fail to notify the instructor that you will miss an exam time prior to the exam, any make-up exam will be at the discretion of the course director. Exams may cover any material prior to the exam but will concentrate on material covered since the last exam.

Demonstrations:

Classes identified as "Demonstration" will be held during the normal class time and either in the Rigler Conference Center or other location announced in advance by the instructor.

Texts:

The required textbook for this course is "Medical Imaging Physics", Hendee and Ritenour, 4th Edition. Additional reading material and references will be handed out in class. Students will be responsible for all information provided during the course unless told otherwise. A good additional reference for the nuclear medicine portion of this course is the text: "The Physics of Nuclear Medicine", Sorenson and Phelps.

Other texts are generally available which deal with basic atomic and nuclear physics, radiation detection, etc.

Availability of Lecturers:

Both lecturers for this course are listed on the syllabus and are generally available for questions. Off-site commitments, however, are such that it may be in your best interest to schedule an appointment through the section secretary, Pam Hansen, if you wish to discuss the course. You may also contact the lecturers via e-mail at the address provided or at their office phone number.

Calendar of Activities

(revised 6/16/08)

Rotation	*Activity*
1 *July, August, Sept.* *Mentor: Dr. Gerbi*	**Orientation:** Observe and participate in physics activities with staff physicists per three-month rotation, attend department conferences. Nursing, Sim., Treatment and Radiation Protection rotations. ***Work with Staff Physicist: clinical responsibilities.** **Courses: (TRAD 7170):** Basic Radiological Physics **(RT 411):** Principles & Practices of Radiation Therapy I **Reading Assignments:** Khan's "The Physics of Radiation Therapy" (CH 10 MU Calcs.), AAPM Medical Physics Residency document. As listed in Rotation 1 expectations.
2 *Oct., Nov., Dec.* *Mentor:* *Dr. Higgins*	***Work with Staff Physicist: clinical responsibilities.** **Courses (TRAD 7170):** Basic Radiological Physics **(RT 411):** Principles and Practices of Radiation Therapy I **Report:** Radiation Detectors: (1) Ion chamber, triax cable, electrometer (2) Film: XV2, EDR2, Radiochromic (3) TLDs (4) Diodes
3 *Jan., Feb., Mar.* *Mentors:Dr. Alaei*	***Work with Staff Physicist: clinical responsibilities.** **Courses (TRAD 7173):** Physics of Radiation Therapy (**RT 412):** Principles and Practices Radiation Therapy II **Report:** Calibration of Orthovoltage X-Ray units; full calibration linear accelerators: photon & electron beams
4 *Apr., May, June* *Mentor: Dr. Watanabe*	***Work with Staff Physicist: clinical responsibilities.** **Courses (TRAD 7173):** Physics of Radiation Therapy **(RT412):** Principles & Practices of Radiation Therapy II **June: Mock Oral Exam** **Report:** Operation, acceptance testing and commissioning of linear accelerator (x-rays and electrons).
5 *July, Aug,. Sept.* *Mentor:DrHiggins*	***Work with Staff Physicist: clinical responsibilities.** **Sept. Courses (BPHY 5171):** Medical and Health Physics of Imaging, **(TRAD 7172):** Radiation Biology **Report:** Acceptance testing and commissioning of treatment planning computer; explanation of algorithm
6 *Oct., Nov., Dec.* *Mentor: Dr. Alaei*	***Work with Staff Physicist: clinical responsibilities.** **Oct-Dec. Courses (BPHY 5171):** Medical and Health Physics of Imaging **(TRAD 7172):** Radiation Biology **Report:** Room shielding design for simulator, CT, orthovoltage and megavoltage facility and radioisotope storage, radiation protection survey-linac
7 *Jan.., Feb., Mar.* *Mentors: Dr. Watanabe, (Hui)*	***Work with Staff Physicist: clinical responsibilities.** **Course (BPHY 5174):** Medical and Health Physics of Imaging II **March: Mock Oral Exam** **Report:** Special Procedures: IMRT, TomoTherapy
8 *April, May, June* *Mentor: Dr. Gerbi*	***Work with Staff Physicist: clinical responsibilities.** **April-May Course (BPHY 5174):** Medical and Health Physics of Imaging II **Report:** Acceptance testing and Commissioning of brachytherapy apparatus and sources (LDR, HDR)

* Work with staff physicist means that the resident will perform, under close supervision, all tasks routinely assigned to staff physicists, e.g. treatment planning, dosimetry, calibrations, radiation protection, quality assurance and special clinical projects.

Special Report Schedule

Report Schedule (July 1, 2008 to June 30, 2010)

		Rotation Coordinator	Report Topic	Report to reviewers	Report Reviewers	Presentation date
July	2007	BG	Nursing rotation, CT sim rotation,			
August	2007		Linac rotation, Radiation Protection	---	---	---
September	2007		Rotation			
			Evaluation of Rotation			
October	2007	PH	Radiation Detectors: Ion chamber, triax cable, electrometer (2) Film:	12/15/06	YW /PA	12/31/08
November	2007		XV2, EDR2, Radiochromic (3) TLDs			
December	2007		(4) Diodes			
			Evaluation of Rotation, Report & Presentation			
January	2008	PA	Calibration of Orthovoltage X-Ray units; full calibration of linear	03/15/06	PH/BG	03/31/09
February	2008		accelerators: photon and electron			
March	2008		beams			
			Evaluation of Rotation, Report & Presentation			
April	2008	YW	Operation, acceptance testing and commissioning of linear accelerator	06/15/06	PA/PH	06/30/09
May	2008		(x rays and electrons)			
June	2008		MOCK ORAL EXAM (DATE TBD)			
			Evaluation of Rotation, Report & Presentation			
July	2008	PH	Acceptance testing and	09/15/06	BG/SH	09/30/09
			commissioning of treatment planning			
August	2008		computer;			
September	2008		explanation of algorithm			
			Evaluation of Rotation, Report & Presentation			
October	2008	PA	Room shielding design for CT simulator, orthovoltage and megavoltage facility,	12/15/06	PH/BG	12/30/09
November	2008		and radioisotope storage, radiation			
December	2008		protection survey-linac			
			Evaluation of Rotation, Report & Presentation			
January	2009	YW	Special Procedure: IMRT	03/16/07	PA/PH	03/16/10
February	2009					
March	2009		MOCK ORAL EXAM (DATE TBD)			
			Evaluation of Rotation, Report & Presentation			
April	2009	BG	Acceptance testing and	06/08/07	YW/PA	06/08/10
May	2009		commissioning of brachytherapy			
June	2009		apparatus and sources (LDR, HDR)			
			Evaluation of Rotation, Report & Presentation			

SPECIAL REPORT EXPECTATIONS

Report 1. Theory and operation of radiation detectors, ion chamber/triax cable/electrometer combination, radiographic film, thermoluminescent dosimeters, diodes. The report should describe the physical phenomenon that allows these devices to measure radiation, and how these detectors function as a radiation detector. How these detectors are tested and prepared for clinical use is to be part of the report.

References: Khan textbook, Attix textbook, Johns & Cunningham, Keithley electrometer manual, Leroy Humphreys Summer School chapter, Cameron TLD book, Goran Richner articles for diodes, Christensen for film.

Report 2. Calibration of Radiation Producing Equipment
A. Orthovoltage Calibration: The purpose of this report is for the resident to know how to perform a calibration of an orthovoltage unit, and the determination of HVL. This report should include a short discussion of TG61, the current AAPM protocol for orthovoltage calibration, why it was developed, and the previous method of calibration. The report should use actual data collected at the most recent orthovoltage calibration and result in a dose rate at 50 cm SSD and 100 cm SSD. The parameters used for the calibrations and why they were chosen should be clearly indicated. The report should include a discussion of the timer error, the timer check, and linearity of the unit. Make sure that the report includes answers to the following questions

- What is different from the current AAPM calibration protocol from previous methods?
- What is the equation used to calculate the dose rate at the calibration point?
- What do each of the factors in the equation represent?
- Explain why you need these factors.
- How do you calculate the dose to other material other than water (tissue) based on the calibration?

References: Measurement of Absorbed Dose in a Phantom Irradiated by a Single Beam of X or Gamma Rays (1973), AAPM protocol for 40–300 kV x-ray beam dosimetry in radiotherapy and radiobiology. Medical Physics, Vol. 28, Issue 6 (2001); 26pp. Radiation Therapy Committee Task Group #61.

B. Calibration of a megavoltage linear accelerator based on TG 51 protocol: The purpose of this exercise is to detail the steps needed to calibrate a megavoltage linear accelerator. The report should include a short description of why this protocol was developed to replace TG21 and state the advantages of this protocol over the previous protocol. The report should use actual data collected at the latest calibration and result in a dose rate at the reference point for both photons and electrons. The parameters used for the calibrations and why they were chosen should be clearly indicated.

References: TG21, TG51

SPECIAL REPORT EXPECTATIONS

3. Operation, acceptance testing, and commissioning a linear accelerator. This report should cover these specific topics. A list of steps associated with accepting a linear accelerator, and the steps needs to commission the linac need to be described.

References: TG-40 and TG-45.

4. Acceptance testing and Commissioning of a Treatment Planning Computer: The purpose of this report is to perform the steps necessary to accept and commission a treatment planning computer system. It also provides the resident the opportunity to understand the model, normalization, and operation of the planning system at a higher level than required to simply perform computerized treatment plans. The report should specify which planning system is being described, what steps need to be taken to formally accept the unit and what needs to be done to commission the treatment planning system. It specify how you check that this data is correctly entered, the tolerances for acceptability of the data, and where you find these tolerances of acceptability. The report should describe how the algorithm calculates dose to a point ($D_p = \ldots$) and what the terms in the equation mean. How the algorithm handles wedges, inhomogeneities, and CT data should also be described. It is anticipated that the resident will actually perform many of the steps required to commission the system.

References: Quality Assurance for Clinical Radiotherapy Treatment Planning (Reprinted from Medical Physics, Vol. 25, Issue 10) (1998) Radiation Therapy Committee Task Group #53, Commissioning Manual for that Treatment Planning System.

5. Radiation Room Shielding: linear accelerator, simulator, CT simulator, HDR brachytherapy, isotope storage room.

References: NCRP 151, Shielding Techniques for Radiation Oncology Facilities, Patton H. McGinley, Shielding Techniques for Radiation Oncology Facilities, Medical Physics Publishing, 1998.

6. Intensity Modulated Radiation Therapy (IMRT). The report should cover the theory of IMRT, how inverse planning is performed, the steps in establishing an IMRT program, a description of the testing of plans needed to be performed before a patient receives treatment using IMRT.

7. Acceptance testing and Commissioning in Brachytherapy: The purpose of this report is to cover the steps needed to acceptance test brachytherapy equipment associated with Low Dose Rate Brachytherpay (LDR), High Dose Rate Brachytherapy (HDR), and Intravascular Brachytherapy (IVB), and the sources and apparatus used in each of these activities. Commissioning a planning system for brachytherapy should be included in the report.

SPECIAL REPORT EXPECTATIONS

References: High Dose-Rate Brachytherapy Treatment Delivery (Reprinted from Medical Physics, Vol. 25, Issue 4) (1998) Radiation Therapy Committee Task Group #59.

Clinical Rotation Schedule and Objectives

Rotation 1 **Chief Mentor: B Gerbi**

Orientation
Machine QA: monthly mechanical checks, calibration
Brachytherapy: GYN loading/unloading, HDR QA
Rotations: Nursing, Linacs, Simulator, Radiation Protection
MU calculation problem set
Chart checking
Special procedures: TBI

1. The resident shall:
   a. Meet with the program director to discuss program objectives
   b. Meet to discuss Rotation 1 Objectives(Attachment R.1.A)
   c. Attend the department orientation course

1. Cover the Quality Management Program (QMP)
2. Cover Monitor Unit Calculation (Attachment R.1.B)
3. Cover Brachytherapy LDR Loading/unloading and control of radioactive material
4. Cover other items on Attachment R.1.A

2. Attend hospital orientation
3. Primary clinical responsibilities: 1) complete Low Dose Rate (LDR) brachytherapy loading training and take over the loading duties from senior resident, 2) complete Monitor Unit Calculation Problem set and pass "Calc Doer" exam
4. After orientation, the next two weeks of this rotation are spent in observation of treatment simulation and delivery in the clinic. The goal is for the resident to become familiar with the daily activities and the treatment flow of the clinic.
   a. Nursing rotation (Attachment R.1.C)
   b. Linac rotation (Attachment R.1.D)
   c. Simulator rotation (Attachment R.1.E)
   d. Radiation protection rotation (Attachment R.1.F)

5. The resident will observe the monthly mechanical and calibration checks on the linear accelerators. The resident will perform the monthly checks during the 3rd month with close supervision. The resident will be assigned monthly QA tasks for the remainder of their two year training. Their rotation evaluations will be based partly on their attention to this task.

6. The resident shall participate in machine troubleshooting, repair and maintenance as the opportunity arises. This will continue throughout the resident's two year training.
7. The resident will learn treatment planning for low dose rate (LDR) gynecological implants. The resident will participate in the preparation of source loading, observation of the insertion and removal of the sources, and the radiation safety

surveys for all planned patients. After appropriate training, the new resident will be responsible for this task for this rotation and then on an alternate basis with the other resident.

8. The resident shall attend Graduate courses TRAD 7170 Basic Radiological Physics and RTT 3581 Principles and Practices of Radiation Therapy I
9. The resident will cover the total body irradiation procedures using photons for pre-transplant treatment.
10. AAPM task group reports and other documents will be reviewed, and for this rotation, will include:

    a. Professional information such as:
        i. AAPM's "The Roles, Responsibilities, and Status of the Clinical Medical Physicist"
        ii. AAPM Report No. 36, "Essentials and Guidelines for Hospital-Based Medical Physics Training Programs,"
        iii. AAPM Report No. 38, "Statement on the Role of a Physicist in Radiation Oncology"
    b. Comprehensive QA for Radiation Oncology (Reprinted from Medical Physics, Vol. 21, Issue 4) (1994) Radiation Therapy Committee Task Group #40; 37 pp.
    c. TG71: Monitor Unit Calculations (when report finished)
    d. State/NRC regulations for brachytherapy practice
    e. State regulations for linear accelerator QA, MN Dept of Health Ionizing Radiation Rules, Chapter 4730
    f. The Physical Aspects of Total and a Half Body Photon Irradiation (1986) Radiation Therapy Committee, Task Group #29; 55 pp.
    g. Total body irradiation conditioning regimens in stem cell transplantation, K. Dusenbery & B. Gerbi, [In] SH Levitt, JA Purdy, CA Perez, S. Vijayakumar, eds. Technical Basis of Radiation Therapy, 4th Ed., Springer-Verlag, Berlin, 2006.

First Rotation Objectives (Attachment R.1.A)

Activity	**Covered**	**Completed**
Monitor Unit Calculations – complete the standard handout for monitor unit calculations, "Routine calculations in the U. of MN Department of Therapeutic Radiology"		
Take and pass the monitor unit Level I (doer) test		
Read and understand the Quality Management Program (QMP)		
Participate in, and take over the loading, unloading, logging, and control of sources in the Low Dose Rate Brachytherapy Program; Training Case 1_____, 2_____, 3_____		
Become proficient in performing the morning HDR QA		
Be able to perform TBI calculations and compensator design by hand and using in-house program		
Be able to describe the commissioning of a TBI treatment program		
Participate in the Linac Monthly QA		
First month – observe and participate in the mechanical and radiation check of the accelerator		
Second Month – take a more active part in the monthly QA with a greater understanding of the theory of calibration (TG-21/TG-51 protocols).		
Rotate with the nursing staff (see attached proficiency) 2 days		
Rotate in the Simulator (see attached proficiency) 2 days		
Rotate on the linear accelerator (see attached proficiency) 3 day, Elekta, Varian, TomoTherapy		
Rotate with Environmental Health (see attached proficiency)		

Staff Signature ____________ Date: _____ Resident Signature ___________ Date_____

Evaluation of Resident:
____
____

Nursing Rotation Checklist (Attachment R.1.C)

Activity	**Completed**
Participate in a new patient consult with the Medical Resident	
Observe nurse training & education of a new patient	
Be present for informed consent of a patient	
Be present for the placement of applicators for a HDR brachytherapy procedure	
Observe an on-treatment visit (OTV)	
Observe patient follow-up visit	
Observe an HDR placement	
Discuss what are appropriate conversations and behaviors near patients	

Student name/signature: ____ Date / _______

Clinical Instructors name/ signature: ____ Date / _______

Performances: Observe and assist **one New Patient Exam**. Identify the patient's name, diagnosis, stage of disease, and treatment techniques to be used - noting the major anatomical structures.

New Patient Exam

1. Patient's Initials: __________
2. Diagnosis: ____
3. Stage of Disease: ____
4. Describe treatment to date and the proposed treatment technique:

____
____
____
____
____
____
____
____
____
____

Student name/signature: ____Date / _______

Clinical Instructors name/ signature: ____Date / _______

Performances: Observe and assist **one Current Patient Exam**. Identify the patient's name, diagnosis, stage of disease, treatment technique, number of treatments and dose received, and reaction noted.

Current Patient

1. Patient's Initials: _______
2. Diagnosis: ____
3. Stage of Disease: ____
4. Describe the treatment technique:

____

____

5. Number of Treatments and Dosage Received to Date:

____

____

6. Reaction Description (tumor response and/or normal tissue reaction):

____

____

____

____

____

____

Student name/signature: ____ Date / _______

Clinical Instructors name/ signature: ____ Date / _______

Performances: Observe and assist **one Follow-up Exam** from two different services. Identify the patient's name, diagnosis, stage of disease, treatment technique, doses given and current status of patient's health.

Follow-up Exam

1. Patient's Initials: ________
2. Diagnosis: ____
3. Stage of Disease: ____
4. Area(s) of Treatment:

____

____

5. Total Dose(s) Administered:

____

6. Discuss the Current Status of the Patient's Health and any past and/or present side effects due to treatment:

____

____

____

____

____

____

Student name/signature: ____ Date / _______

Clinical Instructors name/ signature: ____ Date / _______

Simulation Rotation Checklist (First Resident Rotation)

Activity	**Covered**	**Completed**
CT Simulation		
Participate in the warm-up and morning QA of the equipment		
Participate in the positioning of the patient for a CT simulation		
Be present for patient interview concerning the use of contrast		
Be present at the injection of contrast		
Observe the CT scanning procedure		
Have a general knowledge of CT operation		
Know how to transfer CT scans to the treatment planning computers		

Reference: Gerbi, B.J.: The Simulation Process in the Determination and Definition of the Treatment Volume and Treatment Planning. [In] Levitt SH, Khan FM, Potish RA, (eds.), Levitt and Tapley's Clinacal Application of Radiation Therapy, 3rd Ed. (Williams & Wilkins, Baltimore, MD, 1999).

KP McGee, I Das: Part I: Technical Aspects of CT simulation and treatment planning, Chapters 2-6, [In] A practical guide to CT simulation, LR Coia, TE Schultheiss, GE Hanks, Eds. Advanced Medical Publishing, Madison, WI, 1995

CT Simulators, Canadian Association of Provincial Cancer Agencies Standards for Quality Control at Canadian Radiation Treatment Centres (http://www.medphys.ca/content.php?doc=58)

Evaluator's Comments: ____
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Evaluator's Signature: ____

Student's Comments:
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Student's Signature: ____

Linac Treatment Rotation Checklist (Attachment R.1.D)

Activity	**Covered**	**Completed**
Observe/participate in the warm-up of the equipment -Record operating parameters of the linac & Tomo and know why this is important to perform		
Observe/participate in the morning QA of the equipment -Know what our output tolerances are and what to do if the checks are outside of these tolerances		
Observe/participate in other morning QA checks - Optical distance (SSD) indicator check - Door interlock check - Laser alignment checks - Audio/video operation check - (At HCMC, see their morning warm up for Portal Vision)		
Observe/participate in pre-treatment chart check		
Observe New start/patient pre-port procedure		
Observe normal treatment of patients & charting		
Observe weekly porting of patients & notes written in chart		
Observe/assist in port film developing, documentation, & filing		
Observe/assist in the treatment of a Rt/Lt lateral TBI patient		
Observe/assist in the treatment of a Total Skin electron patient		
Observer/assist in taking diode readings for port verification		
Observe/understand operation of IMPAC system		
Observe/be aware of billing of treatments at the accelerator		
Observe/participate in the checking of MLC blocked fields		

Evaluator’s Comments: ____

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Evaluator’s Signature: ______________________________________

Resident’s Signature: ____

Environmental Health & Radiation Protection Rotation Checklist (First Resident Rotation)

Activity	**Covered**	**Completed**
Participate in the receipt, assay, inventory, and disposal of radioactive material.		
Participate in Survey Meter calibration		
Participate in the preparation of a room for an I-131 patient		
Discuss DOT regulations for the transport and labeling of radioactive material		
Observe the training of nursing staff for the handling of patients containing radioactive material		

Signature of Staff Individual ___________________________________

Date: _______________________

Evaluation of Resident:
____

Topic: Total Body Irradiation

Recommended reading:

1. AAPM Report on TBI: The Physical Aspects of Total and a Half Body Photon Irradiation (1986) Radiation Therapy CommitteeTask Group #29; 55 pp.
2. Dusenbery, K.E., Gerbi, B.J.: Total Body Irradiation in Conditioning Regimens for Bone Marrow Transplantation. [In] Levitt SH, Khan FM, Potish RA, Perez, CA (eds.), Levitt and Tapley's Clinacal Applications of Radiation Therapy, 3rd Ed. (Williams & Wilkins, Baltimore, MD, 1999).

Topics - Treatment Planning	**Covered**	**Completed**
1. Simulation measurements-measurements of the patient for TBI calculation and treatment		
2. Hand calculations for design of compensators and Monitor Unit calculations		
3. Computer program use for compensator design and patient treatment		
4. Description of the Rt/Lt lateral TBI technique		
5. Description of the Anterior/Posterior standing TBI technique		
Physics topics – Intent: be able to initiate a Total Body Program from the beginning		
Field Size determination – field flatness		
Output determination at the TBI treatment distance		
TMR verification at extended distances		
Beam spoiler factor measurement		
Verification of Inverse Square Law		
Compensator factor measurement and evaluation		
In-vivo dosimetry using TLDs and diodes		
-		

Clinical Rotation Schedule and Objectives

Rotation 2 Chief Mentor: P Higgins

Machine QA: monthly dosimetric checks
IMRT QA
HDR morning QA, TBI TLDs

REPORT: Radiation detectors: (1) ion chambers, triax cable, electrometer, 2) film, XV2, EDR2, Radiochromic, 3) TLDs, 4) diodes

1. The resident shall attend Graduate courses TRAD 7170 Basic Radiological Physics and RTT 3581 Principles and Practices of Radiation Therapy I

2. Clinical responsibility: 1) learn the morning High Dose Rate quality assurance procedure and take this activity over, and 2) learn how to do the TBI TLDs.

3. Linac QA concentration will be on dosimetry measurements, including the monthly calibration of the beams.

4. The practical use of ion chambers, diodes and TLDs will be reviewed by the chief mentor. This is also covered in Graduate course TRAD 7170.

5. The resident will start to learn the treatment planning process including IMRT. This will include the use of the current inverse planning software. There will be close supervision of the resident.

6. Single and multiple fraction stereotactic radiosurgery procedures will be mastered during this rotation. The resident will be directly involved in the planning and treatment of these cases.

7. AAPM task group reports and other documents will be reviewed, and for this rotation, will include:

   a. ICRU Report 50, Prescribing, Recording, and Reporting Photon Beam Therapy
   b. ICRU Report 62, Prescribing, Recording and Reporting Photon Beam Therapy
   c. Quality Assurance for Clinical Radiotherapy Treatment Planning (Reprinted from Medical Physics, Vol. 25, Issue 10) (1998) Radiation Therapy Committee Task Group #53; 57 pp.
   d. The Calibration and Use of Plane-Parallel Ionization Chambers for Dosimetry of Electron Beams (Reprinted from Medical Physics, Vol. 21, Issue 8) (1994) Radiation Therapy Committee Task Group #39; 10 pp.
   e. Reports and articles associated with the Report for the current rotation

Topic: Special Procedures: *in vivo* or patient specific dosimetry

Recommended reading:

1. The Physics of Radiation Therapy, 2nd Edition, 1984, F.M. Khan, pp. 167-174
2. Radiation Detection and Measurement, 2nd Edition, G.F. Knoll, Chapter 11
3. The Essential Physics of Medical Imaging, 2nd Edition, J.T. Bushberg, pp. 157-163
   or Christensen's Physics of Diagnostic Radiology, …….
4. Leuens, G et al, Quality Assurance in Radiotherapy by in vivo Dosimetry, 1. Entrance Dose Measurements,
   A Reliable Procedure, Radiotherapy & Oncology 17(2): 141-151, 1990

Topics – *in vivo* or patient specific dosimetry	**Covered**	**Completed**
1. Diodes: basic theory of operation and types		
2. Diodes: radiation damage		
3. Diodes: factors affecting response		
4. Diodes: calibration		
5. TLDs: basic theory of operation		
6. TLDs: most common types/forms, shapes		
7. TLDs: calibration and annealing		
8. Film: composition		
9. Film: Optical density, characteristic curve, average gradient, gamma, speed, latitude		
10. Film: various types		
11. Film: screens		
12. Film: processing		
13. Procedures for patient dose measurements using diodes		
14. Procedures for patient dose measurements using TLDs		
15. Special measurements: internal dosimetry, total skin treatment dosimetry		

Clinical Rotation Schedule and Objectives

Rotation 3 **Chief Mentor: P Alaei**

Machine Acceptance testing
CT simulator QA
Special procedures: EPID
Brachytherapy: GYN loading/unloading

REPORT: Calibration of Orthovoltage X-ray units; full calibration of liner accelerators, both photon and electron beams

1. The resident shall attend Graduate courses TRAD 7173 Physics of Radiation Therapy and RTT 4581 Principles and Practices of Radiation Therapy II.

2. Daily, monthly and annual measurements will be reviewed and performed for the simulator and CT simulator by the resident.

3. Some brachytherapy procedures, HDR and LDR gynecological implants, happen on a less frequent basis. The resident will participate in the clinical treatment process and radiation safety aspects of these types of brachytherapy procedures.

4. It is expected for the resident to become more proficient in the planning and treatment of radiosurgery cases. The resident will take the lead on planning and QA for these cases, with limited supervision.

5. AAPM task group reports and other documents will be reviewed and for this rotation, will include:

   a. Comprehensive QA for Radiation Oncology (Reprinted from Medical Physics, Vol. 21, Issue 4) (1994) Radiation Therapy Committee Task Group #40; 37 pp.
   b. AAPM Report 83, Quality assurance for computed-tomography simulators and the computed-tomography-simulation process. Medical Physics, Vol. 30, Issue 10 (2003); 31pp. Radiation Therapy Committee Task Group No. 66
   c. Protocol for Clinical Dosimetry of High-Energy Photon and Electron Beams (Reprinted from Medical Physics, Vol. 26, Issue 9) (1999) Radiation Therapy Committee Task Group #51
   d. AAPM protocol for 40-300 kV x-ray beam dosimetry in radiotherapy and radiobiology. Medical Physics, Vol. 28, Issue 6 (2001); 26pp. Radiation Therapy Committee Task Group #61.
   e. Reports and articles associated with the Report for the current rotatio

Clinical Rotation Schedule and Objectives

Rotation 4 Chief Mentor: Y. Watanabe

Machine QA: annual checks, cont.
External beam treatment planning
Monitor unit calculations
HDR morning QA, TBI TLDs

REPORT: Operation, acceptance testing and commissioning of linear accelerators: x rays and electrons

1. The resident shall attend Graduate courses TRAD 7173 Physics of Radiation Therapy and RTT 4581 Principles and Practices of Radiation Therapy II.
2. Machine QA concentration will continue to be on annual measurements. The resident is expected to write the annual report.
3. The resident will continue to learn the 3D treatment planning process. The goal for this rotation is to become proficient in contouring, virtual simulation, beam's eye view planning for simple cases, field shaping, monitor unit calculations, entering of patient data into the record and verify system, and proper chart documentation. The resident will have close supervision during this rotation.
4. The resident will become proficient with the Gamma Knife, calibration, quality assurance, commissioning
5. Tomotherapy QA: Daily QA, Monthly QA and Annual QA
6. Tomotherapy treatment planning (initial), delivery and delivery QA.
7. Specification and implementation of monitor unit calculations will be reviewed.
8. The resident will continue to participate in brachytherapy program.
9. AAPM task group reports and other documents will be reviewed and for this rotation, will include:

   a. AAPM Code of Practice for Radiotherapy Accelerators (Reprinted from Medical Physics, Vol. 21, Issue 7) (1994) Radiation Therapy Task Group #45
   b. Medical Accelerator Safety Considerations (Reprinted from Medical Physics, Vol. 20, Issue 4) (1993) Radiation Therapy Committee Task Group #35; 15 pp.
   c. Clinical use of electronic portal imaging (Reprinted from Medical Physics, Vol. 28, Issue 5) (2001) Radiation Therapy Committee Task Group #58; 26 pp.
   d. Reports and articles associated with the Report for the current rotation

Topic: Stereotactic Radiosurgery

Recommended reading:

1. AAPM Report 54 from Task Group 42, Report on SRS
2. Cho, C.K., Gerbi, B.J., Hall, W.A.: Ch. 10 pp. 147-172: Stereotactic Radiosurgery and Radiotherapy. [In] Levitt SH, Khan FM, Potish RA, (eds.), Levitt and Tapley's Clinacal Applications of Radiation Therapy, 3rd Ed. (Williams & Wilkins, Baltimore, MD, 1999).
3. Bova, F.J., Meeks, S.L., Friedman, W.A.: Ch. 10 pp. 215-241: Linac Radiosurgery: Systems requirements, Procedures, and Testing. [In] Khan, F.M. and Potish, R.A. Treatment Planning in Radiation Oncology (Williams & Wilkins, Baltimore, MD, 1998)
4. Users manuals from Elekta Gamma Knife, MR Fusion

Topics - Treatment Planning	**Covered**	**Completed**
1. Fusion Program		
2. Simple single spherical target		
3. Monitor unit calculations		
4. Single non-spherical target		
5. Multiple Target planning and plan normalization		
6. Angiographic program		
7. Planning for AVMs		
8. Planning using MR and CT scans		
9. Planning for Trigeminal Neuralgia cases		
10. Image Fusion software		
11. Planning using fused images		
Physics topics -		
Radiation related topics		
Cone factor measurements		
TMR measurements		
OAR measurements		
Geometric Accuracy checks		
Check of the accuracy of the test phantom		
Independent floor stand checks		
Imaging accuracy check		
MR scanner imaging accuracy		

CT scanner imaging accuracy		
Angiographic localizer accuracy checks		
Verification of accurate image data to treatment planning computer		

Treatment Planning Clinical Objectives and Performance

Resident name: ____________________________ Month: ____________________________

Evaluator: ____

During clinical rotation in treatment planning, the resident will receive instruction and observance of assignments presented by physics personnel. He/she must complete ALL ASSIGNMENTS to the satisfaction of the supervising staff members.

Objective 1: Understand and record pertinent information in a Radiation Therapy Treatment Chart.

	Staff Initial	Date
1. Read and understand a Radiation Therapy treatment prescription as prescribed by a physician.		
2. Document and verify accurate patient measurements from the simulator and treatment machine (including wedges, compensators, computer plan information, etc.) in the Radiation treatment chart.		
3. Document and describe various methods of immobilization devices used for patient set-up.		
4. Document and describe the importance of using wedges, compensators and bolus.		
5. Understand the importance and procedure of obtaining patient contours and their use in treatment planning, including orthogonal films, and verifying their accuracy.		
6. Discuss different treatment machines and its energies. Identify "hot spots" and methods to eliminate them.		

Treatment Planning Clinical Objectives and Performance

During clinical rotation in treatment planning, the resident will receive instruction and observance of assignments presented by physics personnel. He/she must complete ALL ASSIGNMENTS to the satisfaction of the supervising staff members.

Objective 2: Assist in the design and manufacturing of various treatment aid devices.

	Staff Initial	Date
1. Discuss the design and manufacturing of custom bolus.		
2. Explain why there is a need to use bolus in various treatments.		
3. State how the bolus will change the dose at various points within the treatment field.		
4. Assist in manufacturing or explain the use and design of mouth shields, eye shields, and TSI nail/hand shields.		
5. Explain what information is needed to decide whether a particular treatment field will need a compensator. State department policy regarding acceptable dosage variances within uncompensated field.		
6. Discuss and explain uses of a 3-D compensator for patient treatment.		
7. Discuss and explain the utility of segmented fields		

Treatment Planning Clinical Objectives and Performance

During clinical rotation in dosimetry, the student will receive instruction and observance of assignments presented by physics personnel. He/she must complete ALL ASSIGNMENTS to the satisfaction of the dosimetry department.

Objective 3: Demonstrate knowledge of basic computer plans as well as the ability to do calculations for Radiation Therapy Treatments.

		Staff Initial	Date
1.	Demonstrate knowledge of basic and computer plan calculations. Understand all parameters used in calculations and use of appropriate tables.		
2.	Identify appropriate equations (i.e., SSD, SAD, electron and extended SSD calculations) and demonstrate the ability to perform Radiation Therapy calculations.		
3.	Successfully perform skin gap calculations.		
4.	Observe and understand the purpose weekly chart checks.		
5.	Define, state the purpose, and perform an irregular field calculation.		
6.	Perform calculations for each of the following: single open field, weighted fields, wedged fields, electron field, multiple fields with blocks, and a computer generated plan.		
7.	Observe and assist with basic computer plans for patient treatment. Be able to give examples of types of treatment used for specific treatment fields (i.e. breast, lung parotid, prostate, etc.)		
8.	Discuss and observe basic treatment planning, 3-D non-conformal and stereotactic treatment planning.		

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Treatment Planning Terms 1

Resident name: ___________________________ Date: ________________________

On a separate sheet of paper, define the terms below giving examples and mathematical formulas where applicable.

1. Air Gap
2. Attenuation
3. Beam Hardening
4. D_{max}
5. Effective Field
6. Equivalent Square / A/P
7. Given Dose
8. Fluence
9. Homogeneous Dose
10. Hot Spots
11. HVL
12. Isodose Curve
13. Magnification Factor
14. Minification Factor
15. Maximum Target Dose
16. Minimum Target Dose
17. Output factor
18. Orthogonal films
19. PDD, %DD
20. Penumbra
21. Prescribed Dose
22. Primary Radiation
23. Scatter Radiation
24. Skin Sparing
25. SAD Technique
26. SSD Technique
27. PTV
28. CTV

Treatment Planning Terms 2

Resident name: ____________________________ Date: ________________________

On a separate sheet of paper, define the terms below giving examples and mathematical formulas where applicable.

1. Absorbed Dose
2. Activity
3. Attenuation Coefficient
4. Buildup Region
5. Decay Constant
6. Dynamic Wedge
7. Entrance Dose
8. Exit Dose
9. Gap calculation
10. GM Meter
11. Sensitometric curve
12. Heterogeneity
13. Independent Jaw
14. ICRU
15. Irregular Field
16. Manchester Method
17. Mass Attenuation Coefficient
18. MLC
19. IMRT
20. 3D-Conformal
21. Paterson-Parker Method
22. Pig
23. Quimby Method
24. Quality Factor
25. SAR
26. S_c
27. S_p
28. TMR
29. TLD
30. Tissue Tolerance
31. Wedge Angle
32. Hinge Angle
33. DVH

COMMENTS: TREATMENT PLANNING 1 ROTATION
(Give any further information that you feel might be helpful in evaluating this student.)

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STUDENT COMMENTS: TREATMENT PLANNING 1 ROTATION

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This form was reviewed with me, and I understand this information will become a part of my permanent file at the University of Minnesota, Medical Physics Residency Program.

________________	____________________________________
Date	Student Signature
________________	____________________________________
Date	Evaluator
________________	____________________________________
Date	Program Director

I, the student, do not agree with this evaluation. However, I did review and sign it on the date listed below:

________________	____________________________________
Date	Resident Signature

Clinical Rotation Schedule and Objectives

Rotation 5 **Chief Mentor: P Higgins**

External beam treatment planning
IMRT planning
Plan Checks/Chart checks
Brachytherapy: GYN loading/unloading

REPORT: Acceptance testing and commissioning of treatment planning computers, explanation of algorithm

1. The resident shall attend graduate course TRAD 5171 (Medical and Health Physics of Imaging), and TRAD 7172 Radiation Biology

2. External beam treatment planning continues to be the main focus of rotation 5. Tasks are the same as with rotation 4, but the goal is for the resident to become increasingly independent, taking minimal direction from the dosimetry team.

3. Machine QA concentration will be on annual measurements. A comprehensive document exists that describes the procedure for performance, calculation and analysis for all mechanical, dosimetric and radiation safety measurements. The resident shall assist with one machine and take the lead for the next two linear accelerators. It is expected that these measurements will be completed over a 6 month period. The resident is expected to write the annual reports for each machine. Acceptance testing documents and procedures will be reviewed.

4. IMRT QA is an integral part of the IMRT treatments and the resident will be expected to perform the routine QA for each patient that is planned. This includes dosimetric measurements for verification of the intensity pattern. The resident will also become skilled at using an independent monitor unit program of the IMRT plan.

5 The resident will learn the physicists' checks for treatment plans and for paper and electronic charts. Chart checks by the resident will be carried out under close supervision.

6. AAPM task group reports and other documents will be reviewed, and for this rotation, will include:

   a. Basic Applications of Multileaf Collimators (2001) Radiation Therapy Committee Task Group #50

b. Reports and articles associated with the Report for the current rotation

TOPIC: Advanced Calculation Practice Set

A. Routine monitor unit calculations:

1. Field size is 12x22. A ¼” block tray is used. Calculate the monitor units needed to deliver 100 cGy to the prescription point (10cm depth) for each situation below:

SSD	E	Eff fs	OAD	fdd	*I.Sq.*	*OAR*	S_c	S_p	Tray	MU
100	6	15	0							
80	18	12	5							
410	25	30	10							

2. Repeat for isocentric calculations:

SAD	E	Eff fs	OAD	TMR	*I.Sq.*	*OAR*	S_c	S_p	Tray	MU
100	6	15	0							
80	18	12	5							
410	25	30	10							

3. a.) How well do the monitor units compare? Is a Mayneord correction needed? If so, what is it?

b.) How is the off-axis ratio defined? If you were to measure it, how would you go about it, using:

i.) Ionization chambers.

ii.) Pinnacle or Eclipse treatment planning systems.

4. Consider the following situations: The 2300cd linear accelerator has MLC capability and two sets of wedges, designed so that the wedge is always placed below the blocked field aperture. The Elekta linear accelerator has only a single wedge (60 degrees) which are inserted using a motorized drive (thus the name motorized wedge). Suppose the secondary collimators are set to 20x20 for each machine and the blocked field is set to 10x10 (at 100 cm) for each machine.

Due to beam hardening effects, the central axis depth dose curves for wedged fields are more penetrating than for open fields. This hardening effect can be accounted for in the wedge factors by either; i.) scaling the d_{max} wedge factor measurements to different depths by multiplying them by the ratio of the wedged:open field depth doses at each depth, or ii.) by measuring them directly at different depths.

In the following, determine the appropriate wedge factors and calculate the monitor units needed to deliver 100 cGy. Use all isocentric calculations, assuming 100 cm SSD. Assume the MLC is used where it exists. Use the clinic data books.

E	Machine	depth	*Wedge*	*WF*	*TMR*	S_c	S_p	Tray	MU
6	Elekta	5	15						
6	Elekta	10	30						
6	Elekta	20	45						
25	2300cd	5	15						
25	2300cd	10	30						
25	2300cd	20	45						

a.) How are the wedge factors selected?

b.) If the TMR tables were constructed from the measured central axis depth dose curves for the wedges, how would the factors above be modified?

B. Treatment planning problems

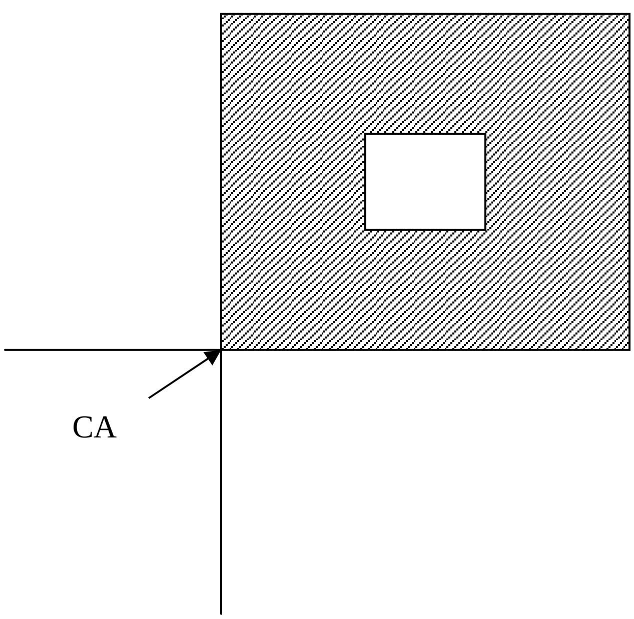
1. If the Pinnacle planning system is used,

a.) How is the dose normalization point defined?

b.) If a 20x20 field setting is used, and that field is blocked down to a 5x5 field, and 100 cGy are to be delivered to a depth of 10 cm (Elekta, 6x), what monitor unit setting should be used?

c.) If the physician were to prescribe to the 98% isodose line, what would the monitor unit setting become?

d.) If the field (1b.) looked like the one below (BEV), where would the dose normalization be defined? What information would be needed to calculate the monitor units? Calculate monitor units, assuming the SSD at the field center is 90 cm and the SSD at the CA is 85 cm. Write down all the factors.



2. Eclipse planning system. Answer the same questions as for the problem above.

a.)

b.)

c.)

d.) In this case, assume the beam weight has been adjusted to 1.04, to put the 100% isodose line through the center of the field at the 10 cm prescription depth.

Clinical Rotation Schedule and Objectives

Rotation 6 **Chief Mentor: P Alaei**

External beam treatment planning
IMRT planning
Treatment planning system QA
Monthly Linac QA
HDR morning QA, TBI TLDs

REPORT: Room shielding design for simulator, CT, megavoltage facility, and radioisotope storage. Radiation protection survey of linac room.

1. The resident shall attend graduate course TRAD 5171 (Medical and Health Physics of Imaging), and TRAD 7172 Radiation Biology.

2. Experience with external beam treatment planning will continue to ensure that the resident has experience with all items on the treatment planning checklist.

3. The main concentration of this rotation will be shielding.

4. The QA concentration will be on treatment planning systems. Data entry and beam fitting will be learned for one treatment planning system and monitor unit calculation program. Routine QA tests for a treatment planning system will be performed and documented.

5. The resident will continue to perform chart and plan checks.

6. One of the main concentrations of this rotation will be on review of radiation safety. This will include NRC and state regulations, quality management programs, and structural shielding design. Additionally, the resident will work through several sample problems of designing a room for an accelerator or a simulator. Radiation safety surveys of several of the treatment rooms will also be conducted.

7. AAPM task group reports and other documents will be reviewed, and for this rotation, will include:

   a. Fetal Dose from Radiotherapy with Photon Beams (Reprinted from Medical Physics, Vol. 22, Issue 1) (1995) Radiation Therapy Committee Task Group #36; 20 pp.

b. Management of Radiation Oncology Patients with Implanted Cardiac Pacemakers (Reprinted from Medical Physics, Vol. 21, Issue 1) (1994) Task Group #34; 6 pp.

c. Neutron Measurements Around High Energy X-Ray Radiotherapy Machines (1986) Radiation Therapy Committee Task Group #27; 34 pp.

d. NCRP 49: Structural Shielding Design and Evaluation for Medical Use of X-rays and Gamma Rays of Energies up to 10 MeV

e. National Council on Radiation Protection and Measurement, Structural shielding design and evaluation for megavoltage x- and gamma-ray radiotherapy facilities, NCRP Report No. 151 (National Council on Radiation Protection and Measurement, Washington, 2005).

f. NCRP 116: Recommendations on Limits for Exposure to Ionizing Radiation

g. Reports and articles associated with the Report for the current rotation

Topic: Shielding Design (Linacs, Brachytherapy, HDR, Gamma Knife, Tomotherapy)

Recommended reading:

National Council on Radiation Protection and Measurement, Protection against neutron radiation, NCRP Report No. 38 (National Council on Radiation Protection and Measurement, Washington, 1971).
National Council on Radiation Protection and Measurement, Structural shielding design and evaluation for medical use of X rays and gamma rays of energies up to 10 MeV, NCRP Report No. 49 (National Council on Radiation Protection and Measurement, Washington, 1976).
National Council on Radiation Protection and Measurement, Structural shielding design and evaluation for megavoltage x- and gamma-ray radiotherapy facilities, NCRP Report No. 151 (National Council on Radiation Protection and Measurement, Washington, 2005).
National Council on Radiation Protection and Measurement, Neutron contamination from medical electron accelerators, NCRP Report No. 79 (National Council on Radiation Protection and Measurement, Washington, 1984).
Kersey, R.W.: Estimation of neutron and gamma radiation doses in the entrance mazes of SL 75-20 linear accelerator treatment rooms, Medicamundi 24:151 (1979).
O'Brien, P., Michaels, H.B., Gillies, B., Aldrich, J.E., and Andrews, J.W.: Radiation protection aspects of a new high-energy linear accelerator, Med. Phys. 12:101, (1985).
McGinley, P. H.: Shielding Techniques for Radiation Oncology Facilities, 2nd Ed..

Medical Physics Publishing, Madison, WI. 2002

Topics – Room Shielding Design	**Covered**	**Completed**
1. Regulatory Requirements for shielding design		
2. Linac Shielding		
- Photon primary barrier determination, single and multiple material calculations		
- Secondary barrier shielding requirements		
- Neutron shielding		
- Maze design and evaluation		
- Room design considerations without mazes		
- Door shielding considerations with and without maze		

- Skyshine calculations		
- Shielding considerations for ventilation, pipes, ductwork, voids		
- Ozone production and ventilation considerations		
- Other considerations, patient communication, visualization, safety		
3. Brachytherapy shielding considerations		
- Isotope storage room		
- Radioactive material storage and safe design		
- Work area evaluations and shielding		
- Surveys		
- Radioactive material short term storage		
- Radioactive material transport		
- Patient hospital room shielding		
- Shielding built into rooms		
- Secondary shielding		
4. HDR room shielding considerations		
5. Gamma Knife shielding determination		
6. Tomotherapy shielding considerations		

Topic: Acceptance testing and commissioning of a CT simulator

Recommended reading:

1. McCullough EC and Earle JD, The Selection, Acceptance Testing, and Qulaity Control of Radiotherapy Treatment Simulators, Radiology (131): 221-230 (1979)
2. Pennington EC and Jani SK, Quality Assurance Aspects of a CT Simulator. In: Jani, SK, CT Simulation for Radiotherapy. Medical Physics Publishing, 1993
3. McGee KP and Das IJ, Commissioning, Acceptance Testing, & Quality Assurance of a CT Simulator. In: Coia LR, Schultheiss TE, and Hanks, GE. A Practical Guide to CT Simulation. Advanced Medical Publishing, 1995
4. AAPM Report 39: Specification and Acceptance Testing of Computed Tomography Scanners (1993), Diagnostic X-Ray Imaging Committee Task Group #2

Topics – Acceptance testing and commissioning of a CT simulator	**Covered**	**Completed**
1. Acceptance testing the simulator		
2.1 Acceptance testing the CT Scanner		
Test phantoms		
Procedure: AAPM Report 39		
2.2 Acceptance testing the CT Scanner-Virtual Simulator interface		
2.3 Acceptance testing the laser system		
2.4 Acceptance testing the virtual simulator		
DRR verification		
Contour verification		
3. Generating a quality control schedule		

Clinical Rotation Schedule and Objectives

Rotation 7 **Chief Mentor Y Watanabe (S Hui)**

Machine QA: annual checks
IMRT planning
Brachytherapy: GYN loading/unloading

REPORT: IMRT: commissioning, planning, quality assurance, plan verification

1. The resident shall attend graduate course TRAD 5174 (Medical and Health Physics of Imaging II)

2. QA concentration will be on annual checks of the simulation and treatment machines. The second year resident, along with a staff physicist, will work with the first year resident to perform measurements for one linac, during month 1.

3. IMRT planning for head and neck treatments

4. Tomotherapy planning for various areas of the body

5. Other advanced treatment planning activities.

6. AAPM task group reports and other documents will be reviewed, and for this rotation, will include:

    a. AAPM report 82, Guidance document on delivery, treatment planning, and clinical implementation of IMRT: Report of the IMRT subcommittee of the AAPM radiation therapy committee. Medical Physics, Vol. 30, Issue 8 (2003); 27pp.

Clinical Rotation Schedule and Objectives

Rotation 8 **Chief Mentor B Gerbi**

Eye plaque (COMS)
HDR brachytherapy QA
LDR brachytherapy QA
Radiation Protection, Licensing
HDR morning QA, TBI TLDs
Special procedures: TSE

REPORT: Acceptance testing and commissioning of brachytherapy apparatus and sources, LDR and HDR

1. This rotation will focus on brachytherapy and radiation protection associated with radiation therapy.
2. Finish up all reports and pending proficiencies. Ensure topic sheet material completed.
3. The resident will cover total skin electrons.
4. The resident will participate in COMS eye plaque placements.
5. The student will participate in and become proficient in prostate seed implantation techniques
6. AAPM task group reports and other documents will be reviewed, and for this rotation, will include:

    a. High Dose-Rate Brachytherapy Treatment Delivery (Reprinted from Medical Physics, Vol. 25, Issue 4) (1998) Radiation Therapy Committee Task Group #59; 29 pp.
    b. Code of Practice for Brachytherapy Physics (Reprinted from Medical Physics, Vol. 24, Issue 10) (1997) Radiation Therapy Committee Task Group #56
    c. Permanent Prostate Seed Implant Brachytherapy (Reprinted from Medical Physics, Vol. 26, Issue 10) (1999) Radiation Therapy Committee Task Group #64; 23 pp.
    d. Intravascular Brachytherapy Physics. Medical Physics, Vol. 26, Issue 2 (1999); 34 pp. Radiation Therapy Committee Task Group #60 (If still relevant in Therapy)
    e. Reports and articles associated with the Report for the current rotation
    f. Total Skin Electron Therapy: Technique and Dosimetry (1987).

Topic: Brachytherapy (LDR and HDR)

Recommended reading:

1. AAPM Report 51. AAPM Task Group 43 Report: A protocol for the determination of absorbed dose from high energy photon and electron beams. Med Phys **10**:741-771, 1983.
2. The Physics of Radiation Therapy. 2nd Edition, F. M. Khan, 1984, Chapter 15: Brachytherapy.
3. High Dose-Rate Brachytherapy Treatment Delivery (Reprinted from Medical Physics, Vol. 25, Issue 4) (1998) Radiation Therapy Committee Task Group #59.
4. Code of Practice for Brachytherapy Physics (Reprinted from Medical Physics, Vol. 24, Issue 10) (1997) Radiation Therapy Committee Task Group #56
5. AAPM Report 84. Update of AAPM Task Group No. 43 Report: A revised AAPM protocol for brachytherapy dose calculations. Medical Physics, Vol. 31, Issue 3 (2004); Radiation Therapy Committee Task Group #43; 42 pp. This is an update of Report #51

Topics – LDR Implant Loading Procedures and Documentation	**Covered**	**Completed**
Program requirements for control of radioactive material, Isotope Room layout, logout-login procedures for Cs-137, Ir-192, I-125, Sr-90 Intravascular Brachy sources; inventory control		
Loading procedures for Cs-137 Low Dose Rate Brachytherapy Reading Physics Loading procedure Understand operation of CRC-10 Deep-well ionization chamber		
Participate in complete loading cycle for three LDR Cs-137 patients □ □ □		
Participate in complete loading cycle for LDR IR-192 patients		
TG-43 formalism & Update		
Visit an Accredited Dose Calibration Laboratory to observe deep-well chamber calibration		
Physics topics -		
Testing of new apparatus, tandems, ovoids, inserts, ongoing apparatus QA		
Testing of new Cesium tubes		
Calibration check of new cesium tubes		
Calibration check of HDR-1000 deep well chamber, & CRC-10 deep well chamber		
Elongation factor for CRC-10 deep well chamber determination		
Topics – HDR Implant Loading Procedures and Documentation		
HDR morning QA procedure, tests performed, level of accuracy required		
HDR Emergency procedures		
HDR treatment planning		

HDR checks of treatment plan & documentation		
HDR source exchange calibration		
HDR monthly QA required by license		
HDR Radiation Protection issues, source receipt, source disposal, source inventory		

Topic: COMS eye plaque technique

Recommended reading:

1. COMS eye plaque protocol, Chapter 12.
2. Sou-Tung Chiu-Tsao, Episcleral eye plaques for treatment of intraocular malignancies and benign diseases, Ch. 34, [In] Brachytherapy physics, 2nd Ed. BR Tomadsen, MJ Revard, WM Butler, Eds. Medical Physics Monograph No. 31, Medical Physics Publishing, Madison, WI, 2005.
3. "Plaque simulator" program (internet access to information).

Topics – LDR Implant Loading Procedures and Documentation	**Covered**	**Completed**
1. Initial determination of seed strength, &		
a. Planning using Xcel spreadsheets		
b. Planning using BrachyVision		
2. Ordering of seeds		
3. Replanning using actual seed strength		
4. Source logging & calibration		
5. Implant preparation, required equipment		
6. Eye plaque sterilization procedure		
7. OR activities, film badges, lead aprons, thyroid shield		
8. OR implantation Radiation Protection survey and documentation		
9. Recovery room Radiation Protection survey and documentation		
10. Explanation of home radiation precautions or hospital room precautions		
11. OR explanation of procedures		
12. Post implant Radiation protection survey of OR		
13. End of implant duties, source inventory, seed removal from plaque		
14. Disposal of seeds		

Topic: Total Skin Electron Beam Treatment

Recommended reading:

1. AAPM REPORT NO. 23, TOTAL SKIN ELECTRON THERAPY: TECHNIQUE AND DOSIMETRY: REPORT OF TASK GROUP 30, RADIATION THERAPY COMMITTEE, (1987) C. J. Karzmark, Ph.D., Chairman
2. Gerbi, BJ.: Clinical implementation of Total Skin Electron Beam Treatments. 19th Annual meeting of the ACMP, Jackson Hole, WY, June 1–6, 2002. CDROM slide presentation.

Topics - Treatment Planning	**Covered**	**Completed**
1. Simulation measurements-/technique determination		
2. Hand calculations for treatment		
3. Chart preparation and diagrams		
4. Verification of Linac operation		
5. Calibration of TSEB setting on Linac		
6. Verification of dose monitor for TSEB, Protea calibration of technique		
Physics topics – Intent: be able to initiate a Total Skin Electron Treatment Program		
Field Size determination –		
Field flatness determination, gantry angle matching		
Relative output determination at the patient plane		
Dose variation around periphery of patient/phantom		
Absolute determination of dose per monitor unit at patient plane Ionization chamber TLD Film		
In-vivo dosimetry using TLDs		
- Boost field dose determination		
Shielding considerations of eyes, nails, top of feet		

TOPIC: ADCL- University of Wisconsin

Recommended reading:

UW RCL Application notes 99-01, 94-02, 99-02, 94-01, 01-01, 02-01, 96-01, 97-01

Topics	**Covered**	**Completed**
1. Cylindrical chamber calibration Determination of $N_{D,W}^{Co-60}$ Determination of N_{gas} (if applicable)		
2. Cylindrical chamber calibration, Orthovoltage unit How is orthovoltage beam energy determined and ensured? How is chamber energy response verified?		
3.Plane-parallel chamber calibration		
4. Deep-well ionization chamber calibration - For Cs-137 - For HDR sources - For IVB sources (30 mm Cal Fac X 1, 40 mm Cal Fac X 0.75, 60 mm Cal Fac X 0.5) - Calibration for I-125 and Pd-103 seeds		
5. Cross comparison of calibration accuracy between ADCLs (US & international)		
6. ADCL TLD verification program operation		
7. Stereotactic Radiosurgery QA Testing Program description		

Appendix 9: Resident Application Information

UNIVERSITY OF MINNESOTA

Twin Cities Campus

Department of Therapeutic Radiology-Radiation Oncology

Medical School

Mayo Mail Code 494
420 Delaware Street S.E
Minneapolis, MN 55455-0385

Office at M26 Masonic

Medical Physics Residency Program in Radiation Oncology Physics
Clinic located at Fairview-University Medical Center

(612) 626-6146 (Office)
(612) 625-5445 (Fax)

APPLICATION FOR ADMISSION

Type or print responses to the following information:

Personal Information

Name ____
Last First Middle Maiden

Social Security Number (optional) ____________________

Present Mailing Address___________________________________
Street City/State/Zip Until What Date?

Permanent Address (if different) ____________________________
Street City/State/Zip

Present Telephone Number: ( ) _________________

Permanent Telephone Number: (______) _______________

E-mail Address: ___________________________________

Date of Birth ___________________
(Optional)

Criminal History

Have you ever been convicted of a crime? ________ Yes _______ No

If yes, please explain on a separate sheet of paper.

Education

College, university or other post-graduate schools attended:

Name of School	City and State	Degree	Year Awarded	Major Field of Study

Employment History

List all employment (begin with most recent employer). Use additional pages if necessary.

Employer/Address | Type of Work | Dates

1. ______________________________

2. ______________________________

3. ______________________________

References

List three professional references. (Please have the letters sent to the Medical Physics Residency Program by deadline listed in resident position availability.)

Name | Department/Position | Institution

1. ______________________________

2. ______________________________

3. ______________________________

Waiver of Access to Reference Statements

Under the Family Educational and Privacy Rights Act, 20 U.S. C. 1232(g), you may, but are not required to waive your right of access to confidential references given in connection with this application. If you waive your right of access, the waiver remains valid indefinitely. Check the appropriate space below:

________ I do waive my right of access

________ I do not waive my right of access

Signature ________________________________ Date ____________________________

Please provide a letter of intent detailing your interests and goals for this medical physics training program.

Please Read Carefully Before Signing:

The responses given above are true and correct. I understand that any omissions of fact or any false or misleading statements will be considered just cause for dismissal from the program. I agree that all former employers or former faculty with whom I have been associated may furnish the University of Minnesota, Department of Therapeutic Radiology-Radiation Oncology with all information regarding my character and qualifications, and I release all such employers and faculty from any liability for providing such information in good faith

I understand that this application will become inactive after one year.

I understand that I am responsible to have my official transcript(s) of grades from prior undergraduate and graduate academic institutions and letters of reference forwarded (by each school and person giving reference) directly to:

Bruce J. Gerbi, Ph.D.
Associate Professor and Director, Radiation Physics Section
Department of Therapeutic Radiology-Radiation Oncology
Fairview University Medical Center
420 Delaware St. SE, Mayo Mail Code 494
Minneapolis, MN 55455

Signature of Applicant ______________________________ Date____________________

The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regards to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation.

Privacy Statement

All information on this form is private. It will be used to identify and communicate with you, and to determine your qualifications for admission to this program. All items requested on the form are required to process your application, except for those identified as optional (social security number and date of birth). Failure to provide the optional items will have no effect on you application, however, if you are accepted into the program, you must provide a social security number in order to receive a paycheck. Those who may gain access to the information in your file are staff and faculty at the University who have a need to know the information to perform their job responsibilities, and outside organization and government bodies in limited circumstances as authorized by state of federal law. In addition, you may review your own file. No one else may review your file without your written consent or a subpoena or court order.

UNIVERSITY OF MINNESOTA

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Office at M26 Masonic

(612) 626-6146 (Office)
(612) 624-5445 (Fax)

September 25, 2007

Dear

Thank you for your interest in our Medical Physics Residency program. Admission to the two-year Medical Physics Residency program requires a PhD in a technical field. The next opening will be in July of 2008. Application materials and more information on the program can be found on our web site at www.trad.umn.edu. The application deadline is January 15, 2008. Please do not hesitate to call my assistant, Connie Blasing, at 612-626-2440 with any questions.

Sincerely,

Bruce J. Gerbi, Ph.D
Professor
Physics Residency Program Director

MEDICAL PHYSICS RESIDENCY POSITION

A position is available on July 1, 2009, for residency training in radiation oncology physics at the University of Minnesota, Department of Therapeutic Radiology-Radiation Oncology. The residency-training program is conducted in accordance with the AAPM Guidelines and is accredited by the Commission on Accreditation of Medical Physics Education Programs, Inc. (CAMPEP). The program duration is 2 years.

The intent of the program is to provide hands-on clinical training and to prepare the graduate for the board certification examination and a professional career in radiation therapy. Extensive training is provided in the area of patient setup and positioning, treatment planning and planning computers, clinical dosimetry, brachytherapy, linac calibration and quality assurance, and radiation safety. Experience is offered in the special procedures of stereotactic radiosurgery (GammaKnife), intensity modulated radiation therapy (IMRT), tomotherapy, and low and high dose rate brachytherapy.

The applicant must have a Ph.D. degree, preferably in physics or medical physics or a closely related field. Application materials should be received before the January 15, 2009, deadline. Decisions for filling the position will be completed by April 30, 2009. It is hoped that the successful applicant will start July 1, 2009. The position is contingent on the applicant's legal eligibility to work in the United States.

The application must include a detailed resume, a description of eligibility to work in the United States, the formal application sheet, three letters of recommendation and a copy of an official transcript detailing graduate and undergraduate work. Please visit our department web site at http://www.med.umn.edu/trad/ for application materials and additional information. Email may be sent to cblasing@umn.edu and written correspondence may be directed to the following address:

Bruce J. Gerbi, Ph.D.
Director, Radiation Physics Section
University of Minnesota
Department of Therapeutic Radiology-Radiation Oncology
Mayo Mail Code 494
420 Delaware St. SE
Minneapolis, Minnesota 55455

The University of Minnesota is an equal opportunity employer.

University of Minnesota Medical School
Department of Therapeutic Radiology-Radiation Oncology

Medical Physics Residency
Training Program
2009-2011

Mayo Mail Code 494
420 Delaware St. S.E.
Minneapolis, Minnesota 55455
Voice: (612) 626-2440
Fax: (612) 626-7060
E-mail: cblasing@umn.edu

PROGRAM GOALS

The program is intended to provide comprehensive training and experience in radiation oncology physics to candidates with a Ph.D. degree in physics, medical physics or a closely related field. The training will involve full participation of the physics resident in the clinical routine, under the supervision of the Program Director and the program faculty. Comprehensive training and experience will be provided in the broad areas of equipment calibration, radiation dosimetry, treatment planning, radiation shielding, facility design, radiation protection and quality assurance. The program is designed in accordance with the essentials and guidelines contained in the residency document of the American Association of Physicists in Medicine (AAPM). After successful completion of this training program, the candidate should have covered the essential curricula for the board certification examination in radiation oncology physics.

DESCRIPTION OF PROGRAM

a. Entry Requirements

Candidate must have completed their Ph.D. degree in Physics, Medical Physics, or a closely related discipline before acceptance into the program. The applicant's undergraduate and graduate education should demonstrate knowledge acquired in the following areas:

a. Fundamental physics
b. Advanced mathematics
c. Advanced atomic and nuclear physics
d. Electronics
e. Computers
f. Physical chemistry

b. Length of Training and Orientation

The length of training will be two years for a medical physics graduate. The training calendar will normally start on July 1. During the first three months, the physics resident will receive orientation lectures and demonstrations in the clinic. The resident will work with a staff physicist to observe and participate in treatment planning, treatment simulations, patient dosage calculations, calibrations, clinical dosimetry, quality assurance, and other physical and technical tasks performed in the clinic. During this time the resident should develop an overall understanding of the physicist's role in the clinic.

c. Didactic Training

Starting with the fall quarter, the physics resident will receive didactic instruction (if not a medical physics graduate) in the radiation oncology physics, diagnostic radiology physics, nuclear medicine physics, radiation biology, radiation oncology, anatomy and physiology. The following courses offered at the University of Minnesota will cover these areas:

TRAD 7170	Basic Radiological Physics
TRAD 7172	Radiation Biology
TRAD 7173	Physics of Radiation Therapy
BPHY 5171	Medical and Health Physics of Imaging I
BPHY 5174	Medical and Health Physics of Imaging II
RT 411	Principles and Practices of Radiation Oncology I
RT 412	Principles and Practices of Radiation Oncology II
Seminars:	Fundamentals of Clinical Oncology

The resident will be given time to attend the above classes and must pass the examinations associated with these courses. The results of these exams will be placed on record in the resident's file.

d. Practical Experience

In parallel to the didactic course work, the physics resident will be assigned to a staff physicist by rotation to perform clinical tasks under his/her supervision. At the end of each rotation (e.g. 3 months), the staff physicist will hold a review session with the resident. The resident will identify and list procedures or tasks performed during the previous rotation and will be given a mock oral test in those areas. Additional literature reading assignments may be given at this time to strengthen theoretical understanding of various clinical procedures. A resident evaluation form will be completed and put in the resident's file.

The following broad areas will be covered during the two years of residency period. Normally, most of these procedures are encountered routinely in the clinic and the resident will perform these tasks repeatedly as the need arises for patients. However, the Program Director will augment training in areas which may not be practiced with sufficient frequency in the department. Also, additional areas may be added to the list if deemed essential to the professional needs of the resident. At the end of two years, the resident should be competent in the following areas:

a. Treatment Equipment (Teletherapy)

Calibration: calibration according to protocol, acceptance testing, commissioning, beam data input into the computer, verification of computer isodose distributions, surface doses, buildup dose distributions, determination of parameters for monitor set calculations.
Radiation Protection: head leakage, neutron contamination, area survey, design specifications, facility design.
Quality assurance: daily, weekly, monthly and annual checks.

b. Simulator/CT Scanner

Testing:acceptance testing and commissioning.

Radiation Protection: beam quality, head leakage, and area survey.
Quality assurance: mechanical, radiation, fluoroscopic, and processor.

c. Dosimetric Equipment
Ion chambers: use of Farmer Chamber, plane parallel chamber, survey meter (calibration and use), radiation field scanner (water Phantom).
TLD: annealing procedures, calibration, use of capsules, chips, in vivo dosimetry.
Film: film dosimetry for electrons and photons, sensitometric curve, and film badges.
Quality Assurance: Chamber calibration and intercomparisons, TLD quality control
and survey meter calibration checks.

d. Treatment Planning
Equipment: Acceptance testing and commissioning of treatment planning computer, digitizer, plotter and other auxiliary devices.
Software: Check of computer algorithms for isodose generation, blocking, inhomogeneity and other benchmark tests.
Imaging: Check of CT and MRI images for accuracy of contour delineation, magnifications; CT numbers vs. electron density curve.
Isodose Plans: Treatment technique design and optimization, plan display and evaluation.
Quality Assurance: Point dose verification by manual calculation.

e. Treatment Aids
Field shaping: Custom blocking, multileaf collimators, half-value thickness blocks, gonadal
shields, eye shields, and internal shields with electrons.
Bolus: Material and thickness.
Compensators: Design of missing tissue compensators
and dosimetry check.
In vivo Dosimetry: Use of TLD chips, diodes (if available).
Patient Positioning: Immobilization devices, body position, leveling, and anatomic landmarks.
On-line Imaging: Verification of portal images in comparison with simulation images.

f. Special Techniques
TBI: Establishing dosimetry protocol for total body irradiation technique including dose calculation formalism, compensation and dosimetric verification.
TSI*:* Establishing total skin irradiation technique including treatment parameters, dosimetry and in vivo checks.
Electron Arc Therapy: Treatment planning and technique for electron arc therapy, and special dosimetry.

Intraoperative Electron Therapy (if available): Acceptance testing, commissioning, and complete dosimetry of applicators and other treatment conditions specific to IORT.
IMRT: Intensive modulated radiation therapy, theory and practice
Gamma Knife activities: Acceptance testing, commissioning, treatment planning, continuing quality assurance.
Tomotherapy

g. Stereotactic Radiosurgery
Specifications: Acceptance testing and commissioning of radiosurgery apparatus, beam data acquisition for small fields, data input into the treatment planning computer, and testing of dose calculation algorithm by head-phantom dosimetry.
Treatment Planning: Acquisition of CT, MRI, angiographics data; planning of isodose distributions in 3-D, plan evaluation, generation of treatment parameters.
Quality Assurance: QA checks before each case.

h. Patient Dose Calculations
Dosimetric Quantities: Percent depth dose, TPR, TMR, TAR, etc. and their relationship.
Monitor Unit Calculation: Calculations for different treatment conditions and techniques,
Verification of calculation formalism using bench mark problems.

i. Brachytherapy
Calibration: Acceptance testing and commissioning of brachytherapy sources, applicators, and HDR.
Source Preparation: Preparation of sources and applicators for implantation.
Radiation Protection: Radiation surveys, leak testing and other requirements of regulatory agencies.
Treatment Planning: Computer isodose distributions, check of dose calculation algorithm, implant system rules and dose specification.
NRC-Mandated Quality Management Program: Detailed Review of QMP document, implementation and audit.

j. Quality Assurance Program
Design or review of physical quality assurance program for the department, including the NRC mandated Quality Management Program, AAPM Report (TG-40), JCAHO guidelines, etc.

SPECIAL REPORTS

In addition to the above practicum as part of the routine clinical operation, the physics resident will be required to prepare a detailed report on selected practical projects which will include the following as a minimum:

a. Radiation Detectors: ion chamber, triax cable, electrometer (2) Film: XV2, EDR2, Radiochromic (3) TLDs (4) Diodes

b. Calibration of Orthovoltage X-Ray units;
full calibration of linear accelerators: photon and electron beams

c. Operation, acceptance testing and commissioning of linear acceleratord. Acceptance testing and commissioning of treatment planning computer; explanation of algorithm

d. Acceptance testing and commissioning of treatment planning computer;explanation of algorithm

e. Room shielding design for simulator, CT, orthovoltage and megavoltage facility and radioisotope storage, radiation protection survey-linac

f. Special Procedure: IMRT

g. Acceptance testing and commissioning of brachytherapy apparatus and sources (LDR,HDR)

CONFERENCES

The physics resident will participate in all departmental conferences which the physics staff is required to attend. Presently these include:

New patient presentations (1/week).
Treatment planning (1/week).
Quality assurance (1/week).
Complications (1/month).
Special lectures and Seminars (as scheduled).

STAFF

The department currently has 6 board certified radiation oncology physicists, eight board certified radiation oncologists, 3 radiation biologists and other cancer research faculty. The following will participate in the training of medical physics residents.

<u>Physicists</u>

Bruce J. Gerbi, Ph.D. *(Program Director)*	*Board Certified*
Patrick D. Higgins, Ph.D.	*Board Certified*
Faiz M. Khan, Ph.D.	*Board Certified*
Parham Alaei, Ph.D.	*Board Certified*
Susanta Hui, Ph.D.	*Board Certified*
Yoichi Watanabe, Ph.D.	*Board Certified*
Lihong Qin, Ph.D.	*Board Certified*

Jane Johnson, M.S.	*Board Certified*

Radiation Oncologists

Kathryn Dusenbery, M.D. *(Department Head)*	*Board Certified*
Chung Lee, M.D.	*Board Certified*
Gordon Grado, M.D.	*Board Certified*
Seymour Levitt, M.D.	*Board Certified*
James Orner, M.D.	*Board Certified*
L. Chinsoo Cho, M.D.	*Board Certified*
Margaret Reynolds, M.D.	*Board Certified*
Joaquin Silva, M.D.	*Board Certified*
Xin Wang, M.D.	*Board Certified*

Radiation Biologists

Chang W. Song, Ph.D.
Daniel A. Vallera, Ph.D

The department is staffed with 7 registered therapy technologists, two certified medical dosimetrists, one maintenance engineer supported by the Hospital Biomedical Engineering department, one computer systems specialist, two nurses, two radiation oncology administrators, one physics executive secretary and other secretarial and clerical staff for the clinic.

FACILITIES

a. Treatment Machines:Currently the department has:
Varian Clinac 2300 CD, with multileaf collimators, x-ray beams of 6 MV and 25 MV and electron beams of 6, 9, 12, 15, 18, and 22 MeV.
Varian Clinac 2100C with x-ray beams of 6 MV and 18 MV and electron beams of 6, 9, 12, 16, and 20 MeV.

b. Simulator:Varian Ximatron C, Tomotherapy unit with 6 MV x-rays, CT Scanner, Siemens

c. Brachytherapy: 137Cs for GYN implants, 192Ir and 125I for interstitial implants and a Varian HDR unit.

d. Stereotactic Radiosurgery Unit: Varian Zmed system with BRW frame, SRS apparatus and Radionics XKnife-4 treatment planning system Gamma Knife unit.

e. Hyperthermia: Thermotron RF Model 8 treating at 8 MHz.

f. Dosimetry Equipment:Wellhofer water phantom, calibration water phantom, plastic phantoms, Rando phantom, electron arc dosimetry phantoms; three Farmer type 0.6 cc ion chambers, extrapolation chamber, three plane-parallel chambers, four Keithley electrometers; diodes, LiF-TLD system, film dosimetry system; ion chamber survey meter, neutron meter, G.M. counter, dose calibrator, scintillation well-counter; mercury barometer, aneroid barometer, thermometers, hyperthermia thermometry system.

g. Electronics lab, treatment aid and machine shop; hospital scientific apparatus shop

h. Well-equipped radiation oncology clinic.
i. Well-equipped radiation biology and immunology labs.
j. Treatment planning computer systems:
3-D treatment planning system (Philips Pinnacle) with two work stations, Varian Eclipse & IMRT System with two work stations, Theratronics external beam/ brachytherapy treatment planning system, Radionics XKnife 4 Stereotactic treatment planning system with HP high performance graphics work station. Approximately twenty desktop computers.
k. Access to imaging equipment (CT, MRI, US, etc.) through Diagnostic Radiology Department. Images available on Ethernet. Three dedicated PACS workstations with PACS access on all PC's
l. Varian Varis record and verify system.
m. Library: Department library for radiation oncology literature, medical school library and other University libraries on campus

CLINICAL RESOURCES

A wide variety of cancer patients are treated, including total body irradiation, total skin irradiation, brachytherapy of cancer of the cervix, stereotactic radiosurgery, head and neck cancers, breast, Hodgkin's disease, lung, prostate, leukemias, sarcomas, etc. Patient load varies between 500 to 600 patients treated per year.

INSTITUTIONAL SUPPORT

Support is available for administration, budget, space, clinical and educational resources. The department also has a medical residency program and radiation therapy technology school.

EVALUATIONS

Electronic evaluation forms have been developed to monitor resident's performance and progress throughout the training period. The assigned faculty grades the performance of the resident at the end of each rotation and reports are filed in the resident's record. The Program Director meets with the resident at the end of each rotation to evaluate the overall effectiveness of the program and discuss any areas of concern. It is the Program Director's responsibility to advise, censure or dismiss residents, after due process, who fail to demonstrate adequate progress or competence.

ADMISSION PROCEDURE

Qualified applicants are requested to submit their application material (listed below) as soon as possible. A transcript of undergraduate and graduate work, a personal statement, along with three reference letters must accompany the application. A Selection Committee consisting of medical physics faculty and a staff radiation oncologist grade the applications and select three or more candidates for interview. Interview expenses are borne by the candidate. Final evaluation of the candidates is made by the Selection

Committee on the basis of the candidate's educational background, special experiences, letters of reference and interview performance.

STIPENDS

Stipends and benefits provided to Physics Residents and their dependents are, in general, in accordance with the AAPM guidelines. However, the funding levels are updated annually and adjusted appropriately to reflect local situations.

DISCIPLINARY AND GRIEVANCE PROCEDURES

Discipline/Dismissal for Academic Reasons

A. Grounds

As students, Physics Residents/Post Docs are required to maintain satisfactory academic performance. Academic performance that is below satisfactory is grounds for discipline and/or dismissal. Below satisfactory academic performance is defined as a failed rotation; relevant exam scores below program requirements; and/or marginal or unsatisfactory performance, as evidenced by faculty evaluations, in the areas of clinical diagnosis and judgment, medical knowledge, technical abilities, interpretation of data, patient management, communication skills, interactions with patients and other healthcare professionals, professional appearance and demeanor, and/or motivation and initiative.

B. Procedures

Before dismissing a Physics Resident/Post Doc or not renewing the Contract of a Physics Resident/Post Doc for academic reasons, the Program must give the Physics Resident/Post Doc:

1. Notice of performance deficiencies;
2. An opportunity to remedy the deficiencies; and
3. Notice of the possibility of dismissal or non-renewal if the deficiencies are not corrected.

Physics Residents/Post Docs disciplined and/or dismissed for academic reasons may be able to grieve the action through the Regents Student Academic Grievance policy. This grievance process is not intended as a substitute for the academic judgments of the faculty who have evaluated the performance of the Physics Resident/Post Doc, but rather is based on a claimed violation of a rule, policy or established practice of the University or its programs.

Academic Probation

Physics Resident/Post Docs who demonstrate a pattern of unsatisfactory or marginal academic performance will undergo a probationary period. The purpose of probation is to give the Physics Resident/Post Doc specific notice of performance deficiencies and an opportunity to correct those deficiencies. The length of the probationary period may vary but it must be specified at the outset and be of sufficient duration to give the Physics Resident/Post Doc a meaningful opportunity to remedy the identified performance problems. Depending on the Physics Resident/Post Doc's performance during probation, the possible outcomes of the probationary period are: removal from probation with a return to good academic standing; continued probation with new or remaining deficiencies cited; non-promotion to the next training level with further probationary training required; contract non-renewal; or dismissal.

Discipline / Dismissal for Non-Academic Reasons

A. Grounds

Grounds for discipline and/or dismissal of a Physics Resident/Post Doc for non-academic reasons include, but are not limited to the following:

1. Failure to comply with the bylaws, policies, rules or regulations of the University of Minnesota, affiliated hospital, medical staff, department, or with the terms and conditions of this document.

2. Commission by the Physics Resident/Post Doc of an offense under federal, state, or local laws or ordinances which impacts upon the abilities of the Physics Resident/Post Doc to appropriately perform his/her normal duties in the residency program

3. Conduct, which violates professional and/or ethical standards; disrupts the operations of the University, its departments, or affiliated hospitals; or disregards the rights or welfare of patients, visitors, or hospital/clinical staff.

B. Procedures

1. Prior to the imposition of any discipline for non-academic reasons including, but not limited to, written warnings, probation, suspension or termination from the program, a Physics Resident/Post Doc shall be afforded:

a. Clear and actual notice by the appropriate University or hospital representative of charges that may result in discipline, including where appropriate, the identification of persons who have made allegations against the Physics Resident/Post Doc and the specific nature of the allegations; and,

b. An opportunity for the Physics Resident/Post Doc to appear in person to respond to the allegations. Following the appearance of the Physics Resident/Post Doc, a determination should be made as to whether reasonable grounds exist to validate the proposed discipline. The determination as to whether discipline would be imposed will be made by the Department Head or his or her designee. A written statement of the discipline and the reasons for imposition, including specific charges, witnesses, and applicable evidence shall be presented to the Physics Resident/Post Doc

2. After the imposition of any discipline for non-academic reasons, a Physics Resident/Post Doc may avail himself or herself of the following procedure:

a. If within thirty (30) calendar days following the effective date of discipline, the Physics Resident/Post Doc requests in writing to the Department Head a hearing to challenge the discipline, a prompt hearing shall be scheduled. If the Physics Resident/Post Doc fails to request a hearing within the thirty (30) day time period, his/her rights pursuant to this procedure shall be deemed to be waived.

b. The hearing panel shall be comprised of three persons not from the Physics Residency/Post Doc program involved: a chief resident; a designee of the Department Head and a faculty member. The panel will be named by Department Head or his or her designee and will elect its own chair. The hearing panel shall have the right to adopt, reject or modify the discipline that has been imposed.

c. At the hearing, a Physics Resident/Post Doc shall have the following rights

- Right to have an advisor appear at the hearing. The advisor may be a faculty member, Physics Resident/Post Doc, attorney, or any other person. The Physics Resident/Post Doc must identify his or her advisor at least five (5) days prior to the hearing.
- Right to hear all adverse evidence, present his/her defense, present written evidence, call and cross-examine witnesses; and,
- Right to examine the individual's Physics Resident/Post Doc files prior to or at the hearing.

d. The proceedings of the hearing shall be recorded.
e. After the hearing, the panel members shall reach a decision by a simple majority vote based on the record at the hearing.
f. The Physics Resident/Post Doc program must establish the appropriateness of the discipline by a preponderance of the evidence.
g. The panel shall notify the medical Physics Resident/Post Doc in writing of its decision and provide the medical Physics Resident/Post Doc with a statement of the reasons for the decision.
h. Although the discipline will be implemented on the effective date, the stipend of the medical Physics Resident/Post Doc shall be continued until his or her thirty (30) day period of appeal expires, the hearing panel

issues its written decision, or the termination date of the agreement, whichever occurs first.

i. The decision of the panel in these matters is final, subject to the right of the medical Physics Resident/Post Doc to appeal the determination to the President's Student Behavior Review Panel.

j. For employment grievances see the University of Minnesota Grievance Policy

3. The University of Minnesota, an affiliated hospital, and the department of the medical Physics Resident/Post Doc each has the right to impose immediate summary suspension upon a medical Physics Resident/Post Doc if his or her alleged conduct is reasonable likely to threaten the safety or welfare of patients, visitors or hospital/clinical staff. In those cases, the medical Physics Resident/Post Doc may avail he or she of the hearing procedures described above.

4. The foregoing procedures shall constitute the sole and exclusive remedy by which a medical Physics Resident/Post Doc may challenge the imposition of the discipline based on non-academic reasons.

Non-renewal of the Agreement of Appointment

In instances where a medical Physics Resident/Post Doc's agreement is not going to be renewed, the Medical Physics Training Program ensures that its CAMPEP accredited programs provide the medical Physics Resident/Post Doc (s) with a written notice of intent not to renew a medical Physics Resident/Post Doc agreement no later than four months prior to the end of the medical Physics Resident/Post Doc current agreement. However, if the primary reason(s) for the non-renewal occurs within the four months prior to the end of the agreement, the Department ensures that its CAMPEP accredited program provides the medical Physics Resident/Post Doc with as much written notice of the intent not to renew as the circumstances will reasonably allow, prior to the end of the agreement.

Medical Physics Resident/Post Doc(s) will be allowed to implement the institution's grievance procedures if they have received a written notice of intent not to renew their agreements. Note: For employment grievances, see the University of Minnesota General Grievance Policy.

Regents Student Academic Grievance Policy

A. Scope and Purpose

1. This policy addresses academic grievances only. Academic grievances are complaints brought by students regarding the University's provision of education and academic services affecting their role as students. Academic grievances must be based on a claimed violation of a University rule, policy, or established practice. This policy does not limit the University's right to change rules, policies, or practices.

2. This policy does not apply to conflicts connected with student employment or actions taken under the Student Conduct Code. Also, complaints alleging violation of the University's policies of sexual harassment and academic misconduct are not grievances under this policy. Such claims shall be referred to the appropriate office for investigation and review. Any compliant alleging discrimination in the University/student relationship, other than sexual harassment, may be filed under either this policy or with the Office of Equal Opportunity and Affirmative Action, but not both.

3. It is the goal of this policy to provide a simple and expeditious process, allowing for both informal and formal resolutions of conflicts. Resolutions may include student reinstatement or other correction action for the benefit of the student, but may not award monetary compensation or take disciplinary action against any employee of the University.

B. Informal Resolution

1. The first step of any resolution should be at the lowest unit level, between the parties involved or the parties and an appropriate administrator. Students may wish to consult the Student Dispute Resolution Center or similar support services for advice and possible mediation. If no informal resolution can be found at the lowest unit level, informal resolution may be sought at the collegiate level with the parties and higher-level administrators. If the issue cannot be resolved informally, the complainant may move the case to the FORMAL level.

2. Grievances involving an instructor's judgment in assigning a grade based on academic performance may be resolved only through the INFORMAL RESOLUTION procedures.

C. Formal Resolution

1. Each collegiate unit and the Office of Student Affairs will have an Academic Grievance Officer and an Academic Grievance Committee. Members will be drawn from the faculty, students, and academic staff, as provided by the committee structure of that unit. The Academic Grievance Officers of each collegiate unit will be a faculty member who holds no other administrative appointment. In the case of Student Affairs or other involved units without an established faculty, the Grievance Officer will be a member of that staff, with academic staff members drawn from the unit's professional staff and with students and faculty drawn from throughout the University.

2. There will also be a University Academic Grievance Committee and A University Academic Presidents/Chancellors of Student Affairs. The

University Academic Grievance Officer will serve as Grievance Officer for these matters. The University Academic Grievance Officer and the University Academic Grievance Committee will be appointed by the President in consultation with the appropriate appointing agencies and will be drawn from the faculty, students, and academic staff.

3. A complaint must be submitted in writing to the appropriate College Grievance Officer identifying the student grievant, the respondent individual(s) involved, the incident, the rule/policy/established practice claimed to be violated, and a brief statement of the redress sought.

4. The grievance should be filed in the collegiate unit in which the incident is alleged to have occurred, which may not necessarily be the student's own college. For graduate student, the appropriate unit is the Graduate School.

5. The College Academic Grievance Officer will meet with the student and individual(s) involved to determine whether a satisfactory resolution can be reached. If this cannot be achieved, the Grievance Officer shall obtain a written answer from the respondent(s) and refer the matter to a hearing panel of the Academic Grievance Committee.

6. Hearing panels will be chaired by a faculty member and will have a maximum of three and, if determined necessary by the College Grievance Officer, a maximum of five members. On a panel of three, one will be a student. If membership exceeds three, it may include more than one student. In the case of a graduate/professional school complaint, the student member(s) will be graduate/professional school student(s). In the case of an undergraduate complaint, the student member(s) will be an undergraduate(s).

7. Hearing panels will review the evidence and hold hearings as necessary. The panel will not substitute its judgment for that of those most closely acquainted with the field, but will base its recommendations on the whether a rule, policy, or established practice was violated. The panel will prepare a written report recommending a resolution of the matter and will send the report to the parties and to the Dean of the collegiate unit for review and action. If the Dean does not accept the recommendation, the Dean will provide a written explanation of any non-concurrence.

8. If any of the parties are not satisfied with the Dean's resolution of the grievance, they may appeal to the University Academic Grievance Committee. Based on the written appeal and response, this Committee will determine whether there are sufficient grounds to hold an appeal hearing. The University Academic Grievance Committee will not hear a case de novo, but rather will determine whether the parties have been afforded due process. The University Academic Grievance Committee

will report its recommendation to the appropriate Vice President, Provost, or Chancellor for review an action. If the recommendation is not accepted, the Vice President, Provost, or Chancellor will provide a written explanation of any non-concurrence.

9. The decision of the appropriate Vice President, Provost, or Chancellor is final and cannot be appealed.

D. Timelines

1. All complaints must be filed within 30 calendar days after the incident being grieved occurred. A response to the complaint must be filed within 15 working days.
2. Deans and Vice Presidents must act upon the recommendation of the committees within 30 calendar days. Appeals must be filed within 15 working days.
3. Timelines may be adjusted if there are compelling reasons for delay offered by any of the parties.

UNIVERSITY SENATE ON SEXUAL HARASSMENT POLICY

Sexual harassment in any situation is reprehensible. It subverts the mission of the University, and threatens the careers of students, faculty, and staff. It is viewed as a violation of Title VII of the 1964 Civil Rights Act. Sexual harassment will not be tolerated in this University. For purposes of this policy, sexual harassment is defined as follows:

"Unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature constitutes sexual harassment when (1) submission to such conduct is made either explicitly or implicitly a term or condition of an individual's employment or academic advance, (2) submission to or rejection of such conduct by an individual is used as the basis for employment decisions or academic decisions affecting such individual, (3) such conduct has the purpose or effect of unreasonable interfering with the individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment."

As defined above, sexual harassment is a specific form of discrimination in which power inherent in a faculty member's or supervisor's relationship to his or her students or subordinates is unfairly exploited. While sexual harassment must often takes place in a situation of power differential between persons involved, this policy recognizes also that sexual harassment may occur between persons of the same University status, i.e., student-student, faculty-faculty, staff-staff.

It is the responsibility of the administration of this University to uphold the requirements of Title VII, and with regard to sexual harassment specifically, to ensure that this University's working environment be kept free of it. For that purpose, these Senate procedures and guidelines are promulgated to avoid misunderstandings by faculty, student, sand staff on (1) the definitions of sexual harassment, and (2) procedures specifically designed to file and resolve complaints of sexual harassment.

Appendix 10: Selection Committee – Candidate Review Forms

Medical Physics Resident
Application Review and Evaluation (with Directions)

University of Minnesota Medical School – Twin Cities

Applicant's Name: ______________________________

Reviewer: ______________________________

Date of Evaluation: ______________________________

Purpose: The purpose of this form is to provide a description of what should be evaluated for each category. This is to aid in the fair, uniform, and complete evaluation of each candidate.
Scoring is to be done numerically. A score of **1** is for an excellent candidate, **2** outstanding, **3** good, **4** fair, and **5** not acceptable or poor.

The final score will be the average of all the categories. Final selection will be done by ranking the candidates numerically (those with the lowest (best) scores first). The candidates for interview will be selected in numerical order from the list.

1. **Academic Performance:** This category pertains to "Transcripts, Highest Degree, and Granting Institution." Consider rigor, undergraduate and graduate institution, course work, size of course load, and performance in undergraduate and graduate school. **GRE:** Graduate record exam, if available. Consider scores in relationship to major, non-science and overall scores, times taken, etc.	
2. ***Medical Physics* related experience** (accredited program, clinical experience/shadow)**:** Consider duration, intensity of involvement, setting of activity, etc.	
3. ***Non-medical physics* related activities or work experience:** Consider duration, intensity of involvement, setting of activity, etc.	
4. **Personal Statement Quality:** Consider organization, style, content, clarity, creativity, reference to motivation, understanding of the field, demands of medical physics, etc	
5. **Letters of Recommendation:** Compare with previous evaluations from the institutions/professors.	
6. **English language ability:** communication skills (did the applicant communicate clearly in the written statement), were communication issues noted in the letters of recommendation, is there any indication that performance as a medical physicist would be negatively impacted due to communication skills, TOEFL score concerns	
7. **Research experiences:** Consider duration, intensity of involvement, setting of activity, etc	
8. **Reasons for not interviewing:** if the above information supports the candidate, are there any reasons for not interviewing the candidate?	

9. **Other considerations:** **Honors/Awards:** Consider number and significance.**Extracurricular activities** (avocational, work experience, hobbies, sports, artistic, etc.) *not* related to sections 6 and 7: Consider duration, intensity of involvement, setting of activity, etc. **Leadership experiences** **Quality of supplemental comments:** Consider clarity, content, organization.	
Total Score	

Recommendations for improving this application:

- ☐ Needs Medical Physics experiences
- ☐ Academic: take upper-level science courses and do well
- ☐ Better letters of recommendation
- ☐ Improved essays
- ☐ Demonstrate understanding of a medical physics career
- ☐ Other:

Date: April 9, 2008

To: Selection Committee

From: Dr. Bruce Gerbi

Re: Physics Resident Interview "Grade"

Please record your grade and comments for the candidate listed below.

NAME OF CANDIDATE:

DATE OF INTERVIEW:

April 9, 2008

Grading:

Outstanding	=	1
Excellent	=	2
Good	=	3
Satisfactory	=	4
Unacceptable	=	5

Grade Evaluation = ______

Comments:____

____

____

____

Please return to Connie Blasing upon completion. Thank you.

RESIDENCY APPLICATION REVIEW

Applicants name: ______________________________

Reviewer: ______________________________

Date of Evaluation: ______________________________

EVALUATION OF INTERVIEW

(Personal notes for ranking applicant)

Excellent (5) Good (4) Fair (3) Not Acceptable (2)

* Final Ranking after 1/26, Ranking form to follow*

Appendix 10 Candidate Evaluation Form

Appendix 11: AAPM Placement Bulleting

A position is available on July 1, 2009, for residency training in radiation oncology physics at the University of Minnesota, Department of Therapeutic Radiology-Radiation Oncology. The residency-training program is conducted in accordance with the AAPM Guidelines and is accredited by the Commission on Accreditation of Medical Physics Education Programs, Inc. (CAMPEP). The program duration is 2 years.

The intent of the program is to provide hands-on clinical training and to prepare the graduate for the board certification examination and a professional career in radiation therapy. Extensive training is provided in the area of patient setup and positioning, treatment planning and planning computers, clinical dosimetry, brachytherapy, linac calibration and quality assurance, and radiation safety. Experience is offered in the special procedures of stereotactic radiosurgery (GammaKnife), intensity modulated radiation therapy (IMRT), tomotherapy, and low and high dose rate brachytherapy.

The applicant must have a Ph.D. degree, preferably in medical physics from a CAMPEP accredited program, physics or a closely related field, and significant course work in Medical Physics equivalent to that required in a Medical Physics graduate program. Application materials should be received before the January 15, 2009, deadline. Decisions for filling the position will be completed by March 30, 2009. It is hoped that the successful applicant will start July 1, 2009. The position is contingent on the applicant's legal eligibility to work in the United States.

The application must include a detailed resume, a description of eligibility to work in the United States, the formal application sheet, a personal statement describing why the applicant is interested in the field of Medical Physics, three letters of recommendation, and an original copy of an official transcript detailing graduate and undergraduate work. Please visit our department web site at http://www.med.umn.edu/trad/ for application materials and additional information. Email may be sent to cblasing@umn.edu and written correspondence may be directed to the following address:

Bruce J. Gerbi, Ph.D.
Director, Radiation Physics Section
University of Minnesota
Department of Therapeutic Radiology-Radiation Oncology
Mayo Mail Code 494
420 Delaware St. SE
Minneapolis, Minnesota 55455

Appendix 12: Resident Evaluations

Special Topic Report Evaluation Form	***University of Minnesota*** ***Medical Physics Residency Training Program***
Report Topic:	

Examiners	**Pass/Fail**

Topics Covered	**Evaluation**

Comments:	
Successfully completed: ☐ Yes ☐ No	
Resident:	Date:
Program Director:	Date:

Resident First Year Exam Evaluation Form	*University of Minnesota* *Medical Physics Residency Training Program*
Report Topic:	

Examiners	**Pass/Fail**

Topics Covered	**Evaluation**

Comments:	
Successfully completed: ☐ Yes ☐ No	
Resident:	Date:
Program Director:	Date:

Resident Second Year Exam Evaluation Form	*University of Minnesota* *Medical Physics Residency Training Program*
Report Topic:	

Examiners	**Pass/Fail**

Topics Covered	**Evaluation**

Comments:	
Successfully completed: ☐ Yes ☐ No	
Resident:	Date:
Program Director:	Date:

Appendix 13: New Resident Orientation, Schedule, Radiation Protection Training Info, Training Program Outline, Policies & Procedures

PHYSICS RESIDENT
MATERIALS CHECKLIST
ORIENTATION AND REVISIONS

	"Little Known Facts" information sheet
	Calendar of Activities
	Check List Binder
	Class Schedule
	Medical Physics Residency Training Program 2007-2009
	Orientation Schedule
	Pager
	Physics Resident Policy & Procedures
	Report Schedule
	Task Group Manual
	University of Minnesota Medical School Graduate Medical Education Institution Policy & Procedure Manual 2007-2008 Manual
	Lab Coat
	Dosimetry Card
	Radiation Protection Training
	Fairview Learning Packet

I have received the above-listed information.

_______________________________________ ____________________

Resident's name **Date**
Signature of Physics Resident

I have reviewed and understand the above information.

_______________________________________ ____________________

Resident's name **Date**
Signature of Physics Resident

Medical Physics Residency -- Little Known Facts

Copy Code for M10 office: ######
Dial 8 for an outside line
Clinic Codes: Door codes for the clinic are available from Val Harshe. Please be sure to keep the codes confidential.

You are responsible to have your keycard for access to the M10 office. If this is lost, please contact Connie Blasing @ 626-2440

Vacation Accrual Rate: 22 days per year
Meeting Day Accrual Rate: 15 over the two-year residency
Professional Allowance: $1,500 per year ($3,000 total) - Turn in all original receipts to Connie Blasing. Books can only be reimbursed in increments of $200. The University will not reimburse sales tax as it is tax exempt. (See Physics Resident's Guide for more specifics)

Medical/Physics Resident Leave Request Forms are found in the M10 copy room and must be filled out at least 2 weeks in advance (see attached). Be sure to use Residents, not Faculty, form. If you are requesting meeting leave please indicate the name of the meeting or conference on the form.

Sending Mail: Each time you need to mail an item for the department – fill out a request form located in the M-10 copy room. Fill in name, phone number, date, org # (648-1126). Attach this request to the item to be mailed with a paper clip and place it in the bin under the counter.

Paychecks are direct-deposited every other Wednesday. You must fill out a direct deposit form if you wish to have this service (form available from payroll). You are able to access a copy of your deposit slip on the University web site @ http://hrss.umn.edu. Any payroll questions should be directed to Jean Niemiec (ALRT HR) at 626-6353 or Sally Morris at 625-3518.

Personalized lab coats are available in M10. You should have 3 with your name printed on them. Drop off dirty coats in the bin and pick up clean ones on Tuesdays.

Phone/Fax Numbers:

Connie Blasing (M10)	612-626-2440
M 10 Fax	612-626-7060
T-Rad Main Number (M26)	612-626-6146
Clinic Main Number	612-273-6700

PHYSICS RESIDENTS CLASSES
FALL 2008, SPRING 2009
FALL 2009, SPRING 2010

Resident
(2/6/09)

FALL 2008

TRAD 7170 — Basic Radiological Physics 9/3/07- 12/20/07
Monday: 4:00 - 5:15 PM & Wednesday 7:30-8:45 AM
Dr. Gerbi

RT 411 — Principles and Practices of Radiation Oncology I
Tuesday & Thursday
RT School Director

SPRING 2009

TRAD 7173 — Physics of Radiation Therapy 1/22/07 - 5/17/07
Monday: 4 - 5:15 PM & Wednesday 7:30 - 8:45 AM
Dr. Gerbi

RT 412 — Principles and Practices of Radiation Oncology II
Tuesday & Thursday
RT School Director

FALL 2009 (tentative)

BPHY 5171 — Medical and Health Physics of Imaging I
Tuesday & Thursday 4:45 PM - 6:00 PM

TRAD 7172 — Radiation Biology
Wednesday 4:00 - 5:15 PM, Friday 7:30 AM – 8:45 AM

SPRING 2010 (tentative)

BPHY 5174 — Medical and Health Physics of Imaging II
Tuesday & Thursday 4:45 PM - 6:00 PM
Dr. Ritenour

Seminars: Fundamentals of Clinical Oncology (Tues. Lectures)

NEW RESIDENT ORIENTATION 2009

Department of Therapeutic Radiology-Radiation Oncology

Please be aware that schedules are at the mercy of patient care, which always comes first. If an appointment is delayed, we will attempt to reschedule it at a later time.

Resident
7-1-09

Wednesday, July 1

7:30-8:45	Welcome – Dr. Gerbi/Connie (M-10 G, Dr. Gerbi's office) General information: Beepers, Lab Coats, Mail Room, Department Manuals & Curriculums, Vacation/Leave Requests, E*Value
8:45-9:00	Meet with ALRT HR, Sally Morris
9:00-12:30	View Radiation Protection tapes in Biomedical Library-Learning Center & Take Exam
12:30-1:30	Lunch
1:30-2:00	Scheduling and Ordering Tests, Emergency Equipment, Social Services, Prescriptions/Medications – Teri Sims (Nurses' station)
2:00-3:00	Meet with Vee or Stacey in the clinic (Front desk, review forms)
3:00-4:00	Quality Management Program – Dr. Gerbi & Dr. Dusenbery (M10 library)

Thursday, July 2

7:30-8:30	Morning Conference
8:30-9:00	Reception, Patient Exam Area, Nurses Station, Clinic Tour – Val Harshe (Clinic Reception Area)
9:00-10:30	Dictation Training, Hospital Tour, Library, etc. – Chief Resident
10:30-12:00	Resident Paperwork (lab, x-rays, sim, etc.) & conferences – Chief Resident (Clinic Conference Room)
12:00-1:00	Lunch
1:00-2:00	Policies and Procedures Guide for Physics with Dr. Gerbi in his office
2:00-3:00	Med-line searching and Bibliography Management – Cindy Gruwell 6-3995 (Biomedical-Library) Reference desk 5th floor
3:00-4pm	U-Card, Call for X500 access, 6-4276 www.mail.umn.edu (If needed)

Friday, July 3

Holiday

Monday, July 6

7:30-9:00	Introduction to Treatment & Simulation Machines – Nicole Weis (Clinic Conference Room)
9:00-12:00	Radiation Therapy Chart Preparation, How to Transfer Targets to Contours (continued) – Chief Resident **(Clinic Conference Room)**
12:00-1:00	Lunch
1:00-4:30	Clinic with Dr. Gerbi

Tuesday, July 7

7:00-4:00	GME Orientation

Wednesday, July 8

7:30-8:30	Dr. Gerbi
9:00-12pm	Fairview Orientation-BLS training Riverside Campus (Dining Room A) MB103
12-1pm	Lunch
1:00-2:30pm	Radiation Protection Lecture – Dr. Gerbi (Clinic Conference Room)
2:30-3:30pm	Treatment Planning Systems – Dr. Higgins (Computer Room)
3:30-4:30pm	Monitor Unit Calculations – Dr. Hui Clinic Conference Room)
	Work with Dr. Gerbi throughout first rotation

Department of Therapeutic Radiology-Radiation Oncology

Radiation Physics Section

POLICIES AND PROCEDURES 2/6/09
A GUIDE FOR PHYSICS RESIDENTS

Contents

I. INTRODUCTION

Welcome to the Physics Residency Program in the Department of Therapeutic Radiology-Radiation Oncology at the University of Minnesota! The faculty and staff in this department hope that the time you spend with us will be both educational and enjoyable.

Please note all information outlined in this manual is subject to periodic review and change. Revisions may occur at the program or University of Minnesota level.

Residents are responsible for familiarizing themselves and adhering to the policies and guidelines contained in this manual. Again, welcome to the Radiation Physics Section.

II. EDUCATIONAL GOALS

A. GENERAL OVERVIEW & PROGRAM GOALS

The principle objectives of this program are to provide comprehensive training and experience in radiation oncology physics to candidates with a Ph.D. in physics, medical physics or a closely related field. This training program involves full participation of the physics resident in the clinical routine, under the supervision of the Program Director and the program faculty. Comprehensive training and experience will be provided in the broad areas of equipment calibration, radiation dosimetry, treatment planning, radiation shielding, facility design, radiation protection and quality assurance. This program is designed in accordance with the essentials and guidelines contained in the residency document of the American Association of Physicists in Medicine (AAPM) and is accredited by the Commission on Accreditation of Medical Physics Education Programs, Inc. After successful completion of this training program, the candidate should have covered the essential curricula for the board certification examination in radiation oncology physics.

The organization of the residency program is as follows. In the first month of the training program the resident is taught the basics of clinical radiation dosimetry, radiation protection and radiation therapy by seminars and individual teaching. Following this introduction, the resident joins a clinical service and is gradually given increasing amounts of responsibility for patient treatment, always under constant staff supervision.

Each clinical rotation lasts three months. During that rotation the resident is assigned to a staff physicist.

The resident's responsibilities are gradually increased during the period of training according to the judgment of the staff physicist.

During the training period, the resident attends lectures, conferences and seminars in radiation physics, radiation biology, and tumor pathology. The resident is expected to review the literature concerning radiation oncology and is also expected to prepare conferences.

C. GENERAL EXPECTATIONS

1. **Arrive on time for morning treatment planning conference.**

2. Attend all treatment planning and quality assurance conferences. Other required conferences depend upon the service on which you are rotating.
   Conference objectives include:

a. Understand the rational behind computer plan (why wedges, compensator, IMRT, SRS etc).

b. Review computer plans and be prepared to discuss the plans.

c. Review any questions with the staff physicist prior to conference.

d. Understand the radiation technique being used.

e. Know the dose that is planned and critical organs that will be affected.

f. Participate in simulations. Think about what area your will be treating and which technique(s) your will be using. Plan the immobilization devices and patient positioning before the actual simulation.

g. Prepare the chart for treatment, which includes calculations, Varis entry, treatment parameters (field size, asymmetric collimate locations, linac orientation, wedges, bolus plus treatment field diagram). If a computer plan is used, understand the computer plan. When your staff is looking at the computer plans, be involved in the decision making process.

III. RESIDENT REQUIREMENTS

NECESSARY REQUIREMENTS FOR GRADUATION

1. Service: 24 months of service rotations at Fairview-University Hospital with satisfactory evaluations after each rotation. At the end of every three-month rotation a faculty member completes an electronic evaluation of the resident's performance. This evaluation will be discussed with the resident. The E-Value system is used for the evaluation and a copy of the evaluation is given to the resident and placed in the resident's file. The E-Value system is available to the residents 24 hours a day. If an unsatisfactory rotation occurs, a meeting with the program director will occur and the resident will be placed on probation the following three months. If the performance remains unsatisfactory, the resident may be dismissed.

2. Satisfactory performance (a grade of B or above) in the required course work including the following: (exceptions are given for residents who completed these courses at another institution)

TRAD 7170	Basic Radiological Physics (fall)
BPHY 5171	Medical and Health Physics of Imaging I (fall)
TRAD 7172	Radiation Biology (spring)
TRAD 7173	Physics of Radiation Therapy (spring)
BPHY 5174	Medical and Health Physics of Imaging II (spring)
RT 411	Principles and Practices of Radiation Oncology I (fall)
RT 412	Principles and Practices of Radiation Oncology II (spring)
Seminars:	Fundamentals of Clinical Oncology (Tues. Lectures)

The resident will be given time to attend the above classes and must pass the examinations associated with these courses. The results of these exams will be placed on record in the resident's file.

3. Conferences: Attendance at Tuesday night conferences during the academic year is required unless there is a conflict with formal classes (number 2 above) or other required physics activities (linac calibration, implant loading, etc).

IV. RESIDENT EVALUATIONS

A. FORMAL EVALUATIONS AND TESTS

1. The staff, at the end of every three-month rotation, fills out an evaluation of a resident's performance via the E-Value system. This evaluation is available to the resident immediately and a copy is printed and placed in the resident's file. These evaluations and the copies are available to the resident for review at any time. A review of the candidate's performance will be done at the 10-11th month of the first year to determine if the candidate will continue in the program. An examination will be be given to help make this determination.

2. The yearly exam is not to be used for continuation in the program, but if it is determined by the staff that the resident did not meet the expectations, the Residency Program Director will discuss the results with the resident, and develop a plan for improvement.

3. The Residency Program Director meets with each resident monthly to review their progress. The Program Director also obtains feedback from the residents regarding their overall residency experience.

4. Having a small number of residents and staff, it is usually obvious if someone is having trouble. If a resident is having trouble with a rotation, it is their responsibility to make an appointment to discuss the problem with his/her mentor or the Residency Program Director.

V. DISCIPLINARY AND GRIEVANCE PROCEDURES

<u>Discipline/Dismissal for Academic Reasons</u>

A. Grounds

As students, Physics Residents/Post Docs are required to maintain satisfactory academic performance. Academic performance that is below satisfactory is grounds for discipline and/or dismissal. Below satisfactory academic performance is defined as a failed rotation; relevant exam scores below program requirements; and/or marginal or unsatisfactory performance, as evidenced by faculty evaluations, in the areas of clinical diagnosis and judgment, medical knowledge, technical abilities, interpretation of data, patient management, communication skills, interactions with patients and other healthcare professionals, professional appearance and demeanor, and/or motivation and initiative.

B. Procedures

Before dismissing a Physics Resident/Post Doc or not renewing the Contract of a Physics Resident/Post Doc for academic reasons, the Program must give the Physics Resident/Post Doc:

1. Notice of performance deficiencies;
2. An opportunity to remedy the deficiencies; and
3. Notice of the possibility of dismissal or non-renewal if the deficiencies are not corrected.

Physics Residents/Post Docs disciplined and/or dismissed for academic reasons may be able to grieve the action through the Regents Student Academic Grievance policy. This grievance process is not intended as a substitute for the academic judgments of the faculty who have evaluated the performance of the Physics Resident/Post Doc, but rather is based on a claimed violation of a rule, policy or established practice of the University or its programs.

Academic Probation

Physics Resident/Post Docs who demonstrate a pattern of unsatisfactory or marginal academic performance will undergo a probationary period. The purpose of probation is to give the Physics Resident/Post Doc specific notice of performance deficiencies and an opportunity to correct those deficiencies. The length of the probationary period may vary but it must be specified at the outset and be of sufficient duration to give the Physics Resident/Post Doc a meaningful opportunity to remedy the identified performance problems. Depending on the Physics Resident/Post Doc's performance during probation, the possible outcomes of the probationary period are: removal from probation with a return to good academic standing; continued probation with new or remaining deficiencies cited; non-promotion to the next training level with further probationary training required; contract non-renewal; or dismissal.

Discipline / Dismissal for Non-Academic Reasons

A. Grounds

Grounds for discipline and/or dismissal of a Physics Resident/Post Doc for non-academic reasons include, but are not limited to the following:

1. Failure to comply with the bylaws, policies, rules or regulations of the University of Minnesota, affiliated hospital, medical staff, department, or with the terms and conditions of this document.

2. Commission by the Physics Resident/Post Doc of an offense under federal, state, or local laws or ordinances which impacts upon the abilities of the Physics Resident/Post Doc to appropriately perform his/her normal duties in the residency program

3. Conduct, which violates professional and/or ethical standards; disrupts the operations of the University, its departments, or affiliated hospitals;

or disregards the rights or welfare of patients, visitors, or hospital/clinical staff.

B. Procedures

1. Prior to the imposition of any discipline for non-academic reasons including, but not limited to, written warnings, probation, suspension or termination from the program, a Physics Resident/Post Doc shall be afforded:

a. Clear and actual notice by the appropriate University or hospital representative of charges that may result in discipline, including where appropriate, the identification of persons who have made allegations against the Physics Resident/Post Doc and the specific nature of the allegations; and,

b. An opportunity for the Physics Resident/Post Doc to appear in person to respond to the allegations. Following the appearance of the Physics Resident/Post Doc, a determination should be made as to whether reasonable grounds exist to validate the proposed discipline. The determination as to whether discipline would be imposed will be made by the Department Head or his or her designee. A written statement of the discipline and the reasons for imposition, including specific charges, witnesses, and applicable evidence shall be presented to the Physics Resident/Post Doc

2. After the imposition of any discipline for non-academic reasons, a Physics Resident/Post Doc may avail himself or herself of the following procedure:

a. If within thirty (30) calendar days following the effective date of discipline, the Physics Resident/Post Doc requests in writing to the Department Head a hearing to challenge the discipline, a prompt hearing shall be scheduled. If the Physics Resident/Post Doc fails to request a hearing within the thirty (30) day time period, his/her rights pursuant to this procedure shall be deemed to be waived.

b. The hearing panel shall be comprised of three persons not from the Physics Residency/Post Doc program involved: a chief resident; a designee of the Department Head and a faculty member. The panel will be named by Department Head or his or her designee and will elect its own chair. The hearing panel shall have the right to adopt, reject or modify the discipline that has been imposed.

c. At the hearing, a Physics Resident/Post Doc shall have the following rights

- Right to have an advisor appear at the hearing. The advisor may be a faculty member, Physics Resident/Post Doc, attorney, or any other person. The Physics Resident/Post Doc must identify his or her advisor at least five (5) days prior to the hearing.
- Right to hear all adverse evidence, present his/her defense, present written evidence, call and cross-examine witnesses; and,
- Right to examine the individual's Physics Resident/ Post Doc files prior to or at the hearing.

d. The proceedings of the hearing shall be recorded.
e. After the hearing, the panel members shall reach a decision by a simple majority vote based on the record at the hearing.
f. The Physics Resident/Post Doc program must establish the appropriateness of the discipline by a preponderance of the evidence.
g. The panel shall notify the medical Physics Resident/Post Doc in writing of its decision and provide the medical Physics Resident/Post Doc with a statement of the reasons for the decision.
h. Although the discipline will be implemented on the effective date, the stipend of the medical Physics Resident/Post Doc shall be continued until his or her thirty (30) day period of appeal expires, the hearing panel issues its written decision, or the termination date of the agreement, whichever occurs first.
i. The decision of the panel in these matters is final, subject to the right of the medical Physics Resident/Post Doc to appeal the determination to the President's Student Behavior Review Panel.
j. For employment grievances see the University of Minnesota Grievance Policy

3. The University of Minnesota, an affiliated hospital, and the department of the medical Physics Resident/Post Doc each has the right to impose immediate summary suspension upon a medical Physics Resident/Post Doc if his or her alleged conduct is reasonable likely to threaten the safety or welfare of patients, visitors or hospital/clinical staff. In those cases, the medical Physics Resident/Post Doc may avail he or she of the hearing procedures described above.

4. The foregoing procedures shall constitute the sole and exclusive remedy by which a medical Physics Resident/Post Doc may challenge the imposition of the discipline based on non-academic reasons.

Non-renewal of the Agreement of Appointment

In instances where a medical Physics Resident/Post Doc's agreement is not going to be renewed, the Medical Physics Training Program ensures that its CAMPEP accredited programs provide the medical Physics Resident/Post Doc (s) with a written notice of intent not to renew a medical Physics Resident/Post Doc agreement no later than four months prior to the end of the medical Physics Resident/Post Doc current agreement. However, if the primary reason(s) for the non-renewal occurs within the four months prior to the end of the agreement, the Department ensures that its CAMPEP accredited program provides the medical Physics Resident/Post Doc with as much written notice of the intent not to renew as the circumstances will reasonably allow, prior to the end of the agreement.

Medical Physics Resident/Post Doc(s) will be allowed to implement the institution's grievance procedures if they have received a written notice of intent not to renew their agreements. Note: For employment grievances, see the University of Minnesota General Grievance Policy.

Regents Student Academic Grievance Policy

A. Scope and Purpose

1. This policy addresses academic grievances only. Academic grievances are complaints brought by students regarding the University's provision of education and academic services affecting their role as students. Academic grievances must be based on a claimed violation of a University rule, policy, or established practice. This policy does not limit the University's right to change rules, policies, or practices.

2. This policy does not apply to conflicts connected with student employment or actions taken under the Student Conduct Code. Also, complaints alleging violation of the University's policies of sexual harassment and academic misconduct are not grievances under this policy. Such claims shall be referred to the appropriate office for investigation and review. Any compliant alleging discrimination in the University/student relationship, other than sexual harassment, may be filed under either this policy or with the Office of Equal Opportunity and Affirmative Action, but not both.

3. It is the goal of this policy to provide a simple and expeditious process, allowing for both informal and formal resolutions of conflicts. Resolutions may include student reinstatement or other correction action for the benefit of the student, but may not award monetary compensation or take disciplinary action against any employee of the University.

B. Informal Resolution

1. The first step of any resolution should be at the lowest unit level, between the parties involved or the parties and an appropriate administrator. Students may wish to consult the Student Dispute Resolution Center or similar support services for advice and possible mediation. If no informal resolution can be found at the lowest unit level, informal resolution may be sought at the collegiate level with the parties and higher-level administrators. If the issue cannot be resolved informally, the complainant may move the case to the FORMAL level.

2. Grievances involving an instructor's judgment in assigning a grade based on academic performance may be resolved only through the INFORMAL RESOLUTION procedures.

C. Formal Resolution

1. Each collegiate unit and the Office of Student Affairs will have an Academic Grievance Officer and an Academic Grievance Committee. Members will be drawn from the faculty, students, and academic staff, as provided by the committee structure of that unit. The Academic Grievance Officers of each collegiate unit will be a faculty member who holds no other administrative appointment. In the case of Student Affairs or other involved units without an established faculty, the Grievance Officer will be a member of that staff, with academic staff members drawn from the unit's professional staff and with students and faculty drawn from throughout the University.

2. There will also be a University Academic Grievance Committee and A University Academic Presidents/Chancellors of Student Affairs. The University Academic Grievance Officer will serve as Grievance Officer for these matters. The University Academic Grievance Officer and the University Academic Grievance Committee will be appointed by the President in consultation with the appropriate appointing agencies and will be drawn from the faculty, students, and academic staff.

3. A complaint must be submitted in writing to the appropriate College Grievance Officer identifying the student grievant, the respondent individual(s) involved, the incident, the rule/policy/established practice claimed to be violated, and a brief statement of the redress sought.

4. The grievance should be filed in the collegiate unit in which the incident is alleged to have occurred, which may not necessarily be the student's own college. For graduate student, the appropriate unit is the Graduate School.

5. The College Academic Grievance Officer will meet with the student and individual(s) involved to determine whether a satisfactory resolution can be reached. If this cannot be achieved, the Grievance Officer shall obtain a written answer from the respondent(s) and refer the matter to a hearing panel of the Academic Grievance Committee.

6. Hearing panels will be chaired by a faculty member and will have a maximum of three and, if determined necessary by the College Grievance Officer, a maximum of five members. On a panel of three, one will be a student. If membership exceeds three, it may include more than one student. In the case of a graduate/professional school complaint, the student member(s) will be graduate/professional school student(s). In the

case of an undergraduate complaint, the student member(s) will be an undergraduate(s).

7. Hearing panels will review the evidence and hold hearings as necessary. The panel will not substitute its judgment for that of those most closely acquainted with the field, but will base its recommendations on the whether a rule, policy, or established practice was violated. The panel will prepare a written report recommending a resolution of the matter and will send the report to the parties and to the Dean of the collegiate unit for review and action. If the Dean does not accept the recommendation, the Dean will provide a written explanation of any non-concurrence.

8. If any of the parties are not satisfied with the Dean's resolution of the grievance, they may appeal to the University Academic Grievance Committee. Based on the written appeal and response, this Committee will determine whether there are sufficient grounds to hold an appeal hearing. The University Academic Grievance Committee will not hear a case de novo, but rather will determine whether the parties have been afforded due process. The University Academic Grievance Committee will report its recommendation to the appropriate Vice President, Provost, or Chancellor for review an action. If the recommendation is not accepted, the Vice President, Provost, or Chancellor will provide a written explanation of any non-concurrence.

9. The decision of the appropriate Vice President, Provost, or Chancellor is final and cannot be appealed.

D. Timelines

1. All complaints must be filed within 30 calendar days after the incident being grieved occurred. A response to the complaint must be filed within 15 working days.
2. Deans and Vice Presidents must act upon the recommendation of the committees within 30 calendar days. Appeals must be filed within 15 working days.
3. Timelines may be adjusted if there are compelling reasons for delay offered by any of the parties.

UNIVERSITY SENATE ON SEXUAL HARASSMENT POLICY

Sexual harassment in any situation is reprehensible. It subverts the mission of the University, and threatens the careers of students, faculty, and staff. It is viewed as a violation of Title VII of the 1964 Civil Rights Act. Sexual harassment will not be tolerated in this University. For purposes of this policy, sexual harassment is defined as follows:

“Unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature constitutes sexual harassment when (1) submission to such conduct is made either explicitly or implicitly a term or condition of an individual’s employment or academic advance, (2) submission to or rejection of such conduct by an individual is used as the basis for employment decisions or academic decisions affecting such individual, (3) such conduct has the purpose or effect of unreasonable interfering with the individual’s work or academic performance or creating an intimidating, hostile, or offensive working or academic environment.”

As defined above, sexual harassment is a specific form of discrimination in which power inherent in a faculty member’s or supervisor’s relationship to his or her students or subordinates is unfairly exploited. While sexual harassment must often takes place in a situation of power differential between persons involved, this policy recognizes also that sexual harassment may occur between persons of the same University status, i.e., student-student, faculty-faculty, staff-staff.

It is the responsibility of the administration of this University to uphold the requirements of Title VII, and with regard to sexual harassment specifically, to ensure that this University’s working environment be kept free of it. For that purpose, these Senate procedures and guidelines are promulgated to avoid misunderstandings by faculty, student, sand staff on (1) the definitions of sexual harassment, and (2) procedures specifically designed to file and resolve complaints of sexual harassment.

VI. LEAVE POLICIES

A. VACATION LEAVE POLICY

1. On an annual basis each resident receives 22 vacation days (22 working days) per year. The maximum amount of accrual days is 22. Neither vacation nor meeting requests will be approved for the last day of the Resident’s program. The University of Minnesota Regents Policy states “Vacation may not be used to extend the period of appointment beyond the last day of work.” Consequently, it is University practice that the Resident must be physically present in the Department on the last day of their appointment.

2. Except for emergencies, all vacation day requests must be approved two weeks in advance.

3. In order to request vacation time, the resident fills out a Leave Request Form located in the Copying Room (M-10 Masonic) and gives it to the Physics Section Secretary, who must also approve it, and will then pass it along to the Physics Section Head, and the

Department Head. Please be sure to use the Resident's Leave Request Form, not the Faculty Leave Request Form.

4. Vacation is approved on a "first come first served basis". The minimum number of staff and residents that must be present at the University on any given day is: one resident and one staff person.

5. If you need to leave early or will be arriving late for work, you need to let your staff physicist know this, as well as the clinic receptionist. If you are leaving work before 2 p.m., you will need to request a half-day vacation. No matter how early you leave, there is a request slip that needs to be filled out (located in copying room M10) and signed by the staff person.

B. LEAVE OF ABSENCE

Leaves of absence and vacation may be granted at the discretion of the program director and/or department chair. Within the required period of the medical physics residency, the total of such leave and vacation time may not exceed 12 calendar weeks (60 working days) in any two years. If a longer level of absence is granted for any cause, the required period of graduate medical education must be extended accordingly. The required minimum of 24 months of training must still be completed.

C. PROFESSIONAL LEAVE

Residents are allowed to attend national meetings and two local meetings, for a total of 15 days, over the duration of the two-year residency. The department will reimburse the resident for professional expenses incurred up to $3,000 during the course of their residency (accrued at $1500.00 per year including books and travel). If the expenses exceed $3,000 over the course of the two-year residency, then the resident will be responsible for these additional expenses.

If the resident wishes to go to other conferences at his/her own expense, vacation time needs to be taken.

D. MATERNITY/PATERNITY LEAVE

According to University Policy, 6 weeks of maternity leave or 2 weeks of paternity leave is allowed. Both the Department Head and Physics Section Director must approve any time greater than this.

E. SICK and MILITARY LEAVE

Sick and military leave may be authorized upon proper request. These leaves will not exceed 10 days annually. Leaves beyond 10 days must have Department Head approval, as well as approved by the American Board of Radiology. For any unscheduled absence, proper forms must be filled out within two working days upon return to work.

VII. MOONLIGHTING

The departmental policy for resident moonlighting will be as follows:

1. Moonlighting is only allowed after 5:00 PM on weekdays, weekends, and during vacation time, and with approval of the Department Chairman and Residency Program Director.

2. If the moonlighting appears to be interfering with the resident's performance, a meeting will be held with the residency program director and the department head to discuss the problem. If, after a period of reevaluation, the resident's performance is still not considered adequate, by virtue of University policy, further moonlighting will not be allowed. While not meant to be punitive, this policy instead is meant to ensure ability to pass the written boards, oral boards, and perform as exemplary radiation physicists at the completion of their training.

VIII. RESIDENT HOURS

Resident duty hours are from 7:30 AM until 5:00 PM or until work is done (whichever is later) Monday-Friday. Additional hours may be required after normal working hours to handle loading and unloading of brachytherapy sources.

IX. DRESS CODE

The Department of Therapeutic Radiology at the University of Minnesota adheres to the following standards:

A. IDENTIFICATION

1. **A Fairview-University nametag with the resident's name and job title must be worn when in all clinic areas.**

B. CLOTHING

1. **All clothing must be neat, clean, free from offensive odors, well-fitting, non-transparent and in good condition.**
2. Skirts, dresses, culottes must be knee length.
3. Hosiery must be worn at all times. Knee socks or socks may be worn with pants only.
4. Scrub suits may be worn only in areas approved by the Infection Control Committee.
5. Halters, leotard tops, T-shirts, tube tops, shorts, sweatshirts, sweat pants, and rubber thongs are not permitted.
6. Men must wear ties.

C. GROOMING AND PERSONAL HYGIENE

Personal hygiene includes cleanliness, oral hygiene, an effective means of body deodorant, and freedom from offensive perfumes and odors.

Hats, scarves, large colorful hair ornaments and headbands worn around the forehead are not allowed. Head coverings for ethnic, or religious reasons are permitted.

Fingernails must be clean and a length which does not present a potential for injury to the patient.

Jewelry should be minimal to meet infection control and safety standards. Simple rings, earrings and neck chains are appropriate. Ornamental earrings, necklaces and bracelets are not appropriate.

D. NON-UNIFORM STANDARD

Non-uniform dresses, suits, skirts, pants, culottes are acceptable.

Also acceptable are blouses, shirts, sweaters, vests, jackets, smocks in any color and conservative styles. Prevailing fashion standards of dress may not always be acceptable. Jeans and sweatshirts are not acceptable.

Hose may be of any color.

Shoes may be of any color and style. Closed toes are recommended for safety.

X. STUDENT SERVICES

Please refer to the Part A Medical Residency manual (located at www.trad.umn.edu under Residency Training programs, Medical Residency Program Manuals, Residency Part A manual) for Medical School Policy on the following: Child Care, Computer Discounts, Credit Union, Legal Services,
Library Services, Campus Map, Residency Assistance Program, Tuition Reciprocity, U Card, Recreation Sports Center, University Tickets, and Use of Phone Numbers.

A. UNIVERSITY BEEPER

The Department provides residents with an individual digital pager that is to be utilized for standard duties. The trainee will utilize the same pager over the course of his/her training.

B. E-MAIL AND INTERNET ACCESS

As students at the University, medical physics residents are provided with an e-mail/internet access account. With this account trainees can access the Internet and e-mail from any of their assigned training sites.
Trainees with the appropriate computer equipment can also access the Internet from home. Internet software is available at minimal cost from the University Computer Services in Shepard Labs on the Main University Campus.

C. CAMPUS AND U.S. MAIL

Residents are given a Department mailbox and may utilize the campus mail system at no charge. The campus mail drop box and resident mailboxes are located in the M10 copy room. Physics residents may receive professionally related campus or U.S. Mail as well. Trainees should not receive or send personal mail through the campus mail system.

D. LABORATORY COATS AND LAUNDRY SERVICE

The Department provides medical physics residents with three standard laboratory coats at the start of their residency. The department provides laundry service for soiled laboratory coats. Coats are stored in the M10 office area and are picked up each Tuesday then returned clean nine days later (second following Thursday).

XI. BENEFITS

A. STIPENDS

Medical Physics residents, for residents who meet Department and University requirements, are appointed to one-year training positions from their appointed start date, renewable for one year. Stipend rates for medical physics residents are as follows for the 2009-2010 academic year and subject to change annually:

$41,000.00 year 1 $43,000 year 2

Medical Physics residents are subjected to withholding of federal and state income taxes. Residents also pay tuition and associated fees by payroll deduction, based on University tuition rates and associated fees for each semester of enrollment (subject to change without notice).

B. PAYCHECKS

All trainees receive stipend/pay checks every two weeks. Residents can sign-up for direct deposit, which is the preferred method of payment. Residents participating in direct deposit will have them delivered to their mailbox in the M10 copy room on alternating Wednesdays. Residents not participating in direct deposit can pick up their checks in the M26 office within two weeks. Unclaimed checks are returned to payroll after the two-week period.

C. EDUCATIONAL EXPENSE ALLOWANCE

The department will reimburse the resident for professional expenses incurred up to $3,000 during the course of their residency (accrued at $1500.00 per year including books, travel and professional membership fees). Books are reimbursable in $200 increments. Receipts for reimbursement for these items must be submitted to the Physics Section Administrator. The University of Minnesota is tax exempt and therefore will not reimburse Sales Tax nor will the University of Minnesota reimburse any liquor expense. If the expenses exceed $3,000 over the course of the two-year residency, then the resident would be responsible for these additional expenses.

D. PARKING

The department does not cover the cost of parking for medical physics residents. The University offers daily, carpool, hourly and contract parking as well as bus service from a multitude of areas in the Twin Cities. See the University of Minnesota, Twin Cities Campus web site for more information at www.umn.edu/pts .

GENERAL CURRICULUM

The radiation oncology residency at FUMC includes carefully planned conferences, lectures, and examinations that fully prepare the resident for clinical practice, board certification, and research.

A. CONFERENCES

All physics residents are required to participate in all departmental conferences, which the physics staff is required to attend. Presently these include:

- New patient presentations (3/week)
- Treatment planning (3-week)
- Quality assurance (1/week)
- Complications (1/month)
- Special lectures and Seminars (as scheduled)

B. RADIATION PHYSICS AND RADIOBIOLOGY COURSES

The department's staff medical physicists teach Radiation Physics, which is a comprehensive course. The physics course meets twice weekly from September through March. The radiobiology staff teaches Radiation Biology, which covers basic principles of radiobiology and includes a molecular oncology lecture series which highlights molecular findings related to radiation oncology. The Radiation biology course meets twice weekly from April through June. Attendance is mandatory for residents during their first year of training and must take and pass the written exams. Second through fourth year residents are encouraged to attend the lecture.

C. EXAMINATIONS

1. Residents must take and pass the written exam for the Radiation Physics and the Radiation Biology Courses.
2. Annually the clinical staff administers a mock oral-board exam to the residents. It simulates the oral exam given by the American Board of Radiology. The exam covers the rotation material covered up to the time of the exam.

D. AREAS OF COMPETENCY

The following broad areas will be covered during the two years of the residency period. Normally, most of these procedures are encountered routinely in the clinic and the resident will perform these tasks repeatedly as the need arises for patients. However, the Program Director will augment training in areas, which may not be practiced with sufficient frequency in the department. Also, additional areas may be added to the list if deemed essential to the professional needs of the resident. At the completion of the residency, the resident should be competent in the following areas:

1. Treatment Equipment (Teletherapy)
Calibration: calibration according to protocol, acceptance testing, commissioning, beam data input into the computer, verification of computer isodose distributions, surface doses, and buildup dose distribution, determination of parameters for monitor set calculations.
Radiation Protection: head leakage, neutron contamination, area survey, design specifications, facility design.
Quality Assurance: daily, weekly, monthly and annual checks.

2. Simulator
Testing: acceptance testing and commissioning.
Radiation Protection: beam quality, head leakage and area survey.
Quality assurance: mechanical, radiation fluoroscopic and processor.

3. Dosimetric Equipment
Ion chambers: use of Farmer Chamber, plane parallel chamber, survey meter (calibration and use), radiation field scanner (water phantom).
TLD: annealing procedures, calibration, use of capsules, chips, in vivo dosimetry.
Film: film dosimetry for electrons and photons, sensitometric curve and film badges.
Quality Assurance: chamber calibration and intercomparisons, TLD quality control, and survey meter calibration checks.

4. Treatment Planning
Equipment: acceptance testing and commissioning of treatment planning computer, digitizer, plotter and other auxiliary devices.
Software: check of computer algorithms for isodose generation, blocking, inhomogeneity and other benchmark tests.
Imaging: check of CT and MRI images for accuracy of contour delineation, magnifications; CT numbers vs. electron density curve.
Isodose Plans: treatment technique design and optimization, plan display and evaluation.
Quality Assurance: point dose verification by manual calculation.

5. Treatment Aids
Field Shaping: custom blocking, Multileaf collimators, half-value thickness blocks, gonadal shields, eye shields, internal shields with electrons.
Bolus: material and thickness
In vivo Dosimetry: use of TLD chips, diodes (if available).

Patient Positioning: immobilization devices, body position, leveling, and anatomic landmarks.
On-line Imaging: verification of portal images in comparison with simulation images.

6. Special Techniques
TBI: establishing dosimetry protocol for total body irradiation technique including dose calculation formalism, compensation and dosimetric verification.
TSI: establishing total skin irradiation technique including treatment parameters, dosimetry and in vivo checks.
Electron Arc Therapy: treatment planning and technique for electron arc therapy and special dosimetry.
Intraoperative Electron Therapy (if available): acceptance testing, commissioning and complete dosimetry of applicators and other treatment conditions specific to IORT.
IMRT: Intensive modulated radiation therapy, theory and practice.
Gamma Knife activities: Acceptance testing, commissioning, treatment planning, continuing quality assurance.
Tomotherapy

7. Stereotactic Radiosurgery
Specifications: acceptance testing and commissioning of radiosurgery apparatus, beam data acquisition for small fields, data input into the treatment planning computer and testing of dose calculation algorithm by head-phantom dosimetry.
Treatment Planning: acquisition of CT, MRI, angiographies data, planning of isodose distributions in 3-D, plan evaluation, generation of treatment parameters.
Quality Assurance: QA checks before each case.

8. Patient Dose Calculations
Dosimetric Quantities: percent depth dose, TPR, TMR, TAR, etc. and their relationship.
Monitor Unit Calculation: calculations for different treatment conditions and techniques, verification of calculation formalism using benchmark problems.

9. Brachytherapy
Calibration: acceptance testing and commissioning of brachytherapy sources, applicators and HDR.
Source Preparation: preparation of sources and applicators for implantation.
Radiation Protection: radiation surveys, leak testing and other requirements of regulatory agencies.
Treatment Planning: computer isodose distributions, check of dose calculation algorithm, implant system rules and dose specification.

NRC-Mandated Quality Management Program: detailed review of QMP document, implementation and audit.

10.Quality Assurance Program
Design or review of physical quality assurance program for the department including the NRC mandated Quality Management Program, AAPM Report (TG-40), JCAHO guidelines, etc.

11.Special Reports
In addition to the above practicum as part of the routine clinical operation, the physics resident will be required to prepare a detailed report on selected practical projects, which will include the following as a mimimum:

a. Radiation Detectors: Ion chamber, trix cable, electrometer (2) Film: XV2, EDR2, Radiochromic (3) TLDs (4) Diodes

b. Calibration of Orthovoltage X-Ray Units:
full calibration of linear accelerators: photon and electron beams

c. Operation, acceptance testing and commissioning of linear accelerator.
(xrays and electrons)

d. Acceptance testing and commissioning of treatment planning computer; explanation of algorithm

e. Room shielding design for simulator, CT, orthovoltage and megavoltage facility and radioisotope storage, radiation protection survey-linac

f. Special Procedure: IMRT

g. Acceptance testing and commissioning of brachytherapy apparatus and sources (LDR, HDR)

E. Required Reading List

Students are given a Resident Task Group Report Manual at the start of their residency. The information in this Manual will assist them with their board exams following the completion of their program. Residents are responsible for the material in this manual which covers TG-10, TG-21, TG-25, TG-34, TG-35, TG-39, TG-40, TG-43, TG-45, TG-50, TG-61, TG-54, Radiation Detectors: ion chambers, diode detectors, and other information as listed in the specific rotations.

Radiation Therapy Training Program

Department of Therapeutic Radiology-Radiation Oncology

Category A: Formalized Training:
Offered through courses in radiation physics for residents, graduate students and technologists.

Topics on Radiation Protection:

- background radiation
- delayed radiation effects
- radiation protection
- maximum permissible criteria
- dose levels radiation risks vs. benefits - licensing
- shielding calculations for radiation facilities
- radiation protection for brachytherapy sources - radiation detectors
- radiation surveys
- monitoring of patients with radioactive sources

Category B: Department Radiation Protection:

1. Safety Aspects of Radiation Machines

- Safety interlocks
- Emergency switches
- Emergency procedures with demonstration
- Radiation signs

2. Safety Aspects of Brachytherapy Sources Including

- β-applicators
- Source handling
- Shielding requirements
- Source detection
- Survey measurements

3. Procedures Manuals

- ^{137}Cs applications
- ^{192}Ir applications
- ^{125}I applications
- Source inventory
- Log in and out procedures
- Emergency procedures

4. Film Badges

- Wearing and care
- Reports
- Maximum permissible levels

5. Environmental Health

- (Tapes available in Diehl Hall Library)

RADIATION PROTECTION TRAINING PROGRAM

DEPARTMENT OF THERAPEUTIC RADIOLOGY
FAIRVIEW-UNIVERSITY MEDICAL CENTER

Policy

Adequate radiation protection training will be provided to all persons who work with sources of ionization radiation, in compliance with Title 10, Part 10 of the Code of Federal Regulations. The program will include a series of lectures and demonstrations as well as videotaped seminars.

The specific outline of the program is as follows:

1. A series of radiation protection lectures will be given to a new employee. Although the number and details of these lectures will depend on the prior training of the individual concerned, sufficient information will be provided with regard to the specific radiation sources and procedures followed in this department.

2. A series of videotapes on safe use of ionizing radiation is available in the Diehl Hall Library. Individuals must listen to these seminars at least once and pass the test at the end of the seminars.

3. Emergency procedures are included in the above program, demonstrations will be arranged on an annual basis, specifically for linear accelerators, and brachytherapy sources.

4. A logbook will be maintained for recording the activities related to the radiation protection program.

Appendix 14: Biographic Information of Physics Staff: Bruce J. Gerbi, Ph.D. Program Director, Parham Alaei, Ph.D., Patrick Higgins, Ph.D., Susanta Hui, Ph.D., Yoichi Watanabe, Ph.D., Lihong Qin, Ph.D., and Jane Johnson, M.S. Department Chair: Kathryn Dusenbery, M.D.

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.

NAME
Gerbi, Bruce John

POSITION TITLE
Professor and Director of Medical Physics

eRA COMMONS USER NAME

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
University of Pittsburgh, Pittsburgh, PA	B.S.	1974	Biology
University of Pittsburgh, Pittsburgh, PA	M.S.	1976	Medical Physics
University of Minnesota, Minneapolis, MN	Ph.D.	1987	Biophysical Sciences

1. Positions and Honors.

Positions and Employment

1974-1976 University of Pittsburgh, Presbyterian University Hospital, Physics Training Program, Pittsburgh, PA
1976-1978 Assistant Clinical Physicist, Physics Section, Mallinckrodt Institute of Radiology, Division of Radiation Oncology, St. Louis, MO
1976-1978 Instructor in the Radiation Therapy Technology School, Mallinckrodt Institute of Radiology, Division of Radiation Oncology, St. Louis, MO
1977-1978 Physics Representative to the Clinical Investigative Unit (dealing with clinical protocols), Mallinckrodt Institute of Radiology, St. Louis, MO
1978-1981 Clinical Physicist/Radiation Safety Officer for the group, Norman, Brannan, Riley, Works, Stewart, and Associates, Consulting Radiologists, San Antonio, TX
1979-1981 Instructor in the Radiation Therapy Technology School at the Cancer Therapy and Research Center, San Antonio, TX
1982-1983 Assistant Scientist, Department of Therapeutic Radiology, University of Minnesota, Minneapolis, MN
1983-1987 Instructor, Department of Therapeutic Radiology, University of Minnesota, Minneapolis, MN
1988-1994 Assistant Professor, Department of Therapeutic Radiology, University of Minnesota, Minneapolis, MN
1989-2002 Assistant Head of the Physics Section
1994-2006 Associate Professor, Department of Therapeutic Radiology, University of Minnesota, Minneapolis, Minnesota
2002- Head of the Physics Section and Director of Medical Physics Residency Program, Department of Therapeutic Radiology, University of Minnesota, Minneapolis, MN
2006- Professor, Department of Therapeutic Radiology, University of Minnesota, Minneapolis, Minnesota

Other Experience and Professional Memberships

1974-1976 Health Physics Society, Western Pennsylvania Chapter
1976- American Association of Physicists in Medicine (AAPM)

1976-1978 American Association of Physicists in Medicine (Missouri River Valley Chapter
1978 American Board of Radiology, Therapeutic Radiological Physics
1978- American College of Radiology
1978-1981 American Association of Physicists in Medicine (Southwest Chapter)
1979-1981 Texas Radiological Society
1982- American Association of Physicists in Medicine (North Central Chapter)
1996-1999 AAPM Board Representative, North Central Chapter AAPM
2003- Member, Resident Education Physics Review Committee, AAPM Committee Accreditation of Medical Physics Education Programs (CAMPEP)
2004-2006 Vice-Chair, Resident Education Physics Review Committee, CAMPEP
2006-present Chair, Resident Education Physics Review Committee, CAMPEP

Honors
1974 University of Pittsburgh, graduated Magna cum Laude
1974-1976 Public Health Service Fellowship
1992-1993 President of the North Central Chapter of the American Association of Physicists in Medicine
2001 Fellow, American Association of Physicists in Medicine
2006 Fellow, American College of Medical Physicists

Certification: American Board of Radiology, Therapeutic Radiologic Physics 1978

B. Selected peer-reviewed publications (in chronological order).

1. Choi MC, Purdy JA, Gerbi BJ, Abrath FG, Glasgow GP. Variation in output factor caused by secondary blocking for 7-16 MeV electron beams. Med Phys 1979;6:137.
2. Sharma SC, Gerbi BJ, Madoc-Jones H: Dose rates for brachytherapy applicators using Cs-137 sources. Int J Radiat Onc Biol Phys, 5:1893-1897, 1979.
3. Gerbi BJ: Compensating filter design using radiographic stereo shift information. Med Phys, 12:646-648, 1985.
4. Potish RA, Gerbi BJ: The role of point A in the era of computerized dosimetry. Radiology, 158:827-831, 1986.
5. Tang WL, Khan FM, Gerbi BJ: Validity of lung correction algorithms. Med Phys, 13:683-686, 1986.
6. Gerbi BJ, Levitt SH: Treatment planning of radiotherapy for lung cancer. [In] Veath, Meyer, (eds.), Front. Radiat. Ther. Onc., 21,, pp. 152-180 (Karger, Basel 1987). 21st Annual San Francisco Cancer Symposium, "Treatment Planning in the Radiation Therapy of Cancer", Feb. 28 - Mar. 1, 1986.
7. Khan FM, Gerbi BJ, Deibel FC: Dosimetry of asymmetric x-ray collimators. Med Phys, 13:936-941, 1986.
8. Gerbi BJ, Khan FM. The polarity effect for commercially available plane-parallel ionization chambers. Med Phys, 14:210-215, 1987.
9. Gerbi BJ, Soleimani-Meigooni A, Khan FM. Dose buildup for obliquely incident photon beams. Med Phys, 14:393-399, 1987.

10. Potish RA, Gerbi BJ. Intracavitary dose specification and prescription in gynecologic malignancy. Radiology, 165:555-560, 1987.
11. Gerbi BG. Ph.D. Thesis: Dose buildup for obliquely incident photon beams. University of Minnesota, December, 1987.
12. Das IJ, Khan FM, Gerbi BJ. Interface dose perturbation as a measure of megavoltage photon beam energy. Med Phys, 15:78-81, 1988.
13. Kim TH, Gerbi BJ, Deibel FC, Priest JR, Khan FM. An afterloading brachytherapy device utilizing low temperature plastics. Radiother Oncol, 15:341-344, 1989.
14. Gerbi BJ, Khan FM, Deibel FC, Kim TH. Total skin electron arc irradiation using a reclined patient position. Int J Radiat Onc Bio Phys, 17:397-404, 1989.
15. Johnson JM, Gerbi BJ. Quality control of custom blockmaking in radiation therapy. Med Dosimetry 14:199-202, 1989.
16. Gerbi BJ, Khan FM. Measurement of dose in the buildup region using fixed separation plane parallel ionization chambers. Med Phys, 17:17 1990.
17. Wu RK, Gerbi BJ, Doppke KP. Workbook on dosimetry and treatment planning for radiation oncology residents. (American Institute of Physics, New York, 1991).
18. Gerbi BJ: A mathematical expression for %DD accurate from Co-60 to 24-MV. Med Phys 1991; 18:724-726.
19. Levitt SH, Gerbi BJ, Lee CK. Basic principles of brachycurietherapy of brain tumors. [In] Sauer, Erlangen, (eds.), Medical Radiology-Diagnostic Imaging and Radiation Oncology, Volume "Interventional Radiation Therapy Techniques-Brachytherapy", (Springer, Berlin, 1991).
20. Gerbi BJ. The use of the simulator in treatment planning and determination and definition of treatment volume. [In] Levitt (ed.), Technological basis of radiation therapy: Practical clinical applications, 2nd Ed. (Lea & Febiger, Philadelphia, 1992).
21. Kim TH, Gerbi BJ, Lo JN. Total body irradiation for bone marrow transplantation. [In] Levitt, S.H. (ed.), Technological basis of radiation therapy: Practical clinical applications, 2nd Ed.(Lea & Febiger, Philadelphia, 1992).
22. Doppke KP, Morin RL, Chu W, Gerbi BJ, Gould RG, Hefner LV, Marsden DS, Pavlicek W, Ritenour ER, Schoenfeld AH. A survey of radiation oncologists regarding their radiation physics instruction. Int J Radiat Oncol Biol Phys 1993; 25(2):345-352.
23. Gerbi BJ. The response characteristics of a newly designed plane-parallel ionization chamber in high-energy photon and electron beams. Med Phys 1993; 20:1411-1415.
24. Gerbi BJ, Roback DM, Humphrey SD, Hall WA. Maintaining accuracy in stereotactic radiosurgery. Int J Radiat Onc Biol Phys, 32(4):1199-203, 1995.
25. Gerbi BJ, Dusenbery KE. Design specifications for a treatment stand used for Total Body Photon Irradiation with patients in a standing position. Med Dosim, 20:25-30, 1995
26. Potish RA, Gerbi BJ, Engeler GP. Dose prescription, dose specification, and applicator geometry in intracavitary therapy. [In] Williamson JR and Nath R. (eds.), Radiation Therapy (American Institute of Physics, New York, 1995).
27. Weaver R, Gerbi BJ, Dusenbery KE. Evaluation of dose uniformity in total skin electron beam treatments using thermoluminescent dosimeters. Int J Radiat Onc Biol Phys, 33(2):475-8, 1995.

28. Hall WA, Djalilian HR, Sperduto PW, Cho KH, Gerbi BJ, Gibbons JP, Rohr M, Clark HB. Stereotactic radiosurgery for recurrent malignant gliomas. J of Clin Oncol, 13(7):1642-8, 1995.
29. Roback DM, Gerbi BJ. Evaluation of electronic portal imaging device for missing tissue compensator design and verification. Med Phys, 22:2029-34, 1995.
30. Weprin BE, Hall WA, Cho KH, Sperduto PW, Gerbi BJ, Moertel C. Stereotactic radiosurgery in pediatric patients. Pediatr Neurol, 15(3):193-199, 1996.
31. Klein EE, Gerbi B, Meli J, Marsden D. 1995 Survey of physics teaching efforts in radiation oncology residency programs. Int J Radiat Onc Biol Phys, 38(2), 441-446, 1997.
32. Gerbi BJ, Khan FM. Plane-parallel ionization chamber response in the buildup region of obliquely incident photon beams. Med Phys 1997;24(6):873-878.
33. Dusenbery KE, Gerbi BJ. Low-dose-rate intracavitary brachytherapy for carcinoma of the uterine cervix. [In] Nag S. (ed), Principles and Practice of Brachytherapy (Futura Publishing Co., Inc., Armonk, NY, 1997).
34. Weaver R, Gerbi BJ, Dusenbery KE. Evaluation of eye shields made from tungsten and aluminum in high energy electron beams. Int J Radiat Onc Biol Phys, 39:233-237, 1997.
35. Khan FM, Higgins PD, Gerbi BJ, Deibel FC, Sethi A, Mihailidis DN. Calculation of depth dose and dose per monitor unit for irregularly shaped electron fields. Phys Med Biol, 43:2741-54, 1998.
36. Cho KH, Hall WA, Gerbi BJ, Higgins PD, Bohen M, Clark HB. Patient selection criteria for the treatment of brain metastases with stereotactic radiosurgery. J Neurooncol, 40:73-86, 1998.
37. Gerbi BJ. The Simulation Process in the Determination and Definition of the Treatment Volume and Treatment Planning. [In] Levitt SH, Khan FM, Potish RA, (eds.), Levitt and Tapley's Clinical Application of Radiation Therapy, 3rd Ed. (Williams & Wilkins, Baltimore, MD, 1999).
38. Cho CK, Gerbi BJ, Hall WA. Stereotactic Radiosurgery and Radiotherapy. [In] Levitt SH, Khan FM, Potish RA, (eds.), Levitt and Tapley's Clinical Applications of Radiation Therapy, 3rd Ed. (Williams & Wilkins, Baltimore, MD, 1999).
39. Dusenbery KE, Gerbi BJ. Total Body Irradiation in Conditioning Regimens for Bone Marrow Transplantation. [In] Levitt SH, Khan FM, Potish RA, Perez CA (eds.), Levitt and Tapley's Clinical Applications of Radiation Therapy, 3rd Ed. (Williams & Wilkins, Baltimore, MD, 1999).
40. Gerbi BJ, Lewandowski LA, Higgins PD, Cho KC, Hall WA, Neely KA, Walsh AW. Stereotactic Radiotherapy for Treatment of Subfoveal Choroidal Neovascularization in Age-Related Macular Degeneration. Int J Radiosurgery, 2:113-118, 1999.
41. Alaei P, Gerbi BJ, Geise RA. Generation and use of photon energy deposition kernels for diagnostic quality x rays. Med Phys, 26:1687-1697, 1999.
42. Cho KH, Hall WA, Gerbi BJ, Higgins PD, McGuire WA, Clark HB. Single dose versus fractionated stereotactic radiotherapy for recurrent high-grade gliomas. Int J Radiat Oncol Biol Phys, 45(5):1133-41, 1999.
43. Fetterly KA, Alaei P, Gerbi BJ, Geise RA. Measurement of the dose deposition characteristics of x-ray fluroscopy beams in water. Med Phys, 28(2):205-9, 2001.
44. Alaei P, Gerbi BJ, Geise RA. Evaluation of a model-based treatment planning system for dose computations in the kilovoltage energy range. Med Phys,27(*12):2821-6, 2000.*

45. Alaei P, Gerbi BJ, Geise RA. Lung dose calculations at kilovoltage x-ray energies using a model-based treatment planning system. Med Phys. 28(2):194-8, 2001
46. Lo SS, Cho KH, Hall WA, Kossow RJ, Hernandez WL, McCollow KK, Gerbi BJ, Higgins PD, Lee CK. Single dose vs. fractionated stereotactic radiotherapy for meningiomas. Can J Neurol Sci, 29(3):240-8, 2002.
47. Higgins PD, Gerbi BJ, Khan FK. Application of measured pencil beam parameters for electron beam model verification. Med Phys, 30(4):514-520, 2003
48. Chao C, Ozyigit G, Dusenbery KE, Gerbi BJ, Nag S. Low-dose-rate intracavitary brachytherapy for carcinoma of the uterine cervix. [In] Nag S. (ed), Principles and Practice of Brachytherapy 2nd Ed. (Futura Publishing Co., Inc., Armonk, NY, 2003).
49. Gerbi BJ, Dimitroyannis DA. The response of Kodak EDR2 film in high-energy electron beams. Med Phys, 30(10) 2703-2005, 2003
50. Higgins PD, Alaei P, Gerbi BJ, Dusenbery KE. In vivo diode dosimetry for routine quality assurance in IMRT. Med Phys, 30(12):3118-3123, 2003
51. Higgins PD, Alaei P, Gerbi BJ, Dusenbery KE. Response to Comment on In vivo dosimetry for routine quality assurance in IMRT. Med Phys, 31:1642-1643, 2004
52. Goblirsch M, Mathews W, Lynch C, Alaei PA, Gerbi BJ, Mantyh PW, Clohisy DR. Radiation treatment decreases bone cancer pain, osteolysis and tumor size. Radiation Res, 161(2):228-234, 2004
53. Gerbi BJ, Higgins PD, Cho KH, Hall WA. LINAC-based steriotactic radiosurgery for treatment of trigeminal neuralgia. Journal of Applied Clinical Medical Physics, 5(3), 2004
54. Kubicek GJ, Hall WA, Orner JB, Gerbi BJ, Dusenbery KE. Long-Term Follow-Up of Trigeminal Neuralgia Treatment Using a Linear Accelerator. Sterotact Funct Neurosurg 2005;82(5-60:244-249)
55. Klein EE, Balter JM, Chaney EL, Gerbi BJ, Hughes L; Ad-Hoc Committee on Teaching Physics to Residents. ASTRO's core physics curriculum for radiation oncology residents. Int J Radiat Oncol Biol Phys 2004;60(3):697-705.
56. Wilkinson JD, Bounds C, Brown T, Gerbi BJ, Peltier J. Cancer-Radiotherapy Equipment as a cause of soft errors in electronic equipment. IEEE Transactions on Device and Materials Reliability, Vol. 5, No. 3, Sept 2005, pp. 1-3.
57. Alaei P, Higgins PD, Gerbi BJ. Implementation of enhanced dynamic wedges in pinnacle treatment planning system. Medical Dosimetry 2005;30(4):228-232.
58. Hui SK, Kapatoes J, Fowler J, Henderson D, Olivera G, Manon RR, Gerbi B, Mackie TR, Welsh JS. Feasibility study of helical tomotherapy for total body or total marrow irradiation. Med Phys 2005;32(10):3214-24.
59. Gerbi, BJ. Clinical applications of high-energy electrons. [In] Levitt, SH, Purdy, JA, Perez, CA, Vijayakumar, S, (eds.). Technical Basis of Radiation Therapy: Practical Clinical Applications, 4th Ed. (Springer, Berlin, Germany, 2006).
60. Dusenbery, KE, Gerbi, BJ. Radiation Therapy in Cervix Cancer. [In] Levitt, SH, Purdy, JA, Perez, CA, Vijayakumar, S, (eds.). Technical Basis of Radiation Therapy: Practical Clinical Applications, 4th Ed. (Springer, Berlin, Germany, 2006).
61. Dusenbery, KE, Gerbi, BJ. Total Body Irradiation Conditioning Regimens in Stem Cell Transplantation. [In] Levitt, SH, Purdy, JA, Perez, CA, Vijayakumar, S, (eds.). Technical Basis of Radiation Therapy: Practical Clinical Applications, 4th Ed. (Springer, Berlin, Germany, 2006).

62. Alaei P, Hui SK, Higgins PD, Gerbi BJ. The use of a commercial QA device for daily output check of a helical tomotherapy unit. Med Phys. (2006) 33(10):3680-2.
63. Hui SK, Verneris MR, Higgins P, Gerbi B, Weigel B, Baker SK, Fraser C, Tomblyn M, Dusenbery K. Helical tomotherapy targeting total bone marrow - first clinical experience at the University of Minnesota. Acta Oncol. (2007) 46(2):250-5.
64. Higgins PD, Gerbi BJ, Macedon M, Dusenbery KE. Fractionated stereotactic radiotherapy for pediatric patients with retinoblastoma. J Appl Clin Med Phys. (2006) 7(2):9-17.
65. McClelland S 3rd, Higgins PD, Gerbi BJ, Orner JB, Hall WA. Fractionated stereotactic radiotherapy for pituitary adenomas following microsurgical resection: safety and efficacy. Technol Cancer Res Treat. (2007) 6(3):177-80.
66. Watanabe Y, Gerbi BJ. Radiation exposure during head repositioning with the automatic positioning system for gamma knife radiosurgery. Int J Radiat Oncol Biol Phys. (2007) 68(4):1207-11.
67. Klein EE, Gerbi BJ, Price RA Jr, Balter JM, Paliwal B, Hughes L, Huang E. ASTRO's 2007 core physics curriculum for radiation oncology residents. Int J Radiat Oncol Biol Phys. (2007) 68(5):1276-88.
68. Smith KS, Gibbons JP, Gerbi BJ, Hogstrom KR. Measurement of superficial dose from a static tomotherapy beam. Med Phys. (2008) 35(2):769-74.
69. McClelland III S, Gerbi BJ, Higgins PD, Orner JB, Hall WA. Safety and efficacy of fractionated stereotactic radiotherapy for acoustic neuromas. J Neurooncol (2008) 86:191–194

C. Research Support.

<u>Completed Research Support</u>

BMEI Gerbi (PI) 10/17/2005 – Present
Biomedical Engineering Institute, University of Minnesota
Design and testing of a miniature, wireless radiation detector.
Role: Principal Investigator

MMF/CO-43-00 Gerbi (PI) 2/18/2000 – 2/17/2003
Minnesota Medical Foundation
Design and testing of a miniature, wireless radiation detector.
Role: Principal Investigator

C U R R I C U L U M V I T A E

PATRICK D. HIGGINS, Ph.D.
6918 Black Duck Dr.
Lino Lakes, MN 55014
612/426-8064

DATE/PLACE OF BIRTH: 03/31/51 Detroit, MI

MARITAL STATUS: Married
Wife: Kimberley
Children: Shannon, Ryan, Erin, Kevin

BUSINESS ADDRESS:
University of Minnesota
Department of Therapeutic Radiology-Radiation Oncology
Mayo Mail Code 494
Harvard at East River Parkway
Minneapolis, MN 55455-0110
(612) 626-6225

EDUCATION:

1973 B.S., University of Detroit, Detroit, MI
Summa cum Laude
Minor: Mathematics and Philosophy
Major: Physics

1978 Ph.D., University of Notre Dame, Notre Dame, IN
High Energy Physics,
Ph.D. Advisor: Nripendra Biswas
Dissertation Title: A Study of Resonance and Neutral Particle Production in High Energy π^-p Interactions.

HONORS: Phi Eta Sigma (local chapter of phi beta kappa)
Sigma Pi Sigma (physics)
Pi Mu Epsilon (mathematics)
Sigma Xi
Gerhard Blass Award (outstanding senior physics student)

SOCIETIES: American Association of Physicists in Medicine
American Society of Therapeutic Radiologists

CERTIFICATION: American Board of Medical Physics (1995), Re-certified 2005.

EXPERIENCE:
06/01/07 - Present
Professor (Tenure)
Department of Therapeutic Radiology-Radiation Oncology
University of Minnesota Medical School
Minneapolis, MN 55455-0110

06/01/96 – 05/31/07
Associate Professor (Tenure)
Department of Therapeutic Radiology-Radiation Oncology
University of Minnesota Medical School
Minneapolis, MN 55455-0110

09/01/94 - 05/31/96
Assistant Professor
Department of Therapeutic Radiology-Radiation Oncology
University of Minnesota Medical School
Minneapolis, MN 55455-0110

06/01/86 - 08/31/94
Director of Radiotherapy Physics
Cleveland Clinic Foundation, Cleveland OH 44195-0001

Adjunct Assistant Professor
Department of Medical Physics
University of Wisconsin Medical School, Madison WI

07/01/84-05/30/86
Assistant Professor
Departments of Human Oncology and Medical Physics
University of Wisconsin Medical School, Madison WI

07/01/83-07/31/84
Assistant Scientist
Departments of Human Oncology and Medical Physics
University of Wisconsin Medical School, Madison WI

07/01/81-06/30/83
Project Associate
Section of Radiation Therapy Physics
Division of Radiation Oncology, Department of Human Oncology
University of Wisconsin Medical School, Madison WI

09/78 - 06/30/81
Postdoctoral Fellow
National Cancer Institute Grant for Medical Physics and
Biology Training, Division of Medical Physics
Department of Radiology
University of Wisconsin, Madison WI

05/78-08/78
Member of Technical Staff
Bell Laboratories, Holmdel NJ

09/73 - 05/78
Teaching Assistant
University of Notre Dame, Notre Dame IN

RESEARCH GRANTS:

NIH Grant 1-R23-CA-37057-01A1
Dates: 12/01/84 - 11/30/87
Amount: $103,375.00
Title: Thermal Modeling for Ultrasound Hyperthermia.
Principal Investigator.

University of Wisconsin Graduate School
Grant No. 151560
Dates: 07/01/85 - 06/30/86
Amount: $16,967.00
Title: Calorimetry for Synchrotron Radiation Dosimetry.
Principal Investigator

University of Wisconsin Medical School and
Department of Human Oncology
Dates: 02/01/85 - 01/31/86
Amount: $6,370.00
Title: Study of Normal Porcine Fat and Muscle Response to Focused Ultrasound Hyperthermia.
Principal Investigator

American Cancer Society Institutional Research Grant
Dates: 11/01/85 - 10/31/86
Amount: $2,500.00
Title: Hyperthermia Induction and Tissue Response in Dogs with Thermally Self Regulating Ferromagnetic Implants.
Co-Principal Investigator

NIH Grant NCI-CM-57714-26
Dates: 08/01/85 - 09/28/89
Amount: $5,766,307.00
Title: Neutron Therapy Clinical Trials.
Co-Investigator

NIH Grant DDHS/NCI CA-33951
Dates: 12/01/86 - 11/30/89
Amount: $410,830.00
Title: Cellular Effects of Combined High and Low LET Radiation.
Co-Principal Investigator

Edison Biotechnology Center
Dates: 04/01/88 - 03/31/89
Amount: $30,000.00
Title: A Tissue-Equivalent Detector for Clinical Beams in Radiation Therapy.
Principal Investigator.

PUBLICATIONS:

1. Anderson EW, Higgins PD et.al. Direct e^+e^- Production by 360 GeV/c $^-$ Hydrogen. Phys Rev Lett. 37:1593, 1976.

2. Firestone A, Higgins PD et.al. π^-p Interactions at 360 GeV/c: Measurement of the Total and Elastic Cross Sections and the Charged Particle Multiplicity Distributions. Phys Rev D-14:2902, 1976.
3. Lehman E, Higgins PD et.al. Tests of the Quark-Parton Model in Soft Hadronic Processes. Phys Rev D-18:3353, 1978.
4. Biswas NN, Higgins PD et.al. Inclusive Δ^{++}(1232) Production in 200 GeV/c π^-P Interactions. Phys. Rev D-16:2090, 1977.
5. Higgins P.D., et al: Study of Δ^{++} production in 100, 200, and 360 GeV/c π^-P Interactions. Phys Rev D-19:731, 1979.
6. Lamsa J., Higgins PD et.al. The Inelastic Diffractive Dissociation Cross Section in π^-P Interactions at 200 GeV/c. Phys Rev D-18:3933, 1979.
7. Higgins PD, et.al. Energy Dependence of ρ(770) Production in 100, 200, and 360 GeV/c π^-p Interactions. Phys Rev D-19:65, 1979.
8. Biswas NN, Higgins PD, et al. High-P_t Pion production in π-π Interactions. Phys Lett. 97B:333-336, 1980.
9. DeLuca PM, Higgins PD, Pearson DW, Attix FH. Neutron and Photon Dose Components in a 15 MeV Neutron Beam Determined with a Graphite-walled Proportional Counter. Seventh Symposium on Microdosimetry, Vol. II, edited by J Booz, HA Ebert and HD Hartfiel, Harwood Academic Publ, 1980.
10. Higgins PD, et.al. Measurement of OER and RBE for Mono-energetic 2.5 and 14.3 MeV Neutrons. Int J Radiat Biol 40:313, 1981.
11. Higgins PD, DeLuca PM, Gould MN, Pearson DW. Survival of V79 Chinese Hamster Cells Following Simultaneous Irradiation by 14.8 MeV Neutrons and ^{60}Co. Radiat Res. 95:45-56, 1983.
12. Higgins PD, Sibata CH, Attix FH, Paliwal BR. Calculational Methods for Estimating Skin Dose in ^{60}Co Beams. Med Phys 10:622, 1983.
13. Higgins PD, Zeng XW, Zagzebski JA, Paliwal BR. Versatility of Focused Ultrasound in Treatment of Superficial Tumors. Int J Radiat Oncol Biol Phys 10:1923-1931, 1984.
14. Higgins PD, DeLuca PM Jr., Gould MN. Effect of Pulsed Dose in Simultaneous and Sequential Irradiation of V-79 Cells by 14.8 MeV Neutrons and ^{60}Co Photons. Radiat Res. 99:591-595, 1984.
15. DeLuca PM, Schell MC, Pearson DW, Higgins PD, Attix FH. Performance Characteristics of A150 Plastic-Equivalent Gases in A150 Plastic Proportional Counters for 14.8 MeV Neutrons. Med Phys 11:449-455, 1984.
16. Higgins PD, Adams WM, Siegfried L, Paliwal BR, Steeves RA. Chronic Response of Normal Porcine Fat and Muscle to Focused Ultrasound Hyperthermia. Radiat Res. 104:140-152, 1985.
17. Higgins PD, Sibata CH. Determination of Contamination-Free Build-up for ^{60}Co. Phys Med Biol 30:153-162, 1985.
18. Higgins PD, Jafari F. Thermal Distributions in Spherical Regions with Variable Thermal Conductivity. IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control 1:21-26, 1986.
19. Vijayakumar S., Higgins PD et.al. A Technique Using Electrons and Photons in the Radiotherapy of Orbital Neoplasms. Acta Oncol 26:492-493, 1987.
20. Higgins PD, Adams WM, Dubielzig RR. Thermal Dosimetry of Normal Porcine Tissues. Radiat Res. 114:225-230, 1988.
21. Mota HC, Vijayakumar S, Sibata C, Higgins PD. Posterior Spinal Cord Block: A Dosimetric Study. Radiology 168:859-861, 1988.
22. Kamiya K, Higgins PD, Tanner MD, Clifton KH: Clonogenic Cells and Rat Mammary

Cancer: Effects of Hormones, X-rays and Fission Neutrons. Radiat Res. 120:323-338, 1989.

23. Beddar AS, Higgins PD, Use of Ferroelectric Crystal Detectors for Electron Dosimetry. IEEE Transaction on Ultrasonics, Ferroelectric and Frequency Control, 37:26-29, 1989.
24. Thomason C, Higgins PD. Radial Dose Distribution of Ir-192 and Cs-137 Seed Sources. Med Phys 16:254-257, 1989.
25. Jafari F, Higgins PD. Thermal Modeling in Cylindrical Symmetry Using Effective Conductivity. IEEE Transaction on Ultrasonics, Ferroelectric and Frequency Control, 36:191-196, 1989.
26. Higgins PD, Sibata CH, Thomas F. Application of Thermal Dilution Measurements for Thermal Treatment Planning. Phys in Med Biol 34:651-658, 1989.
27. Higgins PD, Sohn WH, Sibata CH. Effective Field Size Corrections for Elongated Fields. Med Phys 16(5):800-802, 1989.
28. Sibata CH, Higgins PD. Implementation of a Program for Stereotactic Radiosurgery. Proceedings 3rd Congress of the Association of Medical Physicists in Brazil, Sao Paulo, Brazil, 1989.
29. Vijayakumar S, Ng T, Koumoundouros I, Higgins PD, Thomas FJ. Less well known parameters of in vitro radiosensitivity. JAMA 81:799-, 1989.
30. Thomason C, Higgins PD. Reply to Comments of Meli, Meigooni and Nath. Med Phys 16:825, 1989.
31. Mota HC, Sibata CH, Higgins PD. Film Dosimetry: Linearization of dose response for relative measurements. Phys Med Biol 35:565-569, 1990.
32. Majors AW, Higgins PD et.al. Phosphorus metabolites and the distribution of cell cycle phase of RIF-1 Tumors in Response to 14 cGy Irradiation. Magnetic Resonance Med 16, 1990.
33. Higgins PD, Seltzer S, Hubbell J, Berger M, Sibata CH, Attix FH. In-Flight Corrected Mass Energy Absorption Coefficients for the Range 0.001-100 MeV. National Institute of Standards and Technology Report 4812, 1991.
34. Sibata CH, Mota HD, Higgins PD. Influence of detector size in photon beam profile measurement. Phys Med Biol 36:621-631, 1991.
35. Thomason C, Higgins PD et.al. Dose distribution surrounding ^{192}Ir and ^{137}Cs seed sources. Phys Med Biol 36:475-493, 1991.
36. Ngo FQH, Higgins PD et.al. Basic Radiobiological Investigations of Fast Neutrons. Radiat Res. 128:594-602, 1991.
37. Higgins, PD, Sohn JS, Fine R. 3-D Conformal Pancreas Treatment: Comparison of Technique and Effect of Targeting Errors. Int J Radiat Oncol Biol Phys 31(3):605-9,1995.
38. Higgins PD. Response to Chu and Solin on Conformal Treatment Planning for Cancer of the Pancreas. Int J Radiat Oncol Biol Phys 32:1268, 1995.
39. Higgins PD, Siskind L., Roberts W. Deconvolution Correction of Chamber Size Effect for Measurement of Small Beam Profiles. Med Phys 22:1663-1666, 1995.
40. Higgins PD, Lee EJ, Ahuja AS, Mihailidis DN, Khan FM. Blocked Field Effects on Collimator Scatter Factors. Phys Med. Biol 42:2435-2447, 1997.
41. Levitt SH, Khan FM, Higgins PD, Nierengarten MB. Cost-benefit analysis of 3d Conformal radiation therapy. Strahlentherapie 173:441-443, 1997.
42. Khan FK, Higgins PD, Gerbi BJ, Deibel FC, Sethi A, Mihailidis D., Calculation of Depth Dose and Dose per Monitor Unit for Irregularly Shaped Electron Fields. Phys. Med Biol. 43:2741-2754, 1998.
43. Cho KH, Hall WA, Gerbi BJ, Higgins PD. Stereotactic radiosurgery for brain metastases: Prognostic factors associated with increased local control and survival. International Journal of Neuro-Radiology, 40: 73-86, 1998.
44. Cho KH, Hall WA, Lee AK, Gerbi BJ, Higgins PD, Bohen M, Nussbaum S. Stereotactic Radiosurgery Improves Survival in Patients with Solitary Brain Metastasis: A Reasonable

Alternative to Surgery. Journal of Radiosurgery 1:79-85, 1998.
45. Gerbi BJ, Lewandowski LA, Higgins PD, Cho KH, Hall WA, Neely KA, Walsh AW, Stereotactic radiotherapy of subfoveal choroidal neovascularization in age-related macular degeneration. Journal of Radiosurgery, 2:113-118, 1999.
46. Khan FM and Higgins PD. Calculation of depth dose and dose per monitor unit for irregularly shaped electron fields: an addendum Phys Med Biol, 44:N77-N80 (1999).
47. Cho KH, Hall WA, Gerbi BJ, Higgins PD. Single dose versus fractionated stereotactic radiotherapy for recurrent high-grade gliomas. Int. J. Radiat. Onc. Biol. Phys. 45:1133-1141, 1999.
48. Kamiya K, Higgins PD, Tanner MA, Gould MN, Clifton KH. Kinetics of mammary clonogenic cells and rat mammary cancer induction by X-rays or fission neutrons. J. Radiat. Res. (Tokyo) 40(suppl.):128-137, 1999.
49. Cho KH, Hall WA, Gerbi BJ, Higgins PD. The role of radiosurgery for multiple brain metastases. Neurosurg. Focus 9(2): Article 2, 2000.
50. Khan FM and Higgins PD. Field equivalence for clinical electron beams. Phys. Med. Biol. 46: N9-N14, 2001.
51. Lo SS, Cho KW, Hall WA, Kossow RJ, Hernandez WL, McCollow KK, Gerbi BJ, Higgins PD, Lee CK: Single dose vs. fractionated stereotactic radiotherapy for meningiomas. Canadian Journal of Neurological Sciences: 29:240-248, 2002.
52. Higgins PD, Gerbi BJ and Khan FK. Application of measured pencil beam parameters for electron beam model evaluation. Med. Phys. 30:514-520, 2003.
53. Alaei P, Higgins PD, Nguyen N and Weaver R. Comparison of dynamic step-and-shoot intensity-modulated radiation therapy planning and delivery. Medical Dosimetry 29:1-6, 2004.
54. Higgins PD, Alaei P, Gerbi BJ and Dusenbery KE. In vivo diode dosimetry for routine quality assurance in IMRT. Med. Phys. 30:3118-3123, 2003.
55. Gerbi BJ, Higgins PD, Cho KH and Hall WA. Linac-based stereotactic radiosurgery for treatment of trigeminal neuralgia. Journal of Applied Clinical Medical Physics, Summer,5(3):80-92, 2004.
56. Higgins PD, Alaei P, Gerbi BJ and Dusenbery KE. Response to comments on "In vivo diode dosimetry for routine quality assurance in IMRT" by Noria Jornet. Med. Phys. 31:1644, 2004.
57. Alaei P, Higgins PD and Gerbi BJ. Implementation of enhanced dynamic wedges in pinnacle treatment planning system. Medical Dosimetry 30(4):228-232,2005.
58. Higgins PD, Gerbi BJ, Dusenbery KE and Macedon M. Fractionated stereotactic radiotherapy for pediatric patients with retinoblastoma. Journal of Applied Clinical Medical Physics 7(2):1-9, 2006.
59. Higgins PD, Weaver R and Dusenbery KE. Evaluation of bladder dose in IMRT of the prostate. Medical Dosimetry 31(3):197-200, 2006.
60. Alaei P and Higgins PD. Performance evaluation and quality assurance of Varian enhanced dynamic wedges. Journal of Applied Clinical Medical Physics 7:14-20, 2006.
61. Higgins PD and Alaei P. Dose uncertainty due to aperture affects in dynamic fields. Med. Phys. 33(7):2418-2425, 2006.
62. Alaei P, Hui S, Higgins PD and Gerbi BJ. The use of a commercial QA device for daily output check of a helical tomotherapy unit. Med. Phys. 33(10):3680-3682, 2006.
63. McClelland S, Dusenbery KE, Higgins PD and Hall WA, The first facial nerve neuroma treated with fractionated stereotactic radiotherapy. Case Report. Stereotactic Funct Neurosurg. 85:299–302, 2007.
64. McClelland S, Higgins PD, Orner JB and Hall WA, Fractionated stereotactic radiotherapy for pituitary adenomas following microsurgical resection: Safety and efficacy. Technology in Cancer Research and Treatment 6(3):177-180, 2007.

65. Higgins PD, Han EY, Yuan J, Hui S and Lee CK. Evaluation of surface and superficial dose for head and neck treatments using conventional or intensity-modulated techniques. Phys. Med. Biol. 52:1135-1146, 2007.
66. McClelland S III, Gerbi BJ, Higgins PD, Orner JB, Hall WA. Safety and Efficacy of Fractionated Stereotactic Radiotherapy For Acoustic Neuromas. Journal of Neuro-Oncology, 86(2): 191-194, 2008. (Electronic Publication Date: July 11, 2007).
67. Alaei P, Higgins PD and Gerbi BJ, In Vivo diode dosimetry for IMRT treatments generated by the Pinnacle treatment planning system. Medical Dosimetry (accepted), 2008.
68. Alaei P, Higgins PD, Adequacy of single dose film calibration to account for sensitometric curve variations in IMRT QA. Submitted to Phys. Med. Biol., 2008.
69. Saxena R. and Higgins PD, Measurement and Evaluation of Inhomogeneity Corrections and Monitor Unit Verification for Treatment Planning. Submitted to Medical Dosimetry, 2008.

Curriculum Vitae

Parham Alaei, Ph.D.

EDUCATION:

Ph.D., Biophysical Sciences and Medical Physics, University of Minnesota, Minneapolis, Minnesota, August 2000

M.S., Nuclear Engineering Sciences (Medical Physics), University of Florida, Gainesville, Florida, August 1992

B.S., Physics, Florida International University, Miami, Florida, April 1989

PROFESSIONAL EXPERIENCE:

June 2008-Present: Associate Professor, Department of Therapeutic Radiology-Radiation Oncology, University of Minnesota, Minneapolis, Minnesota

August 2001-June 2008: Assistant Professor, Department of Therapeutic Radiology-Radiation Oncology, University of Minnesota, Minneapolis, Minnesota

September 2000-July 2001: Clinical Physicist, Department of Radiation Oncology, University of Michigan, Ann Arbor, Michigan

July 1993-September 1995: Medical Physicist, Department of Radiation Oncology, St. Vincent's Medical Center, Jacksonville, Florida

CERTIFICATION:

American Board of Radiology (Therapeutic Radiologic Physics), 2004

PROFESSIONAL AFFILIATION:

American Association of Physicists in Medicine
American Society for Radiation Oncology

OFFICES HELD IN PROFESSIONAL SOCIETIES:

Secretary/Treasurer, North Central Chapter of AAPM (Nov. 2005-April 2008)
President-elect, Association of Iranian Physicists in Medicine

PUBLICATIONS:

P. Alaei, B. J. Gerbi and R. A. Geise, "Generation and use of photon energy deposition kernels for diagnostic quality x rays," Med. Phys. 26, 1687-1697 (1999)

P. Alaei, B. J. Gerbi and R. A. Geise, "Evaluation of a model-based treatment planning system for dose computations in the kilovoltage energy range," Med. Phys. 27, 2821- 826 (2000)

P. Alaei, B. J. Gerbi and R. A. Geise, "Lung dose calculations at kilovoltage x-ray energies using a model-based treatment planning system," Med. Phys. 28, 194-198 (2001)

K. A. Fetterly, B. J. Gerbi, P. Alaei and R. A. Geise, "Measurement of the dose deposition characteristics of x-ray fluoroscopy beams in water," Med. Phys. 28, 205-209 (2001)

P. D. Higgins, P. Alaei, B. J. Gerbi and K. E. Dusenbery, "In Vivo diode dosimetry for routine quality assurance in IMRT", Med. Phys. 30, 3118-3123 (2003)

M. Goblirsch, W. Mathews, C. Lynch, P. Alaei, B. J. Gerbi, P. W. Mantyh, and D. R. Clohisy, "Radiation Treatment Decreases Bone Cancer Pain, Osteolysis and Tumor Size", Rad. Research 161, 228-234 (2004)

P. Alaei, P. D. Higgins, R. Weaver and N. Nguyen, "Comparison of dynamic and step-and-shoot intensity-modulated radiation therapy planning and delivery", Med. Dosim. 29, 1-6 (2004)

P. D. Higgins, P. Alaei, B. J. Gerbi and K. E. Dusenbery, Response to "Comment on `In vivo dosimetry for routine quality assurance in IMRT' ", Med. Phys. 31, 16421643 (2004)

P. Alaei, P.D. Higgins, B.J. Gerbi, "Implementation of enhanced dynamic wedges in Pinnacle treatment planning system", Med. Dosim. 30, 228-232 (2005)

P. Alaei, P.D. Higgins, "Performance evaluation and quality assurance of Varian enhanced dynamic wedges", J. Appl. Clin. Med. Phys. 7, 14-20 (2006)

M. Goblirsch, P. Zwolak, M.L. Ramnaraine, W. Pan, C. Lynch, P. Alaei, D.R. Clohisy, "Novel *Cytosine Deaminase* fusion gene enhances the effect of radiation on breast cancer in bone by reducing tumor burden, osteolysis, and skeletal fracture", Clin. Cancer Res. 12, 3168-3176 (2006)

P.D. Higgins, P. Alaei, "Dose uncertainty due to aperture effects in dynamic fields", Med**.** Phys**.** 33, 2418-2425 (2006)

P. Alaei, S.K. Hui, P.D. Higgins, B.J. Gerbi, "The use of a commercial QA device for daily output check of a helical tomotherapy unit", Med. Phys. 33, 3680-3682 (2006)

P. Alaei, P.D. Higgins, B.J. Gerbi, "In Vivo diode dosimetry for IMRT treatments generated by Pinnacle treatment planning system", Med. Dosim. (In Press)

BIOGRAPHICAL SKETCH			
NAME Hui, Susanta K.	POSITION TITLE Assistant Professor		
INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEA R(s)	FIELD OF STUDY
University of Calcutta Calcutta, India	B.Sc	1990	Physics Honors
University of Calcutta Calcutta, India	M.Sc	1992	Physics
University of Calcutta and Nuclear Science Centre New Delhi, India	Ph.D.	1999	Experimental Nuclear Physics

A. Positions and Honors.

Positions

1998-2001 Postdoctoral Fellow – Physics Department, University of Purdue, West Lafayette, Indiana; Applied Physics Institute, WKU, Bowling Green, KY; Racah Institute of Physics, Hebrew University, Israel.

2001-2003 Clinical Physics Resident – Department of Human Oncology, University of Wisconsin, Madison, USA.

2004-present Assistant Professor, Therapeutic Radiology, University of Minnesota. Faculty member - Biomedical Engineering, Biophysical Sciences and Medical Physics,

2008-present Associate Professor.

Board Certification American Board of Radiology, 2005

Honors, Awards and Service

1984 National Scholarship, India
1994 National Research and lectureship award (NET), India
1999 Lady Davis Fellowship, Israel

Teaching

Medical Physics Residents; Radiation Oncology Residents; Graduate students in Medical Physics; Radiation Therapy Technology students

B. Selected Five Peer-Reviewed Publications (in chronological order).

1. **Hui SK**, Das RK, Kapatoes J, Oliviera G, Becker S, Odau H, Fenwick JD, Patel R, Kuske R, Mehta M, Paliwal B, Mackie TR, Fowler JF, Welsh JS. Helical Tomotherapy as a Means of Delivering Accelerated Partial Breast Irradiation *Technology in Cancer Research and Treatment*, 2004; 3: 639-636.
2. **Hui SK**, Kapatoes J, Fowler J, Henderson D, Olivera G, Manon RR, Gerbi B, Mackie TR , Welsh JS. Feasibility Study of Helical Tomotherapy for Total Body or Total Marrow Irradiation. *Medical Physics 2005, 32 (10)*.
3. **Hui SK**, Verneris MR, Higgins P, Gerbi B, Weigel B, Baker S, Fraser C, Tomblyn M, Dusenbery K. Helical Tomotherapy Targeting Total Bone Marrow – First Clinical Experience at the University of Minnesota. Oncologica, 2007, vol 46, no 2, pgs 250-255.
4. **Hui, S.,** M. Verneris, J. Froelich, K. Dusenbery, and J. Welsh, *Targeted Marrow Irradiation: Conformality, Concerns, and Adaptive Process.* Submitted to Technology in Cancer Research and Treatment, 2008.
5. Varadhan, R., **S. Hui**, K. Nisi, and S. Way, *Assessing Prostate, Bladder and Rectal doses during Image Guided IMRT—Need for Plan Adaptation?* Submitted to the Journal of Applied Clinical Medical Physics, 2008.

C. Research Support

Active Grants

Grant# 1R03AR055333-01A1 (PI - Hui S K) 2007-2010 5%
NIH/NIAMS $150,000
Title: A Novel Long-Lived ^{41}Ca Marker To Assess Bone Turnover For Breast Cancer Patients Treated With Aromatase Inhibitor and Bisphosphonate Drug; Purpose: To study the pharmacokinetics (PK) and evaluate the clinical potential of a novel ^{41}Ca assay to monitor bone health for breast cancer patients.

Grant# 1-K12-HD055887-01 2008-2011 75%
(Building Interdisciplinary Research Careers in Women's Health grant - BIRCWH)
(PI- Hui S K, Mentors – Yee, D; Froelich, J; Mankoff, D) $300,000
Title: A Novel Long-Lived ^{41}Ca Marker To Assess Bone Turnover For Breast Cancer Patients Treated With Aromatase Inhibitor and Bisphosphonate Drug. Purpose: To study the pharmacokinetics (PK) and evaluate the clinical potential of a novel ^{41}Ca assay to monitor bone health for breast cancer.

Grant # NSF 0821474 (Co-PI- Hui S K, PI – Papanikolopoulos, N) 2008-2011 5%
NSF/Major Research Instrumentation $200,000
Title: MRI: Development of a Vision-based Real-Time Body Motion Tracking Instrument for Advanced Radiation Treatment
Purpose: the development of research instrumentation for use by these intra-organizational entities to solve real-world problems and also to educate physicians in this particular line of therapy systems.

Grant # Seed Grant (PI - Hui S K) 2007-2008 3% (unpaid)
Digital Technology Initiative Program $44,002
Title: An Optical Vision System for a Closed-loop Real-time Body Motion Tracking Instrument for Advanced Radiation Treatment. Purpose: Development of real-time body motion tracking system for precise total marrow irradiation treatment.

Grant # Seed Grant (Co-PI- Hui S K, PI – Verneris M) 2007-2008 3% (unpaid)
Agency: Brainstorm Awards $50,000
Title: Influence of Radiation Dose and Dose Rate on Injury to Malignant and Normal Bone Marrow Cells
Purpose: To investigate influence of radiation dose and dose rate on malignant and normal bone marrow cells.

Grant # Seed Grant (Co-PI: Hui S K, PI- N. Papanikolopoulos) 2007-2008 3% (unpaid)
The Medical Device Center $48,142
Title: Vision-Guided Helical Tomotherapy
Purpose: Development of real-time body motion tracking system for precise total marrow irradiation treatment using Tomotherapy.

Pending Grants

Grant # RSG LIB-116255 (PI - Hui S K, Co-I – Verneris, M) 2009-2013 20%
American Cancer Society Research Scholar Grant $933,636
Title: Assessment of Image Guided Total Marrow Irradiation for Dose Escalation followed by Double Umbilical Cord Transplantation for Patients with Refractory Acute Leukemia. Purpose: To

develop strategies to support dose escalation of radiation given during the conditioning regimen for patients with hematological malignancies to reduce relapse.

Significant synergistic activities:
Targeted Therapy

1. Development of Total marrow and lymphoid irradiation (TMI/TMLI)
   - (a) Anatomical Image-guided Conformal targeted radiation and conformal avoidance of critical organs
   - (b) MVCT Image Quality Enhancement
   - (c) Real time intra-fraction body motion tracking and its impact on targeted radiation therapy
2. Clinical Applications of targeted therapy research
   - (a) High risk and relapsed patients with hematological malignancies (leukemia, lymphoma); and
   - (b) solid tumor (Ewing Sarcoma, Neuroblastoma)

Future Targeted therapy

3. Adaptive Total marrow and lymphoid irradiation (TMI)
   - (a) Image guided dose reconstruction
   - (b) Deformable Image analysis
4. Molecular Image guided marrow and lymphoid irradiation (MIG-TMI)

Collaborators & Other Affiliations:
Subject: Total Marrow Irradiation
S. K. Hui, K. Dusenbery (Therapeutic Radiology), Michael R. Verneris (Pediatric Hematology/Oncology and Blood and Marrow Transplant)
Subject: Body Motion tracking
S. K. Hui (Therapeutic Radiology), Nikos Papanikolopoulos (Computer science and Electrical engineering); Industry – Motion Analysis Corporation, Santa Rosa, CA 95403

Graduate student: Raj Varadhan, Beth Lusczek, Chris Overbeck, Troy Dos Santos
Staff/Post doctorate: Manju Sharma, PhD; Louis Kidder, PhD

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel in the order listed on Form Page 2.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Yoichi Watanabe	Associate Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
University of Tokyo, Tokyo, JAPAN	B.S.	1978	Aerospace Engineering
University of Tsukuba, Ibaraki, JAPAN	M.S.	1980	Applied Physics
University of Wisconsin-Madison, WI	M.S.	1982	Nuclear Engineering
University of Wisconsin-Madison, WI	Ph.D.	1984	Nuclear Engineering
Memorial Sloan-Kettering Cancer Center, New		1997	Medical Physics training

<u>POSITIONS AND HONORS:</u>

EMPLOYMENT:

1984-1986	Research Associate University of Wisconsin Madison, Wisconsin
1987-1989	Assoc. Development Engineer University of California Los Angeles, California
1989-1994	Research Engineer University of Florida Gainesville, Florida
1994-1997	Research Fellow Memorial Sloan-Kettering Cancer Center New York, New York
1997-1998	Clinical Assistant Memorial Sloan-Kettering Cancer Center New York, New York
1998-2005	Assistant Professor Clinical Radiation Oncology Columbia University New York, New York
1998-2005	Assistant Professional Radiation Oncology New York Presbyterian Hospital New York, New York

2005-present Associate Professor
Therapeutic Radiology – Radiation Oncology
University of Minnesota
Minneapolis, Minnesota

PEER-REVIEWED PUBLICATIONS:

L.Anderson, F.W.Mick, K.Zabrouski and Y.Watanabe, “Photoelectrons facilitate autoradiography for 192Ir remote afterloaders,” Medical Physics, 1995; 22: 1759-1761.

Y.Watanabe, J.Monroe, S. Keshavmurthy, A.M.Jacobs, and E.T.Jacob, "Computational Methods for Shape Restoration of Buried Objects in Compton Backscatter Imaging," Nucl.Sci. and Engr., 1996; 122: 55-67.

Y.Watanabe and L.L.Anderson, “A non-radiographic technique for source localization in brachytherapy,” Medical Physics, 1997; 24: 2014-2023.

Y.Watanabe, J.Roy, P.Harrington, L.L.Anderson, "Experimental and Monte Carlo Dosimetry of Henschke Applicator for Ir-192 Remote Afterloading," Medical Physics, 1998; 25: 736-745.

Y.Watanabe, J.Roy, P.Harrington, L.L.Anderson, "Three-dimensional lookup tables for Henschke applicator cervix treatment by HDR Ir-192 remote afterloading," Int. J. Radiation Oncology, Biology, and Physics, 1998; 41: 1201-1207.

Y.Watanabe, "Derivation of attenuation coefficients from CT numbers for low energy photons," Physics in Medicine and Biology, 1999; 44(9): 2201-2211.

Y.Watanabe, "Point dose calculations by analytical pencil beam kernels for IMRT plan check," Physics in Medicine and Biology, 2001; 46(4): 1031-1038.

Y.Watanabe, G.M.Perera, R.B.Mooij, "Image distortion in MRI-based polymer gel dosimetry of Gamma Knife Stereotactic Radiosurgery Systems," Medical Physics, 2002: 29(5): 797-802.

Y. Watanabe*, G.M.Perera, R.Mooij, M.J.Maryanski, "Heterogeneity phantoms for visualization of 3D dose distributions by MRI-based polymer gel dosimetry," Medical Physics, 2004: 31(5):975-984.

Y.Watanabe*, G.N.Patel, and P.Patel, "Evaluation of a new Self-developing, Instant Film for Imaging & Dosimetry," Radiation Protection and Dosimetry, 2005, in press.

Y.Watanabe*, "Variable transformation of calibration equations for radiation dosimetry" Physics in Medicine and Biology, 2005; 50(6): 1221-1234

Y.Watanabe*, T.Akimitsu, Y.Hirokawa, R.B.Mooij, and G.M. Perera" Three-dimensional Evaluation of Dose delivery accuracy of Gamma Knife by Polymer gel dosimetry," Journal of Applied Clinical Medial Physics, 2005; 6(3):133-142.

Y.Watanabe*, G.N.Patel, and P.Patel, "Evaluation of a new Self-developing, Instant Film for Imaging & Dosimetry," Radiation Protection and Dosimetry, 2006; 120(1-4):121-124.

Y.Watanabe*, C.K.Lee, and B.J.Gerbi, “Geometrical accuracy of 3T MRI scanner used for Gamma Knife radiosurgery”, J. Neurosurgery (Suppl) 2006; 105(1): 190-193.

Y Murakami, T Nakashima, Y Watanabe*, T Akimitsu, K Matsuura, M Kenjo, Y Kaneyasu, K Wadasaki, Y Hirokawa, K Ito, “Evaluation of the basic properties of the BANGkit™ gel dosimeter”, Accepted for publication in Phys. Med. Biol., 2007.

RESEARCH SUPPORT:

RSNA Seed Grant 11/1/2000 - 10/31/2002
RSNA Research and Education Foundation $25,000
The goal of this project was to develop and evaluate heterogeneous phantoms with polymer gel dosimeter for three-dimensional dose measurements in heterogeneous media.

MMF Research Grant 1/1/2006 - 6/30/2007
Minnesota Medical Foundation $8,000
The goal of this project was to development of MRI pulse sequences optimized for polymer gel dosimetry.

Lihong Qin, Ph. D.

2228 Leyland Trail, Woodbury, MN 55125
E-mail: qinx0002@umn.edu, Phone: 612-467-4616

EDUCATION

Medical Physics Resident, Fox Chase Cancer Center, 2002 to 2004.

Postdoctoral fellow, University of Minnesota, 1994 to 1996.

Ph.D. in Physics, University of Minnesota, 1994.

M.S. in Physics, Central China Teachers University, Wuhan, China, 1985.

B.S. in Physics, Central China Teachers University, Wuhan, China, 1982.

EXPERIENCE

Assistant Professor, Therapeutic Radiology, University of Minnesota. July 2005– present.
Provide physics coverage for the Department of Radiation Oncology at VA Medical Center, MPLS, MN. Accepted and commissioned 2 VARIAN IX Machines with OBI and IGRT. Started IMRT and IGRT programs.

Medical Physicist, University of Pittsburgh Medical Center September 2004 – June 2005.
In charge of machine QAs and treatment planning systems and record verify system backup. Worked on commissioning for the ADAC planning system. Worked on planning, IMRT QA, MU check, weekly chart check and final chart check. Familiar with both eclipse and ADAC planning systems. Worked on prostate seed implants. Member on the McKeesport Hospital radiation safety committee

Medical Physics Resident / Research Associate, Fox Chase Cancer Center, 2002 – August 2004.
Chief Medical Physics Resident, Fox Chase Cancer Center, September, 2003 – July, 2004.

Schedule the IMRT QA and other clinical duty for 7 Physics Residents. Coordinate the teaching, research and clinical training for the medical physics program.

Studied Monte Carlo methods for modeling radiotherapy. Developed a multiple source model to commission the Siemens electron beams for Monte Carlo treatment planning. It has been implemented in a homegrown Monte Carlo treatment planning system in the clinic.

Simulated Siemens Primus linac treatment head using Monte Carlo methods for electron beam. Developed a software package to analyze the phase space data. The package was used in Monte Carlo Treatment Planning short courses. Studied the electron beam characteristics using phase space data.

Participated in developing new methods of treatments and planning. Studied MRI only based treatment planning for both prostate 3-D and IMRT. Also studied energy- and intensity-modulated electron radiation therapies.

Worked on the development of several automated Monte Carlo based treatment planning tools, including Monitor Unit checking for IMRT, beam commissioning for Monte Carlo treatment planning, and treatment optimization for inverse planning.

Applied Monte Carlo calculations to clinical IMRT cases. Compared MU from the Monte Carlo calculations with measurements and with CORVUS planning system calculations.

Participating in the clinical implementation of stereotactic conformal radiotherapy with dose hypo-fractionation for medical inoperable small lung tumors.

Taught short courses on Introduction to Monte Carlo Treatment Planning at Fox Chase Cancer Center.

Carried out many clinical duties:

- IMRT QA using film and ion chamber measurement as well as Monte Carlo calculation
- Weekly chart check
- Monthly machine QA
- Annual machine calibration
- Participated in the commissioning of 2 new Varian 21EX machines

Familiar with:

- CMS Focus and AcQPlan treatment planning systems
- IMPAC Record and Verify System
- CT/MRI image fusion and BAT
- CORVUS and Radionics IMRT treatment planning systems
- Dosimetry protocols (TG21/51)

Currently undergoing clinical rotation, topics including:

- HDR brachytherapy
- LDR brachytherapy
- External beam treatment planning
- IMRT treatment planning
- RT simulation and setup
- Stereotactic radiosurgery/radiotherapy
- Chart checking procedures
- Radiation protection and shielding design
- Radiation dosimeters (ionization chambers, TLDs, film)
- Special procedures (TBI, in vivo dosimetry, etc)

Award:

- Junior Medical Physicist Travel Grant, Delaware Valley Chapter, AAPM.
- Young investigators award, Delaware Valley Chapter, AAPM (2004)

Senior Software Engineer, VERITAS Software, 1998 – 2001.
Worked on the design, development, test and feature implement of the data storage software product. Administrated and supported databases from various database venders for different UNIX platforms and MS Windows. Worked closely with test engineering, technical publications and release management.

System Engineer, SENCOR, 1996 – 1998.
Developed a data storage system for client/server software for medical images storage. Designed Internet based workflow systems to streamline software maintenance activities.

Research Associate, University of Minnesota, 1994 – 1996.

Studied the scattering of light and thermal neutrons from a chemically reactive fluid. Calculated the scattering function using a modified simple reactive sphere model.

Developed a package in C to model thermal controlled egg pasteurization processes.

Research Assistant, University of Minnesota, 1989 – 1994.
Developed a kinetic theory for a simple, chemically reactive fluid mixture. Developed new algorithms to analyze nonequilibrium effects in gas phase reactions.

Modeled behavior of polymer solutions. Studied viscoelastic behavior of dilute solutions of polymer molecules. Studied orientational behavior of a monolayer of hard oblate spheroids within Onsager theory of Orientational ordering.

Teaching Assistant, University of Minnesota, 1987 – 1989.
Taught General Physics Laboratories and recitation for Physical Chemistry courses.

Instructor, Central China Teachers University, 1985 – 1985.
Taught courses in Atomic Physics, Nuclear Physics and Quantum Mechanics.

Research Assistant, Central China Teachers University, 1982 – 1984.

Studied physical mechanism of super-high energy heavy ion collisions. Analyzed the mechanism of hadron-hadron nondiffractive processes. Developed a phenomenological model to study the results of *proton-antiproton* collider (SPS) experiments.

PROFESSIONAL AFFILIATIONS

American Association of Physicists in Medicine (AAPM)

PUBLICATIONS

1. J Yang, J Li, R Price, L Chen, S McNeeley, L Qin,, L Wang C-M Ma, "Dosimetric verification of IMRT treatment planning using Monte Carlo simulations for prostate cancer" Phys. Med. Biol. 50, 869-878 (2005).

2. L Qin, L Chen, JS Li, RA Price, J Yang, W Xiong and C-M Ma, "Phase Space Analysis of Siemens Electron Beams for Monte Carlo Treatment Planning," Proc. XIV ICCR, Seoul, Korea (2004) pp 665-668.

3. L Qin, JS Li, RA Price, L Chen, S McNeeley, M Ding, E Fourkal, G Freedman and C-M Ma, "A Monte Carlo Based Treatment Optimization Tool for Modulated Electron Radiation Therapy," Proc. XIV ICCR, Seoul, Korea (2004) pp 527-530.

4. JS Li, J Yang, L Qin, W Xiong, L Chen and C-M Ma, "MCBEAM - A Monte Carlo Tool for Beam Simulation," Proc. XIV ICCR, Seoul, Korea (2004) pp541-544.

5. C-M Ma, JS Li, T Pawlicki, SB Jiang, J Deng, RA Price, L Chen, L Wang, E Fourkal, L Qin, J Yang and W Xiong, "MCSIM - A Monte Carlo Dose Calculation Tool for Radiation Therapy," Proc. XIV ICCR, Seoul, Korea (2004) pp 515-518.

6. L Chen, JS Li, RA Price, L Wang, S McNeeley, M Ding, L Qin, ZQ Chen and C-M Ma, "Investigation of MR-based Treatment Planning for Lung and Head & Neck using Monte Carlo Simulations," Proc. XIV ICCR, Seoul, Korea (2004) pp520-523.

7. C.-M. Ma, R. A. Price, J.S. Li, L. Chen, L. Wang, E. Fourkal, L. Qin and J. Yang, "Monitor Unit Calculation for Monte Carlo Treatment Planning," Phys. Med. Biol. 49, 1671-1687 (2004).

8. W Xiong, J Li, R A Price, G Freedman, M Ding, L Qin, J Yang, L Chen and C-M Ma, "Optimization of Combined Electron and Photon Beams for Breast Cancer," Phys. Med. Biol. 49, 1973-1989 (2004).

9. J Yang, J S Li, L Qin, W Xiong and C-M Ma, "Modeling of Electron Contamination in Clinical Photon Beams for Monte Carlo Treatment Planning," Phys. Med. Biol. 49, 2657-2573 (2004).

10. L Chen, R Price Jr., L Wang, J Li, L Qin, S McNeeley, C-M Ma, G Freedman, A Pollack, "MRI Based Treatment Planning for Radiotherapy: Dosimetric Verification for Prostate IMRT," Int. J. Radiat. Oncol. Biol. Phys., 636-647 (2004).

11. L Chen, RA Price, L Wang, L Qin, M Ding, JS Li, E Paralia, C-M Ma, A Pollack, "Dosimetric evaluation of MRI-based treatment planning for prostate cancer". Phys Med Biol. 5157-5170,(2004)

12. J. S. Dahler and L. Qin, "Nonequilibrium statistical mechanics of chemically reactive fluids," J. Chem. Phys. 118, 8396-8404 (2003)

13. C.M. Ma, R.A. Price, S. McNeeley, L. Chen, J.S. Li, L. Wang, M. Ding, E. Fourkal, L. Qin., "Clinical implementation and quality assurance for intensity modulated radiation therapy". In Standards and Codes of Practice in Medical Radiation Dosimetry, (IAEA, Vienna, 2003) IAEA-CN-96-120, 369-380.

14. L. Qin, J. S. Dahler, "The Kinetic Theory of a Simple, Chemically Reactive Fluid: Scattering Functions and Relaxation Processes," J. Chem Phys. 103, 725-750 (1995).

15. A. S. Cukrowski, J. Popielawski, L. Qin, J. S. Dahler, "A Simplified Theoretical Analysis of Non equilibrium Effects in Bimolecular Gas Phase Reactions," J. Chem. Phys. 97, 9086-9093 (1992).

16. H. Jorquera, L. Qin, J. S. Dahler, J. Lee, "Steady, Elongational Flow of Dilute Solutions of Once-bent, Once-broken and Deformable Rod Polymers," J. Chem. Phys. 93, 2116-2124 (1990).

17. J. Wesemann, L. Qin, P. Siders, "Orientational Ordering in a Monolayer of Hard Oblate Spheroids," Langmuir 5, 1358-1363 (1989).

18. L. Liu, L. Qin, P. Zhuang, "On the Stochastic Nature of Nondiffractive Processes, "Chin. Phys. Letter (China) 3, 13 (1986).

19. L. Liu, L. Qin, and P. Zhuang, "Multiplicity dependence of Rapidity Distributions and the Stochastic Nature of Nondiffractive Processes," Sci. Sin. Ser. A (China) 29, 1063 (1986).

20. L. Qin, J. Li, L. Liu, "Mean Multiplicity in Superhigh Energy Heavy Ion Collision," Scientific Bulletin (China) 30, 1471 (1985).

J A N E J O H N S O N , M . S .

OBJECTIVE

To provide optimal medical physics support by implementing my skills in treatment planning, dosimetry and quality management in radiation oncology and diagnostic radiology , while growing professionally through diverse clinical practice and continuing education.

EXPERIENCE

2004 – Present University of MN. Mpls., MN.

Medical Physicist

- QA for a Varian linac, GE CT Simulators, and associated equipment.
- 2-D, 3-D and IMRT/IGRT Treatment Planning on Phillips Pinnacle system.
- Impac Record and Verify.
- Diode Dosimetry.
- Educational Responsilibities for R.T.T. Students (Physics Rotation).
- Supervise the activities of one Dosimetrist.
- IntraOp Prostate Implants using I125 and Pd103 and Variseed Software.
- Ongoing Research and Publications.
- X-ray tube calibration (both mammo and non-mammo) as needed.

1991–2004 United Hosptial. St. Paul, MN.

Medical Physics

- QA for two Varian linacs, and one Ximatron Simulator.
- Brachytherapy programs for: GYN implants using Cs^{137}, Permanent Prostate Seed implants using I^{125} and Pd^{103}, and IVB using Sr^{90} & P^{32}.
- 2-D & 3-D Treatment Planning on ADAC Pinnacle, Eclipse and Prowess.
- IMRT Planning on Eclipse using Helios.
- TLD and Diode dosimetry.
- Multidata RTD film and water Scanning System.
- Radiation Safety Officer.
- Diagnostic Radiology (all modalities) responsibilities.

1984–1991 University of MN. Mpls., MN.

Medical Dosimetrist

- Simulated patients for treatment.
- Treatment planning/MU dose calculations.

- TLD dosimetry and mole room responsibilities.

1982–1984 University of MN. Mpls., MN.

Radiation Therapist

- Administered Radiation Therapy.
- Assisted in Simulations.

EDUCATION

1978–1982 University of MN. Mpls., MN.

- Associates of Art degree.
- Radiologic Technology Certification.

1982-1985 University of MN. Mpls., MN.

- Bachelor of Arts Degree.
- Radiation Therapist and C.M.D. Certifications.

1985-1993 University of MN. Mpls., MN.

- Masters Degree-Biophysical Sciences.

1985-1993 University of MN. Mpls., MN.

Masters Degree-Biophysical Sciences

2006-pending University of MN. Mpls., MN.

Ph.D.-Biophysical Sciences

- ABMP Certified with competence in Radiation Oncology.
- ABMP Certified with competence in Diagnostic Radiology.

PUBLICATIONS

Quality Control of Custom-Made Compensators. Medical Dosimeter; Vol. 31: 109-11. Presented AAMD annual meeting. 1988.

Quality Control of Custom Blocking. Medical Dosimetry; Vol 14: 199-202.

The Provision of a Constant Dose Rate with a Novel Afterloading Cylinder. Medical Dosimetry; Vol 16: 200-208. Presented AAMD annual meeting 1991.

Dosimetric Effects of Abutting 6MV Photons with 9MeV Extended SSD Electrons in the Treatment of Head and Neck

Cancers. Int J of Rad Onc Bio Phys; Vol 28, No 3: 741-747. Presented ASTRO annual meeting 1994.

Improved Dose Distribution with a Universal Acyrlic Breast Compensator. Medical Dosimetry; Vol 21, No 3; 127-132. Presented RSNA annual meeting 1995.

The Use of Tertiary Collimation for Spinal Irradiation with Extended SSD Electron Fields. Onc J of Rad Onc Bio Phys; Vol 37, No 5: 1187-1192.

Opposite Breast Dose from Tangential Fields: Comparison of Symmetric Jaws, Cerrobend Blocking, Multileaf Collimation, Machine Wedges and Dynamic Wedges. Medical Dosimetry; publication date pending. Presented RSNA annual meeting 1997.

Medial vs Lateral Electron Breast Fields: A Comparison of Their Effect on Dose to the Heart and Lung. Medical Dosimetry: publication date pending. Presented RSNA annual meeting 1998.

PROFESSIONAL AFFILIATIONS

American Association of Physicists in Medicine

REFERENCES

Available upon request.

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Curriculum Vitae
of
Kathryn E. Dusenbery, M.D.

University of Minnesota
Department of Therapeutic Radiology-Radiation Oncology
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Minneapolis, Minnesota 55455-0110
Rad Onc Clinic: 612.273.6700
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Education:

Michigan State University
East Lansing, Michigan, B.S. Physiology (1974 -1978)

Post Graduate Training:

Medical School:

Wayne State University School of Medicine
Detroit, Michigan, (1978 -1982)

Residencies:

Internal Medicine
Michigan State University
East Lansing, Michigan, (1982 - 1985)

Therapeutic Radiology-Radiation Oncology
University of Minnesota
Minneapolis, Minnesota (1987 -1990)
Chief Resident (1990)

Fellowship:

Medical Oncology
University of Minnesota Hospital and Clinic
Minneapolis, Minnesota (July 1985 - June 1987)

Honors:

Alpha Omega Alpha
Wayne State University School of Medicine (1981)

Specialty Boards:

American Board of Radiology
Therapeutic Radiology (1990)

American Board of Internal Medicine
Medical Oncology (1987)

American College of Physicians
Internal Medicine (1985)

American Board of Medical Examiners (1983)

Positions Held:

Head, Department of Therapeutic Radiology-Radiation Oncology
University of Minnesota (Oct. 2000 – present)

Interim Head, Department of Therapeutic Radiology-Radiation Oncology
University of Minnesota (May 1999 – Oct. 2000)

University of Minnesota Physicians Board of Directors (1996-2003)

University of Minnesota Physicians Budget & Finance Committee (1999-present)

Associate Professor
Department of Therapeutic Radiology-Radiation Oncology
University of Minnesota
Minneapolis, Minnesota (July 1996 - present)

Consultant Minneapolis/St. Paul VA Hospital (1997-present)

Senator, University of Minnesota
Minneapolis, Minnesota (1996-1998)

Finance & Planning Committee, Academic Health Center
University of Minnesota
Minneapolis, Minnesota (June 1998 – June 2005)

Director, Residency Training Program
Department of Therapeutic Radiology-Radiation Oncology
University of Minnesota
Minneapolis, Minnesota (September 1991 - June 1996)

Assistant Professor
Department of Therapeutic Radiology-Radiation Oncology
University of Minnesota
Minneapolis, Minnesota (July 1990 - June 1996)

Co-Medical Director Hospice Program
University of Minnesota Medical Center, Fairview
Minneapolis, Minnesota (March 1998 – April 2000)

Advisor To:

Douglas Gold	1999 – 2003	Medical Student
Shawn Iganej	1993 –1995	Medical Student

Paul James	1995 – 2001	Undergraduate Student
Mark Macedon	2002 – present	Medical Student
Shelly Marette	1996 – 1999	Medical Student
Christina Freschette	1996 - 1999	Medical Student
Matthew Solgin	1999 - 2000	Medical Student

Research Grants

1. 9608M11565 "Phase IB Study to Evaluate the Safety and Tolerance of Daily Intravenous Doses of RSR13 Administered to Patients Receiving Concurrent Radiation Therapy" 09/1996 to 10/1998. Kathryn E. Dusenbery, M.D., Principal Investigator. Industry Sponsored

2. 9602M10823 "Effectiveness of oral dolasetron mesylate (50 mg) versus prochlorperazine in the treatment of nausea and emesis due to fractionated abdominal radiotherapy"03/96 – 12/97. Kathryn E. Dusenbery, M.D., Principal Investigator. Industry Sponsored.

3. 0713-5773 "Reduction of Pneumonitis from Total Body Irradiation". 06/30/92 - 12/31/94. Kathryn E. Dusenbery, M.D., Principal Investigator.

4. 9012M03233 "Effects of Recombinant Erythropoietin on Anemic Cervical Cancer Patients Undergoing Radiation Therapy with or without Concurrent Weekly Low Dose Cisplatinum Chemotherapy" 1992. Kathryn E. Dusenbery, M.D., Principal Investigator. Industry Sponsored

5. "Use of RSR-13, an Allosteric Modifier of Oxygen Dissociation from Hemoglobin, as a Radiation Sensitizer" 1997. Kathryn E. Dusenbery, M.D., Co-investigator. Industry Sponsored.

6. 0402M56402 "A Phase III Randomized, Open-Label Comparative Study of Standard Whole Brain Radiation Therapy With Supplemental Oxygen, With or Without Concurrent RSR13 (efaproxiral), in women with Brain Metastases from Breast Cancer" 2/25/04 – current. Kathryn E. Dusenbery, M.D., Principal Investigator. Industry Sponsored

7. 20078737 "Initial Target Localization and Seed Migration using BiomarC Tissue Markers in Women with Cancer of the Uterine Cervix or Corpus."

Organizations/Committees

American Board of Radiology: Written and Oral Board Examiner
American Society of Therapeutic Radiology and Oncology
Center for Prostate Cancer Internal Advisory Board Member
Children's Oncology Group – Membership Committee
East Africa Medical Assistance Foundation Board Member (2007 – present)
Gynecologic Oncology Group – Radiation Oncology Committee

Gynecologic Oncology Group – Cervix Committee
Rein In Sarcoma Fund Board of Directors (2006 – present)
University of Minnesota Physicians Budget and Finance Committee (2000 – present)

Teaching:

Course Coordinator, Instructor, with Bruce Peterson, M.D.
Principles of Clinical Oncology
Offered for Year III and IV Medical Students
University of Minnesota (TRad 5-583)
Spring and Fall Quarters 1992 to present.

Clinical Instructor
Radiation Biology, "Principles of Chemotherapy"
University of Minnesota (TRad 5-172)
Spring Quarter 1988 to present.
Clinical Instructor
School of Radiation Therapy Technology
Department of Therapeutic Radiology
University of Minnesota 1988 to present

Attending physician for radiation therapy residents from Mayo Clinic who wish to gain experience in gynecologic brachytherapy. Each resident rotates with me for two months. Usually two residents rotate each year. 1991-present

Attending physician for fellows in Gynecologic Oncology and Pediatric Oncology. Each rotation is for one month and usually two fellows rotate each year. 1991-present.

The bulk of teaching is tutorial, teaching clinical duties, patient care, surgical and other procedures to radiation therapy residents, radiation therapy technology students, technicians and medical students. I also give formal lectures to the above students each year.

Publications:

1. **Dusenbery, K.E.,** Mendiola, J.R., Skubitz, K.M.: Evidence for Ecto-protein Kinase Activity on the Surface of Human Neutrophils. Biochemical Biophysical Research Communication 153:7-13, 1988.

2. **Dusenbery, K.E.,** Peterson, B.A., Bloomfield, C.D.: Chemotherapy with Cyclophosphamide, Vinblastine, Procarbazine and Prednisone (CVPP) for Hodgkin's Disease: Fourteen year follow-up results. American Journal of Hematology 28: 246-251, 1988.

3. Potish, R.A., **Dusenbery, K.E.**: Enteric Morbidity of Postoperative Pelvic External Beam and Brachytherapy for Uterine Cancer. International Journal of Radiation Oncology Biology and Physics 18: 1005-1010, 1990.

4. **Dusenbery, K.E.,** Carson, L.F., Potish, R.A.: Perioperative Morbidity and Mortality of Gynecologic Brachytherapy. Cancer 67: 2786-2790, 1991.

5. **Dusenbery, K.E.,** Alul, I.H., Holland, E.J., Khan, F.M., Levitt, S.H.: Irradiation of Recurrent Pterygia: Results and Complications. International Journal of Radiation Oncology, Biology and Physics 24(2): 315-320, 1992.

6. Cheng, E.Y., **Dusenbery, K.E.,** Thompson, R.C.: Soft Tissue Sarcomas: Preoperative versus postoperative radiotherapy. Journal of Bone and Joint Surgery, Orthopaedic Transactions 16(3): 731, 1992.

7. Kersey, J., Filipovich, A., McGlave, P., Woods, W., Weisdorf, D., **Dusenbery, K.E.,** Nesbit, M., Ramsay, N.: Donor and Host Influences in Bone Marrow Transplantation for Immunodeficiency Disease and Leukemia. Seminars in Hematology 30(4): 105-109 (Suppl 4), 1994.

8. **Dusenbery, K.E.,** McGuire, W.A., Holt, P.J., Carson, L.F., Fowler, Twiggs, L.B., Potish, R.A.: Erythropoietin Increases Hemoglobin During Radiation Therapy For Cervical Cancer. International Journal of Radiation Oncology Biology and Physics 29(5): 1079-1084, 1994.

9. **Dusenbery, K.E.,** Carlson, J.W., LaPorte, R.A., Unger, J.A., Goswitz, J.J., Roback, D.M., Fowler, J.M., Adcock, L.L., Potish, R.A.: Radical Vulvectomy With Postoperative Irradiation For Vulvar Cancer: Therapeutic Implications of a Central Block. International Journal of Radiation Oncology Biology and Physics 29(5): 989-998, 1994.

10. Weisdorf, D.J., Woods, W.G., Nesbit, M.E., Uckun, F., **Dusenbery, K.E.,** Kim, T., Haake, R., Thomas, W., Kersey, J.H., Ramsay, N.K.: Allogeneic Bone Marrow Transplantation for Acute Lymphoblastic Leukemia: Risk Factors and Clinical Outcome. British Journal of Haematology 86(1): 62-69, 1994.

11. **Dusenbery, K.E.,** Daniels, K.A., McClure, J.S., McGlave, P.B., Ramsay, N.K.C., Blazar, B.R. Neglia, J.P., Kersey, J.H., Woods, W.G.: Randomized Comparison of Cyclophosphamide-Total Body Irradiation Versus Busulfan-Cyclophosphamide Conditioning in Autologous Bone Marrow transplantation for Acute Myeloid Leukemia. International Journal of Radiation Oncology Biology and Physics 31(1): 119-128, 1995.

12. Carlson, J.W., Nazarian, G.K., Hartenbach, E., Carter, J.R., **Dusenbery, K.E.,** Fowler, J.M., Hunter, .W., Adcock, L.L., Twiggs, L.B., Carson, L.F.: Management of Pelvic Venous Stenosis with Intravascular Stainless Steel Stents. Gynecologic Oncology 56(3): 362-369, 1995.

13. Gerbi, B.J., **Dusenbery, K.E.**: Design Specifications for a Treatment Stand Used for Total Body Irradiation With Patients in a Standing Position. Medical Dosimetry 20(1): 25-30, 1995.

14. Weaver, R.D., Gerbi, B.J., **Dusenbery, K.E.**: Evaluation of Dose Variation During Total Skin Electron Irradiation Using Thermoluminescent Dosimeters. International Journal of Radiation Oncology Biology, Physics 33(2): 475-478, September 1995.

15. Peters, C., Balthazor, M., Shapiro, E.G., King, R.J., Kollman, C., Hegland, J.D., Henslee-Downey Trigg, M.E., Cowan, M.J., Sanders, J., Bunin, N., Weinstein, H., Lenarsky, C., Falk, P., Harris, R., Bowen, T., Williams, T.E., Grayson, G.H., Warkentin, P., Sender, L., Cool, V.A., Crittenden, M., Whitley, C.B., Packman, S., Kaplan, P., Lockman, L.A., Anderson, J., Krivit, W., **Dusenbery, K.E.,** Wagner, J.: Outcome of Unrelated Donor Bone Marrow Transplantation in Forty Children with Hurler's Syndrome. Blood 87(11): 4894-4902, June 1, 1996.

16. Woods, W.G., Kobrinsky, N., Buckley, J., Lee, J.W., Sanders, J., Neudorf, S., Gold, S., Barnard, D., DeSwarte, J., **Dusenbery, K.E.,** Kalousek, D., Arthur, D., Lange, B.J.: Timed-sequential Induction Therapy Improves Post-Remission Outcome in Acute Myeloid Leukemia (AML) Irrespective of the Use of Bone Marrow Transplantation. Blood 87(12): 4894-4902, June 15, 1996.

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18. Bhatia, S., Ramsay, N.K.C., Steinbuch, M., **Dusenbery, K.E.,** Shapiro, R.S., Weisdorf, D.J., Robison, L.L., Miller, J.S., Neglia, J.P.: Malignant Neoplasms Following Bone Marrow Transplantation. Blood 87(9): 3633-3639, May 1996.

19. Enright, H., Daniels, K., Arthur, D.C., **Dusenbery, K.E.,** Kersey, J.H., Kim, T., Miller, W.J., Ramsay, N.K., Vercellottie, G.M., Weisdorf, D.J., McGlave, P.B.: Related Donor Marrow Transplant for Chronic Myeloid Leukemia: Patient Characteristics Predictive of Outcome. Bone Marrow Transplantation 17(4): 537-542, 1996.

20. Cheng, E.Y., **Dusenbery, K.E.,** Winters, M.R., Thompson, R.C.: Soft Tissue Sarcomas: Preoperative Versus Postoperative Radiotherapy. Journal Surg Onc 61(2): 90-99, 1996.

21. Davies, S.M., Wagner, J.E., Shu, X.O., Blazar, B.R., Katsanis, E., Orchard, P.J., Kersey, J. H., **Dusenbery, K.E.,** Weisdorf, D.J., McGlave, P.B., Ramsay, M.K.C.: Unrelated Donor Bone Marrow Transplantation for Children with Acute Leukemia. Journal of Clinical Oncology 15(2): 557-565, 1997.

22. Peters, C., Shapiro, E.G., Balthazor, M., Henslee-Downey, P. J., Phillips, G., Klemperer, M.R., Saunders, F.E., Rozans, M., Morton, J.C., Harris, R., Kurtzberg, J., deAlarcon, P.A., Grayson, G.H., Williams, T.E., Nachman, J.B., Lenarsky, C., Twist, C., Cool, V.A., Crittenden, M., Clarke, J., Packman, S., Shapira, E., Whitley, C.B., Lockman, L.A., **Dusenbery, K.E.**, Anderson, J., Wagner, J., Krivit, W.: Outcome of HLA-Genotypically Identical and Phenotypically Identical Related Donor Bone

Marrow Transplantation in Fifty-Four Children with Hurler's Syndrome. Blood 91(7): 2601-2608, 1998.

23. Krivit, W., Shapiro, E.G., Peters, C., Wagner, J.E., Cornu, G., Kurtz berg, J., Wenger D.A., Kolodny, E.H., Vanier, M.T., Lord, D.J., **Dusenbery, K.E.,** Lockman L.A.: Hematropoietic stem-cell transplantation in globoid-cell leukodystrophy. New England Journal of Medicine 338: 1119-1126, 1998.

24. Weaver, R., Gerbi, B., **Dusenbery, K.E.**: Evaluation of Eye Shields Made From Tungsten and Aluminum in High Energy Electron Beams. International Journal of Radiation Oncology Biology Physics 41(1): 233-237, 1998.

25. Ghosh, K., **Dusenbery, K.E.,** Twiggs, L.: Cardiac Metastasis of Cloacagenic Carcinoma of the Vagina: A Case and Review of Gynecologic Malignancies with Cardiac Metastasis. Gynecologic Oncology 76(2): 208-212, 2000.

26. Thompson, R.C., Jr., Garg, A., Goswitz, J., Cheng, E.Y., Clohisy, D.R., **Dusenbery, K.E.**: Synovial Sarcoma. Large Size Predicts Poor Outcome. Clinical Orthopaedics & Related Research, 373:18-24, 2000.

27. MacMillan, M.L., Davies, S.M., Defor, T.T.E., Auerbach, A.D., Gillio, A. Giller, R., Harris, R., Cairo, M., **Dusenbery, K.E.,** Hirsch, B., Ramsay, N.K.C., Weisdorf, D.J., Wagner, J.E.: Hematopoietic Cell Transplantion in Patients With Fancomi Anemia Using Alternate Donors: Results of a TBI Dose Escalation Trial. Br Journal of Haemotology, 109(1): 121-129, 2000.

28. Krivit, W., Peters, C., **Dusenbery, K.E.**, Ben-Joseph, Y., Ramsay, N.K.C., Wagner, J.E., Anderson, R.: Wolman Disease Successfully Treated by Bone Marrow Transplantation. Bone Marrow Transplantation 26(5): 567-570, 2000.

29. Lickliter, J.D., McGlave, P.B., DeFor, T.E., Miller, J.S., Ramsay, N.K., Verfaillie, C.M., Burns, L.J., Wagner, J.E., Eastlund, T., **Dusenbery, K.E.**, Weisdorf, D.J.: Matched-Pair Analysis of Peripheral Blood Stem Cells Compared to Marrow for Allogeneic Transplantation. Bone Marrow Transplantation 26(7): 723-728, 2000.

30. Kavanagh, B.D., Khandelwal, S.R., Schmidt-Ullrich, R.K., Roberts, J.D., Shaw, E.G., Pearlman, A.D., Venitz, J., **Dusenbery, K.E.,** Abraham, D.J., Gerber, M.J.: A Phase I Study of RSR13, A Radiation-Enhancing Hemoglobin Modifier: Tolerance of Repeated Intravenous Doses and Correlation of Pharmacokinetics with Pharmacodynamics. International Journal of Radiation Oncology Biology Physics 49(4): 1133-1139, 2001.

31. Woods, W.G., Neudorf, S., Gold, S., Sanders, J., Buckley, J.D., Barnard, D.R., **Dusenbery, K.E.,** deSwarte, J., Arthur, D.C., Lange, B.J., Kobrinsky, N.: A Comparison of Allogeneic Bone Marrow Transplantation, Autologous Bone Marrow Transplantation and Aggressive Chemotherapy in Children with AML in Remission: A Report from the Children's Cancer Group. Blood 97(1): 56-62, 2001.

32. Ghosh, K., Padilla, L.A., Murray, K.P., Downs, L.S., Carson, L.F., **Dusenbery, K.E.**: Using a Belly Board Device to Reduce the Small Bowel Volume within Pelvic

Radiation Fields in Women with Postoperatively Treated Cervical Carcinoma. Gynecological Oncology 83(2): 271-275, 2001.

33. Jennings, M.T., Sposto, R., Vezina, G., Holmes, E., Berger, M.S., Bruggers, C.S., Bruner, J.M., Chan, K-W., **Dusenbery, K.E.**, Ettinger, L.J., Fitz, C.R., Lafond, D., Mandelbaum, D.E., Massey, V., McGuire, W., McNeely, L., Moulton, T., Pollack, I.F., Shen, V.: Preradiation Chemotherapy in Primary High Risk Brain Stem Tumors: CCG-9941, a Phase II Study of the Children's Cancer Group. Journal of Clinical Oncology 20(16): 3431-3437, 2002.

34. Downs, L.S., Ghosh, K., **Dusenbery, K.E.**, Cosin, J.A.: Stage IV Carcinoma of the Bartholin Gland Managed with Primary Chemoradiation. Gynecologic Oncology 76(2): 208-212, 2002.

35. Grewal, S.S., Krivit, W., Defor, T.E., Shapiro, E.G., Orchard, P.J., Abel, S.L., Lockman, L.A., Ziegler, R.S., **Dusenbery, K.E.**, Peters, C.: Outcome of Second Hematopoietic Cell Transplantation in Hurler Syndrome. Bone Marrow Transplantation 29: 491-496, 2002.

36. Lo, S.S., Cho, K.H., Hall, W.A., Kossow, R.J., Hernandez, W.L., McCollow, K.K., Gerbi, B.J., Higgins, P.D., Lee, C.K.K., **Dusenbery, K.E.**: Single Dose Versus Fractionated Stereotactic Radiotherapy for Meningiomas. Canadian Journal of Neurological Sciences 29: 240-248, 2002.

37. Gold, D., Neglia, J., **Dusenbery, K.E.**: Second Neoplasms after Megavoltage Radiation for Pediatric Tumors. Cancer, 97/10: 2588-2596, 2003.

38. **Dusenbery, K.E.,** Howells, W.B., Arthur, D.C., Alonzo, T., Lee, J.W., Kobrinsky, N., Barnard, D.R., Wells, R.J., Buckley, J.D., Lange, B.J., Woods, W.G.: The Role of Radiation Therapy In The Management Of Granulocytic Sarcomas (Chloromas) In Pediatric Patients With Newly Diagnosed Acute Myeloid Leukemia. Journal of Pediatric Hematology Oncology, 2003.

39. Lo, S., Hall, W.A., Cho, K.H., Orner, J., Lee, C.K., **Dusenbery, K.E.**: Radiation Dose Response for Supratentorial Low-Grade Glioma-Institutional Experience and Literature Review. Journal of Neurological Sciences, 43/8: 214(1-2), 2003.

40. Gold, D., Neglia, J.P., Potish, R.A., **Dusenbery, K.E.**: The Development of Subsequent Neoplasms Following Megavoltage Radiation Therapy for Benign Pediatric Disease. Cancer, 2003.

41. Higgins, P.D., Alaei, P., Gerbi, B., **Dusenbery, K.E.:** In Vivo Diode Dosimetry for Routine Quality Assurance in IMRT. Medical Physics, 30: 3118-3123, 2003.

42. Higgins, P.D., Alaei, P., Gerbi, B.J., **Dusenbery, K.E**.: Response to "Comment on '*In vivo* dosimetry for routine quality assurance in IMRT' ". Medical Physics, 30: 1642-1643, 2004

43. Peters, C., Charnas, L.R., Lockman, L.A., Shapiro, E.G., Ziegler, R., Tan, Y., DeFor, T., Grewal, S.S., Abel, S.L., Ramsay, N.K.C., **Dusenbery, K.E**., Goldman, A.I.,

Loes, D.J., Aubourg, P.R., Kato, S., Moser, H.W., Krivit, W.: Cerebral X-Linked ALD: The International Hematopoietic Cell Transplantation Experience from 1982 to 1999. Blood, 104/3: 881-888, 2004.

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