University of Louisville Radiation Oncology Physics Residency Training Program

James Graham Brown Cancer Center, University of Louisville Hospital, Louisville, Kentucky

Self-Study Review – August 2008

A Program Overview:

A1 Program Objective:

The Residency Training Program in Radiation Oncology Physics at the University of Louisville (hereafter referred to as the Residency Program) is a two year comprehensive post-graduate curriculum designed to train residents in physics to provide clinical physics services in radiation oncology. The residency program is designed to comply with guidelines recommended by the Commission on Accreditation of Medical Physics Education Programs, Inc. (CAMPEP) and the American Association of Physicists in Medicine (AAPM) and published as AAPM Report No. 90 (2006). Acceptance into the program requires that the individual has successfully completed a Masters or Doctorate degree in medical physics, physics or a closely related field of study. The program is designed to accept (1) graduates of CAMPEP-accredited medical physics educational programs or (2) graduates of other programs in medical physics, physics, or physics-related areas. Medical physics didactic training may be required of graduates of other physics or related programs. The program is two years in length regardless of whether the resident is a graduate of a CAMPEP accredited M.S. or Ph.D. education program. The first year of residency is, primarily, routine procedure radiation oncology physics, including the basics of room design, machine acceptance and commissioning, treatment planning computer acceptance and commissioning, monitor unit calculations, 3-D treatment planning and low dose brachytherapy. During the second year, the resident will be trained in special procedures including prostate brachytherapy, HDR brachytherapy, total body photons, total skin electrons, radiopharmaceutical therapy, interstitial and intracavitary brachytherapy, stereotactic radiosurgery and fractionated radiotherapy, intraoperative radiotherapy, intensity modulated radiotherapy, image guided radiotherapy and respiratory gated radiotherapy. The program was designed to stagger the two resident positions and contain a junior and senior resident each year. The program was accredited by CAMPEP in 2003 and is scheduled for a 5 year review in 2008. This program is intended to provide clinical training and education in the medical physics subspecialty Radiation Oncology Physics by providing a structured, comprehensive educational experience in a clinical environment. At the conclusion of the program, the resident is competent in radiation oncology physics practice, medical physics knowledge, presentation skills, communication skills, and process improvement. In addition, the program is designed to prepare physics residents for peer examination and certification by the American Board of Radiology (ABR) in Therapeutic Radiological Physics. The resident must complete a two-year training program and be recommended by the Program Director to sit for ABR certification. This program is under the

direction of Michael D. Mills, Ph.D., MSPH, CRP, an Associate Professor at the University of Louisville and Chief of Medical Physics at the Brown Cancer Center, Louisville, Kentucky.

A2 Organizational Structure:

The Residency Training Program in Radiation Oncology Physics exists within the Department of Radiation Oncology in the School of Medicine of the University of Louisville. It is a companion to the Radiation Oncology Training Program under the direction of William J. Spanos Jr., M.D. Currently the Radiation Oncology Training Program is approved for six positions. An American Registry of Radiologic Technology accredited program in Radiotherapy Technology under the direction of Mellonie Brown, BS, R.T.(R)(T) CMD is training nine individuals in Radiotherapy Technology each year. The University of Louisville Hospital acts as a Clinical Training site for the JRCERT-accredited educational program in Medical Dosimetry directed by the University of Wisconsin – Lacrosse. One trainee-dosimetrist is currently completing this program within the Department of Radiation Oncology. A CAMPEP accredited graduate education program in Medical Physics is offered at a sister state institution, the University of Kentucky. It operates under the direction of Ralph C. Christensen, Ph.D., and offers masters and doctoral level training in Medical Physics.

The Section of Physics operates under the Department of Radiation Oncology, School of Medicine of the University of Louisville. Members of the Section of Physics include the Chief of Physics, three additional faculty physics positions, one radiobiology faculty position, two staff physics positions, two resident positions (funding is in place for both), one physics assistant, six dosimetry positions, one dosimetry training position, three engineers, and one secretary. **An organizational chart is supplied and may be found as Attachment 1.** Faculty and staff from the University of Louisville provide services for the University of Louisville Hospital and Brown Cancer Center by contract. The University of Louisville Hospital, under the terms of this contract, grants access to radiation oncology equipment to radiation oncology physics residents and radiation oncology residents.

A candidate gains admission to the program by responding to advertisement in the AAPM Placement Bulletin followed by selection for a personal interview. A six-person Physics Residency Committee (PRC) consists of the Program Director (PRC Chairman), the Department Chairman, one faculty, and one staff medical physicist, one medical dosimetrist and one radiation biologist. PRC members are appointed by the Chairman of Radiation Oncology. The PRC manages all aspects of the Residency Training Program in Radiation Oncology Physics, including the selection of candidates for interview. The faculty and staff medical physicists, physicians and a radiobiologist rank the applicants during the interview process. Primary clinical training and teaching in the

program is divided among faculty (three PhD and one MS level radiation oncology physicists, all with specialty board certification, and one PhD radiation biologist) and staff (two M.S. level medical physicists, one with specialty board certification and one in process to attain certification). In addition, 6 faculty physicians, 6 dosimetrists, 3 engineers, and 1 physics assistant contribute to the clinical training process. Certificates are awarded by the University of Louisville, School of Medicine, and signed by the President of the University, Dean of the Medical School, the Department Chairman and the Program Director upon completion of the program and the recommendation of the Program Director and the Department Chairman.

All of the clinical training will take place within the James Brown Cancer Center and the University of Louisville Hospital, although some procedure observation may take place at Norton Healthcare, Jewish Hospital, the James Brown Cancer Center at Taylor Regional Hospital, Floyd Memorial Hospital and/or other area healthcare facilities. Other than providing for observation of procedures, these facilities will have no role in the residency program. All equipment associated with this program is contained within the physical plant of the James Brown Cancer Center and the University of Louisville Hospital. **A map of the University of Louisville Medical Center is found as Attachment 2**. The University of Louisville Hospital provides funds for the ongoing support for the physics residency program, and strongly supports the program as **evidenced by the statements in Attachment 3**.

Program review will consist of an internal and external program review. The external review will be performed by CAMPEP. The internal review procedure is as follows: A faculty radiation oncologist of the University of Louisville will chair an Internal Review Committee (IRC) in the fifth year of the program, and every fifth year, thereafter. The IRC Chairman will select members of the Internal Review Committee. Committee members may include members of the Radiation Safety Committee, University of Louisville faculty, current or former radiation oncology physics residents, and current or former radiation oncology residents. Members of the PRC are excluded from membership, except that one member may serve as liaison. The IRC will review current CAMPEP guidelines, AAPM Task Group reports and a sample audit of another training program, if available. The IRC will conduct interviews of current and former residents, the Department Chairman, Clinical Director for Radiation Oncology, the PRC Chairman, the Radiation Oncology Program Training Director, and others deemed appropriate for interview. The findings of these interviews along with a review of current guidelines will make up the bulk of the Internal Review Audit. The Audit will consist of these findings: Review Procedure, Survey of Educational Experience of the Faculty and Staff, Clinical Resources, Educational Program Overview, Internal Audit Findings, and Recommendations for Improvement. This Audit report will be made available to the CAMPEP External Review Committee.

A3 History of Program Development:

The Residency Training Program in Radiation Oncology Physics was established at the Brown Cancer Center, University of Louisville, in 1993 by Peter R. Almond, Ph.D., former Chief of Physics and Vice-Chairman for Research, Department of Radiation Oncology of the University of Louisville. The residency program emerged as postdoctoral students needed structured clinical training as part of their overall educational experience. Graduates of the program include Zhigang Xu, Ph.D. (1995), Hui Li, Ph.D. (1995), Gennady Neyman, Ph.D. (1998), Jodi Daves, M.S., (2002), Albert Zacarias, Ph.D. (2003), Joni Funseth, M.S. (2005), YH Zhang, Ph.D. (2006), Eric Nelson Ph.D. (2007), and John Hegseth Ph.D. (2008). Dr. Xu, Dr. Li, Dr. Neyman, Ms. Daves, Dr. Zacarias and Dr. Zhang have acquired specialty board certification. Ms. Funseth and Dr. Nelson began the certification process in 2006 and 2007, respectively. All of the residents above successfully completed each part of the ABR examination process without failure, with the sole exception of Ms. Funseth, who failed to successfully complete Part II Written in 2006. An administrative error in the 2007 exam occurred, so the ABR did not grade her examination that year. In 2008, she was unable to sit for the Part II written exam due to poor health. We are hopeful she will be able to sit for the written part II exam in 2009. Although numerous post-doctoral and post-masters students have been trained at the Brown Cancer Center, the nine mentioned above were the only ones to have graduated from a registered residency program in Radiation Oncology Physics under the administration of the Department of Radiation Oncology, School of Medicine, University of Louisville. **Attachment 3 contains letters from senior administrative heads and leaders regarding the commitment of the University of Louisville to the Physics Residency Program. This list of graduates is summarized in Attachment 4. The training certificates are reproduced in Attachment 6.**

B Training Requirements:

B1 Program Completion Requirements

The minimum program length is two years and includes four continuous semesters: Fall and Spring. Each resident will complete the four didactic courses and the clinical rotations during the 24-month program as described below.

Didactic Courses

The resident will complete four semester-long didactic courses of study: Stanford Dosimetry Training Tool, Basic Radiation Oncology Physics, Core Curriculum and Radiation Biology. Additional readings may be assigned in Advanced Radiation Oncology Physics, according to the background and needs of the student. The course instructor will assign readings and tests. Radiation Biology, Core Curriculum and Basic Radiation Oncology Physics will be the same course as taught to medical residents. Written and/or oral examinations are

required for each of the physics courses and may be required for the medical resident courses. Core Curriculum is a primary component of the Physician Radiation Oncology Residency Program at the University of Louisville. It consists of faculty physician lectures by disease type and site: Skin, CNS, Head & Neck, Thoracic, Breast, GI, Urinary Tract, Male GU, GYN, Adrenal, Lymphoma, Sarcoma, Pediatric, Benign and Palliative diseases are discussed. The residents record their participation in the Typhon Group System. For this course, no tests are given either for Radiation Oncology Residents or for Therapy Physics Residents. In addition, the resident is expected to complete short courses in imaging and nuclear medicine physics, medical statistics, radiation physics review and radiation biology review, as scheduled. The Imaging and Nuclear Medicine course is 20 hours in length and will contain a written final examination.

Clinical Physics Rotations

Additionally, the resident will complete four semester-long clinical rotations. The Program Director will assign a grade and complete an evaluation for each clinical rotation. Passing grades in all courses and rotations are required for the resident to complete the residency program and to be awarded the training certificate. Competency Categories covered in the four semester-long clinical rotations are:

1 External Beam Treatment Planning and Verification
2 Brachytherapy Treatment Planning and Verification
3 Room Shielding Design
4 Quality Assurance – Daily and Monthly
5 Annual Calibration – Clinical Equipment
6 TBI Photons and TSE Electrons
7 Intraoperative Electrons
8 Stereotactic Cranial and Body Irradiation
9 IMRT / IGRT
10 Respiratory Gating
11 HDR / LDR Brachytherapy Special Procedures
12 Administrative and Professional Duties

Oral Examinations

Oral examinations of residents are required annually, based on the American Board of Radiology Oral Examination. Questions may pertain to material covered in coursework, competencies or assigned self-study.

Additional Requirements

The resident is expected to participate in the teaching effort in the Department of Radiation Oncology. Teaching opportunities include lectures/mentoring of radiation oncology residents, dosimetry trainees, and RTT students. The resident is expected to participate in journal club and present at a minimum 2 article reviews per

year. The competency list includes attendance at assigned conferences; attendance must be reported. Failure to attend a minimum number of conferences will result in the resident being placed on probation.

B2 Design and Content

Training essentials are designed generally to be consistent with the recommendations of the AAPM Report Number 90 (2006), "Essentials and Guidelines for Hospital-Based Medical Physics Residency Training Programs." Residents will complete four semester-long courses of instruction. These include courses in The Stanford Dosimetry Training Tool, Radiation Oncology Physics, Radiation Biology, and Core Curriculum Lectures. No tests are given for the core curriculum lectures, but attendance is mandatory. The resident must complete the examinations (midterm and final) with passing grades in each course. In the event of test failure, remedial studies will be assigned and the resident will be reexamined. The primary instructor of each semester-long course assigns a letter grade to the resident for each course of study. This letter grade becomes a part of the resident's permanent record. In addition, the resident is expected to complete short courses in imaging and nuclear medicine physics, medical statistics and radiation biology, as scheduled.

Equipment at the James Graham Brown Cancer Center includes a TomoTherapy Unit, four Varian Linear Accelerators, including one Trilogy with energies 4, 6, 10, and 18 MV photons, and 6, 9, 12, 16, and 20 MeV electrons, one Philips Brilliance CT-Simulator, one Varian Acuity Simulator, Four Varian Eclipse Workstations, three CMS Workstations, an Aria information management system, an Intra-Op Mobetron, one Varian HDR Unit, and an array of LDR brachytherapy sources. Physics equipment includes an IBA 3-D beam scanner, five Farmer chambers / electrometers, Unfors diagnostic instruments, and a variety of test phantoms.

The Residency Training Program in Radiation Oncology Physics shall include clinical training in a) machine acceptance, calibration and commissioning, b) treatment planning computer commissioning and data entry, c) patient and virtual simulation, 3-D treatment planning and dosimetry, d) brachytherapy, HDR and therapeutic nuclear medicine e) radiation oncology special procedures including Total Skin Irradiation, Total Body Irradiation, Stereotactic Radiosurgery, Body Stereotactic Radiotherapy, Intensity Modulated Radiotherapy, Image Guided Radiotherapy, Respiratory Gating and Intraoperative Radiotherapy, f) quality assurance, g) principles of imaging, h) radiation biology, i) human and tumor physiology, j) radiation protection, licensing and room design, k) radiation measurement by ionization chamber, TLD, diodes, film and other dosimeters, and l) administrative training. Residents in the program are assigned on a rotating basis during the first year to the following areas of radiation oncology physics service: machine commissioning, treatment planning commissioning and data entry, treatment planning, simulation and virtual simulation, special treatment device

fabrication, patient treatment, and quality assurance. During the second year, additional requirements include patient chart checks and reviews, and a twenty hour assignment in the University of Louisville Radiation Safety Office. At the end of each year, an oral examination is given to the resident modeled on the American Board of Radiology oral examination in Therapeutic Radiological Physics. Completion of the residency program is dependent on successful completion of the oral examinations at the end of each year of residency. The questions given at the end of the first year are designed to reflect the didactic material covered during the first year of residency. Many questions are drawn from material presented in the Dosimetry Training Tool; others come from the Khan and Hall textbooks. The questions at the end of the second year are designed to mimic the ABR oral as closely as possible. All questions from both examinations are similar to questions found on the ABR oral exam. Figures and questions are presented in PowerPoint format with the resident providing oral responses. During the first year, residents will complete two semester (six month) rotations. These rotations include instruction in a) Room Design & Radiation Safety, Machine Acceptance, Calibration, Commissioning and Quality Assurance, b) Treatment Planning Computer Algorithms, Commissioning, Data Entry and Quality Assurance, IMRT and IGRT planning and Delivery Quality Assurance, c) Patient Simulation, Patient Virtual Simulation, Simulator and CT Quality Assurance, Device Fabrication, and d) 3-D Treatment Planning and in-vivo Dosimetry Measurements. During the first year, the physics resident will learn the basics of dosimetry measurement by ion chamber, Thermoluminescent Dosimetry, diode measurements, and film dosimetry. During the second year, residents will complete two semester (six month) rotations. These rotations include a) Brachytherapy, High Dose Rate Brachytherapy, Prostate Brachytherapy, Therapeutic Nuclear Medicine and Endovascular Brachytherapy, b) 3-D Treatment Planning and Dosimetry Measurements, including Commissioning, and Daily Localization and Image Guidance for IMRT/IGRT, c) External Beam Special Procedures Including Total Body Irradiation, Total Skin Electron Treatments, Intra-Operative Radiation Therapy, Stereotactic Radiosurgery, Respiratory Gating, and d) Diagnostic Equipment, Operational Radiation Oncology Physics, including Information Management, Radiation Safety Officer Responsibilities, Administration, Budgets, Staffing, Space, Professional Responsibilities and Board Preparation.

The resident will be assigned a Physics Rotation Mentor and a Physician Rotation Mentor during each of the four semester rotations. The Physician Rotation Mentor will interact with physics residents so residents can understand the indications, risks, benefits, and side effects of selected treatments for patients. The Rotation Mentors will be responsible to assure the completion of the list of tasks assigned for the rotation. The Rotation Mentors will report a grade evaluation of the resident's performance during each rotation to the program director. This rotation grade along with grade scores from each of the courses of instruction will become part of the resident's permanent record. The Physics Resident is required to report a Rotation Task List Record for

each rotation. Each task or competency must be completed by the resident and signed off by the Program Director before the task is considered complete. At the University of Louisville, this record is kept in the database of the Typhon Group Allied Health Student Tracking software. As part of the Rotation Task List Record, the Physics Resident is required to keep a Training Checklist for Clinical Equipment Operated by Residents in Radiation Oncology (located at the end of the first semester checklist and under the Annual Calibration Section of the Typhon Software). The Program Director will be responsible to assure a Physics Resident is qualified to operate the equipment properly and safely. The Rotation Task List Record and the Training Checklist for Clinical Equipment Operated by Residents in Radiation Oncology becomes part of the Permanent Record of the Physics Resident.

Generally the Competency Categories are scheduled for completion according to the following schedule:

Competency Category	Semester
13 External Beam Treatment Planning and Verification	Fall, Year 1
14 Brachytherapy Treatment Planning and Verification	Fall, Year 1
15 Room Shielding Design	Spring, Year 1
16 Quality Assurance – Daily and Monthly	Spring, Year 1
17 Annual Calibration – Clinical Equipment	Spring, Year 1
18 TBI Photons and TSE Electrons	Spring, Year 2
19 Intraoperative Electrons	Fall, Year 1
20 Stereotactic Cranial and Body Irradiation	Spring, Year 2
21 IMRT / IGRT	Fall, Year 2
22 Respiratory Gating	Fall, Year 2
23 HDR / LDR Brachytherapy Special Procedures	Fall, Year 2
24 Administrative and Professional Duties	Spring, Year 2

However, there is some limited overlap respecting when the competencies may be completed. If we have equipment to commission, if there is an unusual patient presentation, or if there are special tasks assigned to

faculty or staff requiring resident assistance, some competencies may be completed early. Approval of all competencies is at the discretion of the program director. Additional regularly scheduled seminars include a) treatment technique review conference (weekly), b) multi-modality conference (includes medical oncology and surgery, weekly), and c) core curriculum with radiation oncology residents (weekly). Other regularly scheduled conferences include a) physics staff (monthly), b) radiation oncology journal club (monthly, one or more physics articles presented each month), and morbidity and mortality conference (monthly). Registered participation for a number of sessions in each of these activities is required for program completion. The program director will evaluate and determine satisfactory participation respecting attendance at conferences. Attendance at all conferences is recorded in the Typhon Group Software tool. Residents are expected to attend conference at least 80% of the time. All conferences are logged in the Typhon Group Software as part of the resident's permanent record. The program director is made aware if a resident misses a conference for any reason; sickness, vacation, conflicting assignment, etc. Information recorded includes the date and title of the conference, the speaker and the topics covered in the conference. The Program Director validates the attendance record of residents in the conferences.

Residents will be encouraged to attend local medical physics meetings associated with the Ohio River Valley Chapter of the AAPM. In addition, funds will be allocated to allow each resident to attend at least one annual meeting of the American Association of Physicists in Medicine (AAPM). Student presentations at regional or annual meetings are encouraged not required as part of the residency program. The residency program as designed does not require a research component, however if a student has made substantial progress completing required competencies, a research project may optionally be assigned during the final semester of the residency program. The resident will be assigned teaching duties for courses in physics offered to medical residents, medical dosimetry students, and to technologists-in-training within the RTT program. Lectures may include resident seminars, instruction in radiation protection and safety, as well as topics in radiation physics, beam measurement and calibration, treatment planning, brachytherapy and special procedures. Participation in teaching activities will be at the discretion of the program director. The program director will evaluate the quality of teaching effectiveness and will assign a letter grade based on consensus evaluation of the lectures. This grade will become part of the resident's permanent record. Residents are trained to perform the Continuing Medical Physics Consultation for patients under treatment at the end of the first year in residency. Additionally, residents are given increased responsibility for planning approval, delivery quality assurance and lectures for our various training programs during the second year. Treatment approval and final chart review responsibilities remain with senior faculty and staff. Physics Residents receive the same stipend as that of first or second year medical residents (PGY-1 and PGY-2). In addition, benefits, vacation, meeting allowance, book

allowance, and other aspects of the Physics Residency Program are modeled similar to the Radiation Oncology Residency Program at the University of Louisville. The graduate shall be given a certificate upon completion of the program with passing grades for all courses of study and all clinical rotations and teaching activities. The certificate will state the individual has completed a residency in Radiation Oncology Physics, the time interval spent in the program, a notice that it is accredited by CAMPEP, and will contain signatures of the President, University of Louisville, Dean, School of Medicine, University of Louisville; Chairman, Department of Radiation Oncology; and the Physics Residency Program Director.

The length of the program will be twenty-four months for any individual admitted to the training program. For residents entering who have not graduated from an accredited medical physics graduate education program, the didactic training must be provided and successfully completed within the 2-year time period and must not interfere with the clinical training provided. **A sample training plan and clinical physics rotation schedule is found in Attachment 5.**

B3 Sample Training Plan

Sample Training Plan

Physics Residency Program in Radiation Oncology

Semester	Rotation	Mentors	Coursework	Instructor
Fall Semester Year 1	Orientation, Room design, radiation safety, machine acceptance, calibration, commissioning and quality assurance Treatment planning computer algorithms, commissioning, data entry and QA	Albert Zacarias, Ph.D. John Bechtel, M.D. Betty Achino, CMD John Gavin, CMD Judy Turner, CMD	Stanford Dosimetry Training Tool	Michael Mills, Ph.D. and Physics Faculty
Spring Semester Year 2	Patient simulation, patient virtual simulation, simulator and CT quality assurance, device fabrication, two-dimensional treatment planning and in-vivo dosimetry measurements Brachytherapy, high dose rate brachytherapy, prostate brachytherapy, and therapeutic nuclear medicine	Albert Zacarias, Ph.D. M. El-Ghamry, M.D. John Bechtel, M.D. Joshua James, M.S. David Wilson, M.S.	Radiation Physics	Michael Mills, Ph.D. and Physics Faculty
Fall Semester Year 2	IMRT/IGRT treatment planning and dosimetry measurements TBI, TSE, IORT, Stereotactic Radiosurgery, Stereotactic Body Radiotherapy, Respiratory Gating	Tim Guan, Ph.D. Michael Mills, Ph.D. Craig Silverman, MD Dave Wilson, M.S. Keith Sowards, M.S.	Core Curriculum	William J. Spanos, M.D. and Physician Faculty
Spring Semester Year 2	Diagnostic equipment, information management, RSO responsibilities, administration, budgets, staffing, space,	Michael Mills, Ph.D. Tim Guan, Ph.D. William Spanos, M.D.	Radiation Biology	Wayne Zundel, Ph.D.

	professional responsibilities, board preparation	Keith Sowards, M.S. Joel Handley, M.S.		

The following are the components of the residency program:

1 Orientation

2 CPR Training and TB test

3 Completion of course work and passing scores on all tests: Dosimetry Training Tool, Radiation Physics, Radiation Biology and Core Curriculum

4 Completion of additional didactic course work as assigned: Imaging and Nuclear Medicine Physics, Statistics, Radiobiology Review and Physics Review

5 Additional regularly scheduled seminars include a) anatomy and technique review conference (weekly), and b) multi-modality conference (includes medical oncology and surgery, weekly). Other regularly scheduled conferences include a) physics staff (monthly), b) radiation oncology journal club (monthly, one or more physics articles presented each month), and morbidity and mortality conference (monthly).

6 Radiation Safety Rotation (20 hours)

7 Semester Long Clinical Physics Rotations

8 Presentations/lectures for RTT students, Dosimetry trainees, Radiation Oncology Residents and Physics Staff

9 Optional research project based on resident's performance in the program

10 RAPHEX examination and Annual Oral Examinations

B4 Training Administration

A six-person Physics Residency Committee (PRC) consists of the Program Director (PRC Chairman), the Department Chairman, one faculty, one staff medical physicist, one medical dosimetrist and one radiation biologist. The PRC manages all aspects of the Residency Training Program in Radiation Oncology Physics, including the creation and modification of training objectives. Any PRC member may propose changes to the curriculum or training objectives. A majority vote by the PRC confirms the change. During each of four rotations, the physics resident will be assigned a list of tasks and duties under the direction of a Physics Rotation Mentor. The Physics Rotation Mentor will vary depending on the area of training. The Program Director will evaluate the performance of a resident by seeking input from all individuals that mentored the resident during the semester and assign a letter grade. The resident will be evaluated in the following categories: 1) timeliness in the performance of assigned duties, 2) quality of work, 3) completeness of tasks

assigned, 4) mastery of material associated with program objectives, and 5) overall letter grade. All grades will be reported to the Program Director. The resident will also assess the rotation by completing a rotation evaluation form and an evaluation form for each mentor at the end of the rotation. These forms will assess the resident's response to the rotation in several categories: 1) quality of mentoring, 2) availability of mentors, 3) reasonableness of assigned tasks, 4) appropriateness of tasks, and 5) overall impression of the rotation. The forms are provided to the Department Chair to be used in the annual evaluation of each faculty and staff member. A Physician Rotation Mentor will also have input into the assessment of resident performance during the rotation. **Sample review forms for the Mentor, Resident and Rotation are attached as Appendix XX.**

C Physics Residents

C1 Admissions

Prospective residents will be provided with an application packet that contains information necessary to make a decision regarding whether to apply, how to apply, and what to expect during the application process. Information explaining the field of medical physics and residency training will be included. At present, the documents provided include 1) AAPM's "The Medical Physicist", 2) AAPM's "The Roles, Responsibilities, and Status of the Clinical Medical Physicist", and 3) AAPM Report Number 90, "Essentials and Guidelines for Hospital-Based Medical Physics Residency Training Programs". Also included is a brochure, describing the University of Louisville Radiation Oncology Physics Residency Training Program.

Admission standards respecting evidence of degrees and board certification, undergraduate and graduate transcripts, letters of recommendation, biography, and other information concerning the history of the applicant are clearly stated in the application form Appendix XX. Preference will be given to graduates of CAMPEP-accredited academic programs. Prospective students must have acquired or be in the final stages of completing a graduate degree. Trainees entering the University of Louisville Radiation Oncology Physics Residency Training Program will have acquired a strong foundation in basic physics. The trainee shall document a master's or doctoral degree in medical physics, physics, engineering, mathematics, or other science with physics training equivalent to a minor in physics. The latter physics training shall be evidenced by upper level courses in mechanics, electricity and magnetism, quantum mechanics, atomic structure, nuclear physics, and statistical mechanics.

Trainees entering the University of Louisville Radiation Oncology Physics Residency Training Program will have acquired some coursework toward a strong didactic background in medical physics as described in AAPM

Report Number 79, "Academic Program for Master of Science Degree in Medical Physics". This will be demonstrated by 1) graduation from a CAMPEP-accredited medical physics graduate education program, or 2) transcripts from an unaccredited medical physics graduate education program. The preferred qualification for entry into the residency program is a Ph.D. or M.S. degree in medical physics from a CAMPEP accredited program. The program may allow residents to enter with some deficiencies respecting medical physics training, or some other aspect of their preparation. If our program were to accept such a candidate, we would require the resident to take an entry examination equivalent to a final examination given to radiation oncology residents to provide an initial evaluation of that resident. We would require the completion of all modules in the Dosimetry Training Tool within three months, and the completion of a self-study program in Khan within 6 months. The resident would be required to pass a written and an oral examination appropriate for physics mastery of radiation oncology physics at the end of the Fall Semester, 1st year. Failure to complete these examinations successfully would result in additional remedial work, as determined by the PRC. In that event, the PRC will propose the mechanism by which the resident will receive this additional didactic training. This mechanism will include a specific course of study with parameters for satisfactory completion of that course of study. The Program Director will evaluate whether the candidate has successfully completed the didactic training prior to program completion. The Program Director will report his/her findings to the PRC and the PRC will make the final decision respecting training to address the deficiency.

The PRC manages all aspects of the Residency Training Program in Radiation Oncology Physics, including the selection of candidates for interview. The faculty and staff medical physicists, physicians and a radiobiologist rank the applicants during the interview process. Interview factors ranked include Transcript (overall performance during graduate program), Letters of Recommendation, Medical Physics Experience, Motivation/Personality, and whether the individual is a graduate of a CAMPEP-accredited academic program. The top candidates are selected and invited for a personal interview. For candidates requiring significant travel times and costs, a telephone interview may be used as a preliminary screening before a formal invitation for the full interview process is given. The final decision respecting admission to the program rests with the PRC. The offer to the successful candidate is extended by the Program Director at the end of the first week in March.

Admission policies shall be nondiscriminatory expect as related to standards for successful performance in the program. The quality of the entering residents will be such that successful completion of the required training is not precluded by inadequate qualifications or deficiencies upon admission. The general aptitude and qualifications of entering residents will be considered in the accreditation evaluation. **Data on graduates of the University of Louisville Radiation Oncology Physics Residency Program can be found in Attachment**

4. Full admissions records including letters of recommendation and transcripts will be made available for the site visit.

Table 1: Chronological list of residents admitted into the program over the past 5 years

Resident Name	Residency Start Date	Finish Date	Graduate Degrees, University, Year
Joni Funseth, M.S.*	July, 2003	December, 2004	Univ. of Louisville, 2003
Yinghui Zhang, Ph.D.	October, 2004	July, 2006	Utah State Univ., 1998
Eric Nelson, Ph.D.	June, 2005	May, 2007	Univ. Cent. Florida, 2003
John Hegseth, Ph.D.	July, 2006	June, 2008	Ohio State Univ. 1990

*Joni was a Certified Medical Dosimetrist when she entered the program. She was not required to complete the 1st Semester Dosimetry Rotation, and was therefore awarded a 6 month credit. Her program lasted 18 months.

C2 Recruitment Efforts

The Program Director will design the recruitment program, which will have several aspects. An advertisement for the position is placed in the AAPM Placement Bulletin in October and/or November. Applicants will be sent an application packet. The PRC will select the candidates for interview before February 1. **An example of such an advertisement is found in Attachment 17.** It is the history of our program that such efforts produce a satisfactory pool of applicants for the position.

C3 Enrollment

Program capacity is two residents. An agreement between the University of Louisville-Department of Radiation Oncology, and the University of Louisville Hospital provides permanent funding for two positions. With our current faculty and staff numbers, a third residency position, for full or part time enrollment may be a possibility for this program

Table 2: Alphabetical list of current residents:

Resident Name	Residency Start Date	Anticipated Finish Date	Graduate Degrees, University, Year
Ted Steger, Ph.D.	June 2007	May, 2009	U. Texas Grad. Sch. Of Biomed Sci., 2004
Kate Dikeman, M.S.	July 2008	June 2010	Univ. of Kentucky, 2008

University of Louisville Brown Cancer Center
2008-2010 Radiation Oncology Physics Resident Rotation Schedule

Mentors – Faculty or Staff	Fall 2008	Spring 2009	Fall 2009	Spring 2010
Michael Mills	TS	**TS**	KD	**KD**
Tim Guan	**TS**	TS	**KD**	KD
Dave Wilson	TS	KD	KD	NR
Albert Zacarias	**KD**	**KD**	**NR**	**NR**
Keith Sowards	TS	TS	KD	KD
Joshua James	TS	KD	KD	NR
Joel Handley	TS	TS	KD	KD
Elizabeth Achino	KD		NR	
Judy Turner	KD		NR	
John Gavin	**KD**		**NR**	
Lynn Osborne	KD		NR	
Mellonie Brown	KD		NR	

All listed personnel may act to mentor the Physics Residents, depending on the task. If you see your name, follow the column to the right. If the resident's initials are in bold, you bear primary responsibility for helping the resident complete his/her competencies during that semester. If the font is not bold, you bear secondary responsibility for that resident for that semester. You bear primary or secondary responsibility only for one resident at a time.

TS – Ted Steger
KD – Kate Dikeman
NR – New Resident in July, 2009

C4 Evaluation of Resident Progress

Resident progress will be based on the following criteria:

1. Records of competencies completed
2. Successful completion of courses and semester rotations
3. Performance on first year Raphex examination and annual oral examination
4. Attendance at regularly scheduled conferences

The resident will be assigned Physics Rotation Mentors during each of the four semester rotations. The Physics Rotation Mentor will be responsible to assure the completion of the list of tasks assigned for the rotation. The Physics Rotation Mentors will report an evaluation of the resident's performance during each rotation to the Program Director. The Program Director will assign a rotation grade based on input and the evaluations of the resident's Rotation Mentors for that semester. This rotation grade along with letter grade scores from each of the courses of instruction will become part of the resident's permanent record. The Physics Rotation Mentors

will evaluate the performance of a resident in several categories: 1) interactions with others, 2) oral and written communication, 3) anticipation, analysis and reaction to problems, 4) seeks advice and guidance when appropriate, 5) contribution of innovative ideas, 6) initiative, 7) motivation, 8) interest and enthusiasm, 9) effort, 10) preparation, 11) time management, 12) documentation, 13) multitasking, 14) compliance with established policies and procedures, 15) equipment handling, 16) skill development, 17) professional development, 18) participation in meetings/discussions, 19) teaching preparation and delivery, and 20) teaching effectiveness. A Physician Rotation Mentor will also have input into the assessment of resident performance during the rotation. All evaluations are reported to the Program Director and become part of the permanent record of the resident. As residents are required to operate clinical and physics equipment during their rotations, residents must document they have receive training from a senior physicist in the safe and proper operation of this equipment.

Residents will also complete four semester-long courses of instruction. These courses are the Stanford Dosimetry Training Tool, Basic Radiation Oncology Physics, Core Curriculum and Radiation Biology. The resident must complete the examinations (lecture examinations and final) with passing grades in each course. In the event of test failure, remedial studies will be assigned and the resident will be reexamined. The primary instructor of the course assigns a letter grade to the resident for each course of study. This letter grade becomes a part of the resident's permanent record.

Additional regularly scheduled seminars include a) treatment planning conference (weekly), b) tumor conference (clinical case presentations, weekly), c) multi-modality conference (includes medical oncology and surgery, weekly), and d) residents grill with radiation oncology residents (weekly). Other regularly scheduled conferences include a) physics staff (monthly), b) research (monthly), c) radiation oncology journal club (monthly, two physics articles presented each month). Registered participation in each of these activities is required for program completion. The program director will evaluate and determine satisfactory participation respecting attendance at conferences.

All academic and rotation requirements for the resident will be those in effect at the time the trainee enters the program. In addition to the above methods of evaluation, the resident will meet with the Program Director on a semi-annual basis, just after the completion and grading of each rotation. The Program Director may call a meeting of the Physics Residency Committee to discuss the progress of a trainee, if specific guidance from the PRC is needed.

C5 New Resident Orientation

The first month in training will be devoted to resident orientation. The resident will attend University of Louisville orientation respecting policies of all University employees. The Program Director will be responsible for explaining the program's requirements, resident administrative procedures and Department and University expectations. The resident will be informed of staff and program resources, laboratories and funding during the orientation. During the three weeks, new physics and physician residents experience a general orientation to radiation oncology. Since few new residents are familiar with a clinical radiation oncology setting, a rigorous clinical overview is scheduled with 42 classroom hours of instruction. At present, the medical ethics lecture course is not included in orientation, but is provided within the first three months of the program.

2008-2009 New Resident Physics Orientation

Date	Category*	Hours	Time	Topic	Presenter
7/3 Thu 4th Floor Lib		1	1:00 PM – 4:00 PM	Machine Basics On-call duties, Coding	Kristi Owen 1:00 PM,B. Kelly P. Slone (2–4 PM)
7/8 Tue Lower Lib	**1**	2	8:00 am – 10:00 am	Brachytherapy Overview	D. Wilson LDR, K. Sowards HDR
7/8 Tue Lower Lib	**1**	1	10:00 am – 11:00 am	Resident Orientation I Radiation Oncology	Kristi Paris
7/8 Tues Lower Lib		2	11:30 am – 1:30 PM	TomoTherapy Guest Lunch Lecture	Dr. Rock Mackie/Michael Mills
7/8 Tue Lower Lib		1	2:00 PM – 3:00 PM	Research	Liz Wilson
7/8 Tue Lower Lib	**1**	1	3:00 PM – 4:00 PM	Resident Orientation I Radiation Oncology	Dr. William Spanos
7/9 Wed Lower Lib		2	8:00 am – 10:00 am	Nursing	Rosemary Wafford Lisa Tobe
7/9 Wed Labs in Clinic	**1**	2	10:00 am – 12:00 noon	Brachytherapy Laboratory	Keith Sowards HDR Joel Handley LDR
7/9 Wed Lower Lib	**1**	1	1:00 PM – 2:00 PM	RTT and Dosimetry Programs	Mellonie Brown Judy Turner
7/9 Wed Lower Lib	**1**	1	2:00 PM – 3:00 PM	Dosimetry	Betty Achino
7/9 Wed Lower Lib		1	3:00 PM – 4:00 PM	Lab, X-ray Scheduling	Decora Coleman; Lakisha Phillips
7/10 Thu Otho ENT, 3rd Flr	**1**	2	8:00 am – 10:00 am	External Beam Conventional	Albert Zacarias Josh James
7/10 Thu 4th Floor Lib	**1**	2	10:00 am – 12:00 noon	External Beam Hand Calculations	Ted Steger Joel Handley
7/10 Thu 4th Floor Lib	**1**	1	1:00 PM 2:00 PM	Machine Safety	Wendall Sargent Tim Schadt
7/10 Thu Lower Lib	**1**	2	2:00 PM - 4:00 PM	Rad Onc Nomenclature BCC Standards	Michael Mills
7/11 Fri 4th Floor Lib	**1**	2	8:00 am – 10:00 am	External Beam IMRT/IGRT	Albert Zacarias – Trilogy

7/11 Fri 4th Floor Lib	**1**	2	10:00 am – 12:00 noon	IGRT Laboratory – Dosimetry, DQA	Albert Zacarias - Trilogy Josh James – Tomo
7/11 Fri Lower Lib		1	1:00 PM - 2:00 PM	Notes and Coding	JoAnn Ross, Penny Sloan
7/14 Mon Lower Lib	**2**	2	8:00 am – 10:00 am	Radiation Oncology QA	Michael Mills
7/14 Mon Lower Lib	**2**	2	10:00 am – 12:00 noon	QA in Aria	Albert Zacarias
7/14 Mon Lower Lib		1	1:30 PM – 2:30 PM	Coding Orders & Front Office	JoAnn Ross & Penny Slone
7/15 Tue 4th Floor Lib	**2**	2	8:00 am – 10:00 am	Resident Orientation II Radiation Oncology	Kristi Paris
7/15 Tue 4th Floor Lib	**2**	2	10:00 am – 12:00 noon	Radiation Safety	Michael Mills
7/15 Tue 4th Floor Lib		1	2:00 PM – 3:00 PM	Transcription	Pat Noonan
7/15 Tue 4th Floor Lib	**2**	2	3:00 PM – 4:00 PM	Resident Orientation II Radiation Oncology	William Spanos
7/16 Wed Lower Lib	**2**	2	8:00 am – 10:00 am	Radiation Biology in Radiation Oncology	Wayne Zundel
7/16 Wed GYN Onc, 3rd Flr	**2**	2	10 am – 12:00 noon	Radiation Safety Laboratory	Keith Sowards Joel Handley

After these lectures, the new physics residents are assigned to "shadow" radiation therapists in simulation and on the various treatment machines for 2 weeks. This time is intended to give the new physics resident a foundation on which the structured rotations are built. During the first month, the new physics resident also undergoes CPR training and a TB test. All time spent during orientation and observing on the machines is logged into the Typhon Group database.

All residents are assigned appropriate personnel radiation monitoring devices, including body and ring badges. During the orientation process, the entering residents are required to attend one hour of instruction respecting safety around linear accelerators, CT units and therapy simulators. A senior physicist and an engineer offer the latter instruction. The University of Louisville Hospital offers CPR instruction. Entering residents are required to attend a CPR course as soon as it can be arranged with the course director. A TB test is also required during the first month of employment.

D Program Administration

D1 Structure within Hospital or Medical Center

A six-person Physics Residency Committee (PRC) consists of the Program Director (PRC Chairman), the Department Chairman, one faculty medical physicist, one staff medical physicist, one medical dosimetrist and one radiation biologist. The PRC manages all aspects of the Residency Training Program in Radiation

Oncology Physics. The program operates entirely within the Department of Radiation Oncology, School of Medicine, and University of Louisville. The University of Louisville – Department of Radiation Oncology provides professional Radiation Physics and Radiation Oncology services to the Brown Cancer Center and the University of Louisville Hospital. All equipment is located within the James Graham Brown Cancer Center and the University of Louisville Hospital. A service contract between the Department and U of L Hospital provides support for all physics services, including support for two physics residency positions. The Department of Radiation Oncology, the University of Louisville Hospital, and the Medical Director of the Brown Cancer Center strongly support the physics residency program, as evidenced **by the letters of support in Attachment 3.** The University of Louisville Hospital is owned by the University of Louisville, but operates as a separate corporation. The University of Louisville Hospital leases space owned by the University of Louisville for hospital and outpatient facilities. Physicians and medical physicists are employed by the University of Louisville; dosimetrists are employed by the University of Louisville Hospital. Despite disparate sources of income, all faculty and staff mentors work together as a team to fulfill the education / training mission of the Brown Cancer Center. All faculty and staff have access to the Typhon Group system and are able to participate in the completion/recording process of the resident competency progress and in the ongoing resident evaluation process.

The PRC has developed the following rules of administrative procedures for the Radiation Oncology Physics Residency Program:

Contingency Plan if a Resident Fails a Rotation

If a resident in radiation oncology physics receives a failing grade in a rotation, either through a failure of performance or a failure of examination, the six-person Physics Residency Committee will hold a formal meeting to discuss the reasons that contributed to the failure. The PRC will recommend one of two courses of action. 1) The PRC determines the resident has not mastered any part of the knowledge associated with the rotation. In this event, the resident will be required to complete the full rotation again with another Physics Rotation Mentor. This will result in the lengthening of the program for that resident by up to three months. Support for these three months will be provided for the resident, but the salary will be reduced to up to 50% of that for a full-time residency position. University of Louisville Hospital will provide the funding for the three months (maximum) that will be allowed for the resident to complete tasks associated with the residency. 2) The PRC determines the resident has not mastered some part of the knowledge associated with the rotation. In this event, the resident will be required to review this deficiency in knowledge with another Physics Rotation Mentor. The resident will also continue in the residency rotation that would be otherwise assigned. After one

month, the resident will be given a second oral examination. If the resident passes this examination, the resident will continue in the rotation schedule as designed. If the resident fails the examination, the resident will be required to complete the full rotation again with another Physics Rotation Mentor. This will result in the lengthening of the program for that resident by at least three months.

If the program is lengthened under the options listed above, the resident will be required to provide clinical services in the identified areas of weakness. Only one failing grade in a clinical rotation will be permitted for a resident. A second failing grade in any rotation will result in dismissal from the residency program. No funding will be provided to support the residency position beyond three months.

Disciplinary Procedures and Dismissal

A resident in radiation oncology physics may be dismissed from the Program based on failure to achieve the academic standards outlined above, or based on violations of behavior and conduct as outlined below. The disciplinary, dismissal and grievance procedures of the Program are outlined following the behavior and conduct guidelines.

1. Behavior and Conduct Standards. Radiation oncology physics residents are expected to maintain the professional appearance and conduct suitable to a radiation oncology physicist employed by the University of Louisville. The trainee will dress appropriately in the clinical setting. All interactions with staff, patients, visitors and fellow residents will be carried out in a courteous and respectful manner. A resident may be subject to immediate probation or dismissal without warning for any single violation below:
    a. Any abusive or discourteous action to or about a patient or visitor.
    b. Unauthorized removal of property belonging to the University of Louisville, a patient, visitor, employee or other student.
    c. Willful destruction of University of Louisville property.
    d. Conviction of a felony offense.
    e. Defrauding, attempting to defraud, or falsification of any University of Louisville or University of Louisville Hospital record or document, or acquisition, discussion, or release of confidential information regarding patient care, research, employment, or other official University of Louisville or University of Louisville Hospital operations.
    f. Fighting or dangerous “horseplay”.
    g. Unauthorized use or possession of intoxicants or drugs.

h. Willful violation of University of Louisville or University of Louisville Hospital safety regulations.
i. Gross insubordination.
j. Gambling
k. Use of insulting, abusive, or obscene language to other personnel or patients.
l. Failure to report to class or rotation following the expiration of an excused absence or an approved leave of absence.
m. Absenteeism for five days without notification of the Program Director, and/or absenteeism without satisfactory explanation.
n. Notification to the University of Louisville or the University of Louisville Hospital of conviction for a major crime.

2. The resident may be placed on disciplinary action for the following violations:
   a. Unexcused absence from assigned area.
   b. Lack of cooperation with instructors or staff.
   c. Failure to report patient-related incidents or errors that warrant a report

The Program Director will notify the Physics Residency Committee (PRC) regarding dismissal or disciplinary action respecting a resident. The PRC will make the decision and the resident will be notified in writing within 24 hours of the decision.

Progressive Discipline Procedures

If a student is placed on disciplinary action by the PRC, or if misconduct violations are reported to the Program Director, the following steps of progressive discipline will be used.

1. Oral discussion: An oral discussion of the problem should be conducted in private with the Program Director, allowing the resident to offer an explanation or justification. If no justification or satisfactory explanation is offered, the Program Director should put the resident on notice that if unsatisfactory performance or misconduct continues, more severe action will be taken. In doing so, the Program Director should make it clear that the only purpose of the discussion is to correct an unacceptable situation, and there is no wish to penalize or threaten the resident. A written report of the contents of the discussion will be written by the Program Director, and a copy kept in the student's file.
2. Written guidance: During this procedure, the Program Director must always point out prior attempts to resolve problems through instruction and oral discussion. If the resident is unable to satisfactorily respond to the problem, the Program Director will then complete a Guidance Report (Conference /

Counseling Record), and place the resident on Written Guidance for 30 days. When the Written Guidance period expires, the Program Director must determine whether or not the deficiency has been corrected. If corrected, the Program Director should advise the resident that the Written Guidance period has expired. If, however, the deficiency has not been corrected, the Program Director may either extend the Written Guidance period for 30 days or place the student on Probation. In no case should the Written Guidance status be extended more than once. The Program Director must forward a copy of the report of the Written Guidance to the PRC.

3. Probation: Probation is a serious step in the disciplinary process. For this reason, the Program Director must review the circumstances of the situation with two (2) members of the Physics Residency Committee. Probation is normally for a specified period of time, from 30 to 90 days. The Probation Notice becomes part of the resident's file. The Notice should contain the following:
   a. An explanation of the circumstances surrounding the disciplinary action. Copies of the Oral Discussion and Written Guidance notices may be attached, if these steps were taken prior to Probation.
   b. The probation period
   c. A description of the requirements for removal of Probation status.

   If a resident satisfies the requirements for removal of Probation status, the Program Director should complete the Probation Notice with "Date Removed From Probation" and forward a copy to the PRC. If the Probation period expires without a satisfactory resolution of the problem, the student is subject to dismissal.
4. Dismissal: A student, who, despite the preliminary steps described above, continues to violate acceptable standards of performance or behavior may be subject to dismissal. This serious step is never taken against a resident without concurrence of the Program Director, the Department Chairman, and the Physics Residency Committee. This consensus is not a perfunctory one, but is intended to assure that the fact and circumstances fully warrant dismissal and that the student involved has been given every reasonable consideration before this decision is made.

Grievance Procedures for Radiation Oncology Physics Residents

Any resident, who believes that a condition of their training is unjust, inequitable, or a hindrance to effective operations or performance, may initiate a grievance. The resident must first attempting to resolve the problem through informal discussion with their immediate supervisor. The Staff Grievance Officer is available to consult with a resident in each stop of the grievance process, including the initial formulation of the grievance statement. The Staff Grievance Officer cannot serve as an advocate for or representative of residents, but may

work closely with residents, departments and Personnel Services to seek equitable resolutions of all grievances. A resident may provide copies of all grievance materials to the Staff Grievance Officer if the resident chooses to do so. If the grievance is not resolved through informal discussions with the Program Manager, the following procedures shall be followed in pursuing the grievance:

1. The Program Manager who receives the grievance shall respond to the grievance in writing within five workdays of receiving the grievance. The response shall outline the actions that will or will not be taken to resolve the grievance. Copies of the response shall be sent to the Assistant Vice-President for Human Resources and the Director of Affirmative Action.
2. If the resident is not satisfied with the Program Manager's response to the grievance, the resident shall submit copies of the original grievance and the supervisor's response to the grievance to the Department Chairman and, if the resident continues to be dissatisfied with the response to the grievance, to the level of the Dean, whose decision shall be final.

This grievance procedure is parallel to that found in the Staff Handbook of the University of Louisville.

D2 Program Director:

The program director is responsible for coordinating the faculty and staff, advising the residents, and evaluating and promoting the program. The Program Director also serves as Chief of Medical Physics, Department of Radiation Oncology of the University of Louisville – School of Medicine. As Chief of Medical Physics, the Program Director is able to assign rotations, mentoring, supervision and special topics for investigation among the faculty and staff who serve in the Department of Radiation Oncology. The Program Director reports directly to the Radiation Oncology Department Chairman. The Program Director has full authority to organize and direct the teaching program, and devotes a significant amount of time and effort in the organization. Although the Program Director has input, the Program Director does not control the numbers of clinical faculty nor the facilities available for training. Items administered by the Program Director include:

1 Correspondence with prospective trainees
2 Scheduling of prospective residents visits
3 Scheduling of classrooms for faculty lectures
4 Scheduling of Physics Residency Committee meetings
5 Preparation for resident orientation
6 Administrative support for residents
7 Program correspondence
8 Preparation of clinical rotation schedule
9 Preparation of didactic lecture schedule
10 Scheduling Physics Resident seminars
11 Scheduling Oral Exams
12 Initiation of Physics Residency Program Review

The current Program Director and Chief of Medical Physics is Michael D. Mills, Ph.D., MSPH, a Certified Radiological Physicist. Dr. Mills is a Qualified Medical Physicist, with extensive experience in both the clinical and educational aspects required in developing and maintaining excellence in a radiation oncology physics training program. He is an Associate Professor in the School of Medicine, University of Louisville. He is board certified in Radiation Oncology Physics by the ABMP. He is board certified in Radiological Physics by the American Board of Radiology. Dr. Mills is a Fellow of the American Association of Physicists in Medicine, and the American College of Medical Physics. He served as Chairman of the American College of Medical Physics in 1995, served as Editor-in-Chief of the Journal of Applied Clinical Medical Physics (2003 – 2007), and is a recipient of the Marvin M.D. Williams Award of the American College of Medical Physics (2007). He holds license # MP022 to practice all subspecialties of medical physics in Texas (presently, there is no licensure of medical physicists in Kentucky).

D3 Committee Meetings

Faculty Meeting – The Faculty of the Department of Radiation Oncology meets every other week to conduct business of the Department. Ongoing administration of the Radiation Oncology Physics Residency Program is performed at this meeting, and any problems or issues involving the program are discussed and resolved. Input from any faculty member to the PRC may be communicated to the Program Director at any Departmental faculty meeting. Records are retained for three years.

The Physics Residency Committee (PRC) meets at least annually to conduct business associated with the Residency Program in Radiation Oncology Physics. At this meeting the PRC reviews and evaluates files containing the educational, training and work records of program applicants. Also, the PRC considers and addresses any curricula or process issues respecting the program during this meeting. Records of this meeting are retained for three years. Ad-hoc meetings may be called if deemed desirable by the Program Director. The PRC meets to select candidates for interview, and to select the candidates for admission to the program.

D4 Records Available for Review

The Program complies with the "Federal Family Educational Right and Privacy Act of 1974" (Buckley Amendment). The resident has the right to inspect any of his or her own official records. No one but the student may inspect his/her own record, with the following exceptions:

1. Instructors or Program officials who have legitimate academic interest.
2. Representatives of the State Educational authorities
3. Representatives of the President of the University of Louisville.

4. Representatives of the Comptroller General of the United States.
5. Representatives of the United States Department of Health and Human Services
6. Representatives of the Commission on Accreditation of Medical Physics Education Programs, Inc. (CAMPEP) for program approval purposes, when applicable.

Records for review shall include the following:

1 Physics Residency Committee minutes (retained three years)
   a) For administrative activities
   b) Applicant selection activities
   c) Oral examination evaluations (retained for life in the resident file)

2 Resident Applications (finalists retained three years, all applicants retained one year)
   a) Application forms
   b) Transcripts
   c) Candidate interview evaluations

3 Residents (retained for life)
   a) Training Schedules
   b) Rotation objectives and expectations
   c) Rotation evaluations
   d) Examination results
   e) Oral examination results

Application records, transcripts, letters of recommendation, personnel records, performance evaluations, letter grades, and subsequent performance respecting board examination of former residents will be made available to the site-visit team. Departmental policy prevents the distribution of these materials in this document. The site-visit team should request such records for examination from the Program Director.

E Resources

E1 Staff

Current faculty and staff of the Department of Radiation Oncology include:

CLINICAL FACULTY AND STAFF:		% FTE for Physics Residency Program
Physicians:		
Dr. William Spanos	Professor and Chairman Program Director – Radiation Oncology	2%

Dr. Baby Jose	Professor and Vice-Chairman		2%
Dr. Craig Silverman	Professor		2%
Dr. John Bechtel	Assistant Professor		3%
Dr. Moataz El-Ghamry	Assistant Professor		2%
Dr. Anthony Dragun	Assistant Professor	(starts 11/1/08)	2%

Nurse Practitioner:

To Be Named	Nurse Practitioner		1%

PHYSICS FACULTY AND STAFF: % FTE for Physics Residency Program

Qualified Medical Physicists:

Dr. Michael Mills	Associate Professor Chief of Physics, Program Director Radiation Oncology Physics	15%
Dr. Tim Guan	Clinical Associate Professor	5%
Dr. Albert Zacarias	Assistant Professor	10%
Mr. David Wilson	Assistant Professor	5%
Mr. Keith Sowards	Clinical Physicist	5%

Physicists Undergoing Certification:

Mr. Joshua James	Clinical Physicist	5%
Mr. Joel Handley	Physics Assistant	5%

Medical Dosimetrists

Ms. Betty Achino	Chief of Dosimetry	3%
Ms. Judith Turner	Clinical Dosimetrist	3%
Ms. Lynn Osborne	Clinical Dosimetrist	3%
Mr. John Gavin	Clinical Dosimetrist	3%
Ms. Mellonie Brown	Clinical Dosimetrist Director, RTT Program	3%

RADIOBIOLOGY:

Dr. Wayne Zundel	Assistant Professor	5%

Physics faculty and staff will be responsible for mentoring residents during semi-annual rotations. Physics faculty and staff will be responsible for mentoring and testing residents respecting all coursework and competencies in the program. The physicist to resident ratio in 2008 is 7:2. It is possible a third resident could

be admitted with this level of faculty and staff support, but as yet funding is not in place and we have no plans to create such a position.

E2 Finances

The University of Louisville Hospital provides funding for two continuing Radiation Oncology Resident positions. The goal of our program is to fund two residents at 100% of the time. Each resident will be expected to participate full-time in the program. The resident is responsible for personal living and transportation expenses.

Resident Support (annual) is:

Salary (Support):	$	45,000
Benefits (23%)		10,350
Travel		2,150
Books		500
Total	$	58,000

In the Louisville area, expenses (annual) are estimated to be:

Living expense Burden:		
Housing	$	20,000
Utilities	$	5,000
Health Care		2,000 out of pocket
Books, etc.		500
Total	$	27,500

Salaries for Radiation Oncology Physics Residents are equivalent to those of all medical residents at the University of Louisville. Currently these salaries are in excess of $45,000 per year. The resident should expect to provide a personal laptop computer for his or her use. In addition, $500.00 is awarded to each resident annually for the purchase of textbooks.

E3 Facilities

The University of Louisville Hospital has completed a $20 million dollar renovation of the Radiation Oncology Department clinical facilities. It includes the replacement of all therapy equipment with state-of-the-art Varian Accelerators. Currently the department uses a dual photon-energy EX accelerator, three dual photon-energy IX accelerators including one Trilogy with stereotactic and respiratory gating capabilities, and one TomoTherapy Hi-Art unit. With the exception of the latter, all have electron capability and 120 leaf multileaf collimators. A Varian Vari-source HDR unit is placed in a dedicated treatment suite. A Mobetron Intra-operative Radiation Therapy unit is located in the operating rooms of the University of Louisville Hospital. Laboratories are equipped with recent models of ion chambers, electrometers, film-scanners, beam scanners, TLD and other dosimetry devices.

Diagnostic facilities include a Varian Acuity simulator and a dedicated Philips Accusim large bore CT-Sim unit. Four Varian Eclipse workstations and 3 CMX XIO workstations are available for treatment planning. A fully functional mold room provides custom blocks for individual patient needs. A brachytherapy laboratory is available for source storage, calibration and loading. Although no machine shop is available on site, an extensive machine shop is available in the Health Science Center. A conference room is available for lectures and all clinical conferences.

Each resident is assigned a cubicle in the physics work area along with a computer with Web access. Residents have keys and access to the building 24 hours a day. Residents have unrestricted access to the physics and radiation oncology libraries, as well as access to the Kornhauser Medical School Library. The physics library contains contemporary journals such as Medical Physics, IJROBP, Physics in Medicine and Biology, Medical Dosimetry, ICRU and NCRP Reports, and a large number of current texts, proceedings, and workshop reports. The radiation oncology library contains a large number of contemporary texts, journals and proceedings related to the practice of radiation oncology. Residents have access to office supplies, copying equipment, computing equipment, a fax machine and an Internet connection. All laboratories meet modern standards of lighting, ventilation, and comfort. The clinic library/conference room is equipped with a whiteboard, television and video projection equipment. The resident is assigned a desk in the physics laboratory. Residents have keys and access to the building 24 hours a day. Procedures are in place 1) to allow the residents reasonable access time to clinical equipment, 2) to provide residents sufficient training and technical support to ensure safe and proper use of equipment, and 3) to ensure equipment is left in the proper state for clinical use.

F Safety

Residents will be working in a radiation and high-voltage environment, where the potential exists for bodily injury to themselves and others. During the orientation process, the entering residents are required to attend one hour of instruction respecting safety around linear accelerators, CT units and therapy simulators. A senior physicist and an engineer offer this instruction. All residents are assigned appropriate personnel radiation monitoring devices, including body and ring badges. Exposures are reviewed during the quarterly meeting of the University of Louisville Radiation Safety Committee. Thereafter, a senior physicist will instruct a resident in the safe and proper operation of all physics and clinical equipment before the resident is allowed to operate such equipment. Competencies are required that review the Material Safety Data Sheet for Lipowitz metal (Cerrobend), and ozone hazards. Operation of equipment and hazardous materials training is documented as a competency in the Typhon Group software and approved by the Program Director. The University of Louisville Hospital offers CPR instruction. Entering residents are required to attend a CPR course as soon as it can be arranged with the course director. Annually, continuing safety lectures are offered respecting radioactive materials. Material on radiation safety is offered in Attachments XX

G Future Plans

G1 Summary of Strengths and Needs

The facilities, patient load, procedures, and faculty all contribute to a program of significant resources. There are approximately 85 years of combined experience among the physics faculty and staff. Training in almost all special features and procedures are included as part of this residency program. Weaknesses include the limit of two funded residency positions. We would like to expand the program and be able to train four medical physicists, graduating two each year. We are evaluating several options to expand the program.

Program reviews will consist of an internal and external program review. The external review will be performed by CAMPEP. The internal review procedure is as follows: A faculty member of the University of Louisville outside the Department of Radiation Oncology will chair an Internal Review Committee (IRC) in the fifth year of the program, and every fifth year, thereafter, prior to the CAMPEP external review. The IRC Chairman will select members of the Internal Review Committee. Committee members may include members of the Radiation Safety Committee, University of Louisville faculty, current or former radiation oncology

physics residents, and current or former radiation oncology residents. Members of the PRC are excluded from membership, except that one member may serve as liaison. The IRC will review current CAMPEP guidelines, AAPM Task Group reports and a sample internal audit of another training program. The IRC will conduct interviews of current and former residents, the Department Chairman, Clinical Director for Radiation Oncology, the PRC Chairman, the Radiation Oncology Program Training Director, and others deemed appropriate for interview. The findings of these interviews along with a review of current guidelines will make up the bulk of the Internal Review Audit. The Audit will consist of these findings: Review Procedure, Survey of Educational Experience of the Faculty and Staff, Clinical Resources, Educational Program Overview, Internal Audit Findings, and Recommendations for Improvement.

G2 Further Developments and Improvements

An immediate goal is to discuss medical physicist training with the Program Directors of the CAMPEP-accredited academic program at the University of Kentucky. Discussions range from coordinating the residency opportunities for UK students to developing a combined DMP program. Plans for developing a Doctorate of Medical Physics program are contingent on the cooperation of the University of Kentucky and the CAMPEP accredited academic program in existence at that fine University. At this point, negotiations are stalled. The University of Kentucky is uncertain as to the need for a DMP program, but remains highly supportive of its CAMPEP accredited Masters level program in Medical Physics.

Another intermediate goal is to examine incorporation of distributed affiliations with other radiation oncology treatment centers to train medical physicists in therapy physics. At this point, preliminary discussions have taken place with two institutions. Two other institutions have expressed interest, but have yet entered into formal discussions. Any expression of serious intent by any institution would be followed by a clear written proposal for CAMPEP's consideration and support.

Appendix A – Letters of Invitation and Institutional Commitment

UNIVERSITY OF LOUISVILLE
SCHOOL OF MEDICINE

Edward C. Halperin, MD, MA, FACR
Dean of the School of Medicine
Ford Foundation Professor of Medical Education
Professor of Radiation Oncology, Pediatrics, and History

August 21, 2008

Bruce J. Gerbi, PhD, FAAPM
Therapeutic Radiology – Radiation Oncology
University of Minnesota
Mayo Mail Code 494
420 Delaware St. SE
Minneapolis MN 55455

Dear Dr. Gerbi:

The University of Louisville strongly endorses accreditation of our Medical Physics training program by CAMPEP.

The extraordinary growth of our Radiation Oncology program and regional cancer center, along with the acquisition of state-of-the-art radiation oncology equipment, has made the role of medial physicists critical in our environment. Radiation Oncology is a strong specialty at the University of Louisville and we are well equipped to manage a fully accredited program in medical physics. Our core teaching hospital, the University of Louisville Hospital, is fully supportive of this program, including a commitment of funding for a residency position. I also endorse accreditation and the further development of this program. We see a benefit both to our university and to the public that we serve.

We appreciate your careful consideration of our reaccreditation.

Sincerely yours,

EC Halperin

Edward C. Halperin, M.D., M.A.
Dean of the School of Medicine

/bjr

University of Louisville • Abell Administration Center • 323 East Chestnut Street • Louisville, KY 40202-1823
P: 502.852.1499 **F:** 502.852.1484 **W:** louisville.edu

UNIVERSITY of LOUISVILLE
Health Sciences Center

DEPARTMENT OF RADIATION ONCOLOGY
Brown Cancer Center
University of Louisville
529 South Jackson Street
Louisville, Kentucky 40202
Phone: 502-561-2700
Fax: 502-561-2709
www.browncancercenter.org

August 14, 2008

Bruce J. Gerbi, PhD, FAAPM
Therapeutic Rad. – Rad. Oncology
University of Minnesota
Mayo Mail Code 494
420 Delaware St. SE
Minneapolis, MN 55455

Dear Dr. Gerbi:

The Department of Radiation Oncology, School of Medicine, University of Louisville, has embraced the mission to train physicists and physicians for clinical service. We are pleased to support residency programs in both Radiation Oncology Physics and Radiation Oncology. Clinical Faculty Physicians are committed to train Radiation Oncology Physics Residents in the clinical aspects of radiation oncology through the following scheduled training sessions and conferences: a) core curriculum conference, b) treatment planning conference (weekly), c) multi-modality conference (includes Medical Oncology and Surgery (weekly), and d) journal club (monthly).

All of our faculty members participate in educational activities with a significant percentage of our time. I estimate at least 3% of our time could be attributed to educational activities involving Radiation Oncology Physics Residents; with the number being 10% or more for our Physics Faculty.

In conclusion, the Faculty of the Department of Radiation Oncology is committed to the success of the Residency Program in Radiation Oncology Physics.

Sincerely,

William J. Spanos, Jr., M.D.
Chairman

WJS:bjr

University Hospital

a proud member of
UofL Health Care

August 14, 2008

Bruce J. Gerbi, PhD, FAAPM
Therapeutic Rad. – Rad. Oncology
University of Minnesota
Mayo Mail Code 494
420 Delaware St. SE
Minneapolis, MN 55455

Dear Dr. Gerbi:

One aspect of the mission of the University of Louisville Hospital is to serve the need of patients facing the challenge of deadly and terminal diseases, such as cancer. We recognize the needs of our cancer patients and the importance and value of radiation oncology treatments in the overall management of this disease. Also, we recognize the importance of delivering the most accurate and precise radiation treatments, since these may offer an individual patient the best hope of cure or improved quality of life.

We continue to offer ongoing support for the Physics Residency Program at the University of Louisville as part of our overall agreement with the department of Radiation Oncology. The University of Louisville Hospital agreement supports two Physics Residents.

I offer my best wishes for the continued success of the Physics Residency Program.

Sincerely,

Robert Barbier

Robert Barbier
Vice President Operations & CFO

RB:bjr

530 S. Jackson Street, Louisville, KY 40202 ph. 502-562-3000

Appendix B – Documentation of Institutional Accreditation

University Medical Center, Inc.

Louisville, KY

has been Accredited by

The Joint Commission

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

Hospital Accreditation Program

May 19, 2007

Accreditation is customarily valid for up to 39 months.

David L. Nahrwold, M.D.
Chairman of the Board

7767
Organization ID #

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

The Joint Commission 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.jointcommission.org.

Ernie Fletcher
Governor

CABINET FOR HEALTH AND FAMILY SERVICES
OFFICE OF THE INSPECTOR GENERAL
STEVEN D. DAVIS, ACTING INSPECTOR GENERAL
275 East Main Street, 5 East
Frankfort, Kentucky 40621-0001
Phone: 502-564-2888
Fax: 502-564-6546
http://chfs.ky.gov/oig

Mark D. Birdwhistell
Secretary

June 6, 2007

Ms. Kay Lloyd
University Of Louisville Hospital
530 South Jackson Street
Louisville, KY 40202

RE: License 100220

Dear Ms. Lloyd:

The Office of Inspector General within the Cabinet is responsible for issuing licenses to providers of health services under KRS Chapter 216B.

Enclosed you will find a license for your hospital. We suggest that you have the license framed with a glass cover. State regulations require that your license be posted in a conspicuous place in a public area of your facility.

If you have any questions, please contact Connie Barker at (502) 564-7963, ext 3280.

Sincerely,

Jennifer Mitchell

Jennifer Mitchell, Director
Health Care Facilities and Services

JM/cbb
Enclosure
c: Northern Enforcement Branch

Appendix C – Clinical Rotation Summaries –

Training Plan: **Schedule of Residents, Mentors, Support Mentors and Rotations**

University of Louisville Brown Cancer Center
2008-2010 Radiation Oncology Physics Resident Rotation Schedule

Mentors – Faculty or Staff	Fall 2008	Spring 2009	Fall 2009	Spring 2010
Michael Mills	TS	**TS**	KD	**KD**
Tim Guan	**TS**	TS	**KD**	KD
Dave Wilson	TS	KD	KD	NR
Albert Zacarias	**KD**	**KD**	**NR**	**NR**
Keith Sowards	TS	TS	KD	KD
Joshua James	TS	KD	KD	NR
Joel Handley	TS	TS	KD	KD
Elizabeth Achino	KD		NR	
Judy Turner	KD		NR	
John Gavin	**KD**		**NR**	
Lynn Osborne	KD		NR	
Mellonie Brown	KD		NR	

All listed personnel may act to mentor the Physics Residents, depending on the task. If you see your name, follow the column to the right. If the resident's initials are in bold, you bear primary responsibility for helping the resident complete his/her competencies during that semester. If the font is not bold, you bear secondary responsibility for that resident for that semester. You bear primary or secondary responsibility only for one resident at a time.

Dr. Bechtel will assist the residents with any clinical / medical questions.
TS – Ted Steger
KD – Kate Dikeman
NR – New Resident in July, 2009

1 During all Semesters, the following conferences are scheduled. Physics residents are asked to attend all conferences, and a minimum number are required:

a) anatomy and technique review conference (weekly)

b) multi-modality conference (includes medical oncology and surgery, weekly)

c) core curriculum with radiation oncology residents (weekly)

d) physics staff (monthly)

e) radiation oncology journal club (monthly, one or more physics articles presented each month)

f) morbidity and mortality conference (monthly)

2 The following courses are scheduled. Physics residents must pass each course and limited participation teaching the radiation oncology resident physics course is required.

a) Stanford Dosimetry Training Tool (Fall Semester Year 1)
b) Basic Radiation Oncology Physics (Spring Semester Year 1 or Fall Semester Year 2)
c) Core Curriculum (Both Semesters, Both Years)
d) Radiation Biology (Spring Semester Year 1 or Fall Semester Year 2)

3 The following short courses / rotations are required. Residents must complete these with satisfactory grades and evaluations:

a) Imaging Physics and Nuclear Medicine Physics for Radiation Oncology
b) Health Physics Laboratory Rotation
c) Review course in Radiation Oncology Physics
d) Review course in Radiation Biology
e) Advanced Physics Readings assigned from Van Dyk's Textbook

4 The following tests / evaluations must be satisfactory:

a) Annual Oral examinations
b) RAPHEX examination
c) Semester resident evaluations

5 The following competency categories and competencies are required of physics residents. In general, any competency may be completed during any rotation, however many competencies are scheduled for completion during a specific rotation. Some flexibility is needed, since some patient presentations are not seen very often and new capital equipment arrives infrequently.

a) External beam treatment planning, verification

i) Lung with off-cord
ii) Breast
iii) GU
iv) GYN
v) GI

vi) H&N

vii) Lymphoma

viii) Melanoma

ix) Pediatric

x) Sarcoma

xi) Thoracic

xii) Mantle field by hand

xiii) Mantle field 3-D

xiv) Patient Diode Dosimetry

xv) Patient TLD Dosimetry

xvi) Patient Film Dosimetry

xvii) Patient Cast and/or Mold

xviii) Custom Photon Cerrobend Block / Device

xix) Custom Electron Cerrobend Block / Device

xx) Participate in Conventional Patient Simulation

xxi) Participate in Virtual Patient Simulation

xxii) Participate in Image Acquisition / Fusion – CT-MRI

xxiii) Participate in Image Acquisition / Fusion – CT-PET

xxiv) Participate in Patient Simulation – Localization

xxv) Participate in Patient Simulation – Immobilization

xxvi) MU Calculation SSD – PDD

xxvii) MU Calculation SSD-TAR

xxviii) MU Calculation SSD- TMR

xxix) MU Calculation SSD – TPR

xxx) MU Calculation – Photon Extended SSD

xxxi) MU Calculation – Electron Extended SSD

xxxii) MU Calculation – off-axis points

xxxiii) MU Calculation – Heterogeneity calculation

xxxiv) MU Calculation – Asymmetric jaw calculation

xxxv) MU Calculation – Enhanced Dynamic Wedge

xxxvi) Treatment Plan Verification

xxxvii) Treatment Record Verification (Written chart)

xxxviii) Treatment Record Verification (Electronic chart)

xxxix) Patient Position (EPID)

xl) Patient Position CBCT

xli) Patient Position MVCT

xlii) Fetal Dose Calculation

xliii) Pacemaker Calculation

xliv) Planning Workstation – Data Acceptance, Commissioning Review

xlv) Planning Workstation – Quality assurance

xlvi) Planning Workstation – Computer Algorithms Review

xlvii) Patient Safety Review – Blocks, Couch, Accessories

xlviii) Review Electrical, Ozone, Cerrobend Hazards

xlix) 4D-CT Simulation

b) Brachytherapy treatment planning, verification

i) LDR Cervix plan

ii) LDR Tandem and ovoid plan

iii) LDR Prostate plan

iv) LDR Tongue plan

v) LDR H&N plan

vi) HDR Cervix

vii) HDR Tandem and ovoid plan

viii) HDR Lung

ix) Receive Shipment of Radioactive Materials

x) Send Shipment of Radioactive Materials

xi) Receive HDR source

xii) Send HDR source

xiii) Perform source leak check with Radiation Safety

xiv) Perform source activity checks: Cs-127, Ir-192

xv) Perform source activity checks: I-125, Pd-103

xvi) Review Radioactive Materials License with Radiation Safety

xvii) Release calc with radioactive patient - I-131

xviii) Release calc with radioactive patient - I-125

xix) Review reporting procedure for medical events

xx) Review of Records with Radiation Safety

c) Room Shielding Design

i) Simulator vault

ii) Simulator vault with CBCT

iii) CT Simulator Vault

iv) HDR Vault

v) Linear Accelerator Vault with IMRT / IGRT

vi) TomoTherapy Vault

d) Quality Assurance, Daily, Monthly

i) Daily QA – Simulator

ii) Daily QA - CT Simulator

iii) Daily QA - Linear Accelerator

iv) Daily QA - Trilogy Linear Accelerator

v) Daily QA - TomoTherapy Hi-Art Unit

vi) Monthly QA of Dosimetry Equipment - Constancy Checks

vii) Monthly QA – Simulator

viii) Monthly QA - CT Simulator

ix) Monthly QA - Linear Accelerator

x) Monthly QA - Trilogy Linear Accelerator

xi) Monthly QA - TomoTherapy Hi-Art Unit

e) Annual calibration, clinical equipment

i) Annual Simulator Calibration

ii) Annual CT - Simulator Calibration

iii) Annual Linear Accelerator Calibration

iv) Annual Intraoperative Linear Accelerator Calibration

v) Annual Instrument Intercomparison

vi) TG-51 Photon Calibration

vii) TG-51 Electron Calibration

viii) Annual TomoTherapy Hi Art Unit Calibration

ix) Operation of Linear Accelerators

x) Operation of Tomotherapy Unit

xi) Operation of Farmer type Chamber / Electrometer

xii) Operation of Well type Chamber / Electrometer

xiii) Operation of 3-D Beam Scanner

xiv) Operation of Unfors Radiographic Meter

xv) Operation of Unfors CT Meter

xvi) Operation of Intraoperative Unit

f) TBI Photons, TSE electrons

i) TBI Photon Annual Calibration

ii) TSE Electron Annual Calibration

iii) TBI Photon Plan

iv) TSE Electron Plan

v) Ozone Hazard for TSE Electrons

g) Intraoperative electrons

i) Annual Calibration of Intraoperative Unit

ii) Patient Intraoperative Plan and Delivery

iii) Daily QA of Intraoperative Unit

h) Stereotactic cranial, body

i) Stereotactic Daily Quality Assurance

ii) Stereotactic Annual Quality Assurance

iii) Stereotactic Cranial Plan

iv) Stereotactic Body Plan

i) IMRT / IGRT

i) Step and Shoot Plan

ii) Sliding Window Plan

iii) Compensator IMRT Plan

iv) TomoTherapy IMRT Plan

v) Step and Shoot DQA

vi) Sliding Window DQA

vii) Compensator IMRT DQA

viii) TomoTherapy IMRT DAQ

ix) Rapid Arc (VMAT) Plan

x) Rapid Arc (VMAT) DQA

xi) DQA with Film

xii) DQA with Ion Chamber

xiii) DQA with Portal Dosimetry

xiv) DQA with MapCHECK

j) Respiratory Gating

i) Respiratory Gating Simulation

ii) Respiratory Gating Plan

iii) Respiratory Gating DQA

iv) 4DCT Simulation

v) 4DCT Plan

vi) 4DCT DQA

k) HDR / LDR Brachytherapy

i) HDR Cervix Plan and Delivery

ii) HDR Tandem and Ovoids Plan and Delivery

iii) HDR Lung Plan and Delivery

iv) LDR Tandem and Ovoids Plan and Treatment

v) LDR Interstitial with Ir-192 Plan and Treatment

vi) I-131 Plan, Release Calculation and Treatment

l) Administrative and Professional Duties

i) Publishing in Scientific and Clinical Journals

ii) Staffing and Manpower (Abt Studies)

iii) Billing Procedures

iv) Job Search

v) Professional Organizations and Certification

vi) Malpractice and Legal Issues

vii) The Care Bill and Licensure

viii) Workforce and the Future of Medical Physics

6 Rotation Title, Preceptor / Mentor, Duration, Recommended References, and Evaluation Scheme:

Rotation 1; 6 Months – Task List for Radiation Oncology Physics Residents

Orientation, Rotation in Patient Simulation, Patient Virtual Simulation, Simulator and CT Quality Assurance, Device Fabrication, 3-D Treatment Planning and In-Vivo Dosimetry Measurements

Mentors: Betty Achino, CMD; Albert Zacarias, Ph.D.

Overview:

Clinical training will be under the direction of the Assistant Director of the Radiation Oncology Physics Residency Program. The training and supervision of clinical physics activities will be by the faculty and professional staff of the Physics Section of the Radiation Oncology Department. The training in dosimetry procedures will be by the Dosimetry Section of the Department of Radiation Oncology, University of Louisville Hospital. All patient care activities will be checked and signed by either a Certified Medical Dosimetrist or a Certified Medical Physicist, as appropriate. The resident's progress will be reviewed by the Radiation Oncology Physics Residency Program Director quarterly.

Learning Objectives:

1 Learn simulation and virtual simulation procedures, including patient positioning, immobilization and localization. CT virtual simulation will include tumor localization, patient contours and virtual radiographic/fluoroscopic positioning of beams. Beams will be modified with custom blocking/MLC shaping. The resident will develop a simulation skill level acceptable to the faculty radiation oncologists and the rotation supervisors.
2 Learn simulator and CT-simulator quality assurance.
3 Learn computer-assisted isodose generation techniques and external beam treatment planning procedures with a 3-D treatment planning system.
4 Learn and perform Monitor Unit calculations, including: SSD/PDD, SAD/TAR/TMR/TPR, extended SSD for photons and electrons, off-axis points, heterogeneity (inhomogeneity) corrections, tissue compensation, asymmetric collimation, Sc & Sp, and enhanced dynamic/virtual wedge calculations.
5 Learn treatment plan verification, treatment record verification, Monitor Unit calculation/verification, image based (ultrasound/EPID) patient positioning, tissue compensation, information systems data entry and integrity, record and verify systems, fetal dose and pacemaker considerations.
6 Learn treatment delivery verification, in-vivo patient dosimetry methods and procedures.

During the six-month rotation, the radiation oncology physics resident should complete the following tasks:

1 Complete all training modules within the Stanford Dosimetry Training Tool.
2 Observe and participate in patient simulations for six months.
3 Observe and participate in patient virtual simulations for six months.
4 Perform simulator, and CT Quality Assurance for six months according to the following
    a. Perform Daily Quality Assurance checks for simulator and CT-simulator.
    b. Perform Monthly Quality Assurance checks for simulator and CT-simulator.
5 Fabricate custom Cerrobend treatment devices for one month.
    a. Fabricate custom cast and mold work for six months.
6 Plan one or more of the following external beam case types with the 3-D treatment planning system. Plans may be coplanar or non-coplanar (3D). These plans will utilize CT, MRI, PET, Ultrasound and fusion/registration imaging techniques:
    a. Breast
    b. Central nervous system (CNS) - Simple cranium
    c. Genitourinary (GU) - Prostate / Multiple and Conformal Fields
    d. Gynecological/Cervix (GYN)

e. Gastrointestinal (GI) – Esophagus, Colon / Rectum
f. Head and Neck (plan at least one maxillary antrum from file)
g. Lymphoma
h. Melanoma
i. Pediatrics
j. Sarcoma
k. Thoracic (Lung with off cord)

7 Plan one of the following irregular field case types with the 3-D treatment planning system:
   a. Clarkson mantle by hand
   b. Clarkson mantle by 3-D treatment planning system
8 Assist in performing an annual calibration (using TG-51) on at least one linear accelerator. Record the results in Argus.
9 Observe and participate in patient simulations for six months.
10 Observe and participate in patient virtual simulations for six months.
11 Perform Annual Calibration on a simulator and a CT-simulator.
12 Perform all procedures to commission and the following dosimetry systems.
   a. Patient diode dosimetry
   b. Thermoluminescent dosimetry
   c. Film dosimetry system
13 Assist in performing an annual calibration (using TG-51) on at least one linear accelerator. Record the results in Argus.
14 Complete all modules within the Stanford Dosimetry Training Tool.

The Rotation Mentor will train and evaluate resident performance for QA checks and construction of devices. The radiation oncologist must approve all plans for patient use.

Readings:

1 Stanford Dosimetry Tool – all sections.
2 ICRU Report 50 Prescribing, Recording and Reporting Photon Beam Therapy (1993)
3 ICRU Report 62 Prescribing, Recording and Reporting Photon Beam Therapy (Supplement to 50) (1999)
4 XR Zhu, Entrance Dose Measurements for in-vivo dosimetry, JACMP (1) 3, 2000.
5 AF McKinlay, Thermoluminescence Dosimetry, Adam Hilger, (1981).
6 DMB Watkins, Radiation Therapy Mold Technology, Pergamon Press, (1981).
7 SK Jani, CT Simulation for Radiotherapy, Medical Physics Publishing, (1993).
8 JP Gibbons, Monitor Unit Calculations for External Photon & Electron Beams (2000).
9 GC Bentel, Radiation Therapy Planning, McGraw Hill, (1993).
10 LK Wagner, RG Lester and LR Saldana, Exposure of the Pregnant Patient to Diagnostic Radiations: A Guide to Medical Management 1997.
11 AF McKinlay, Thermoluminescence Dosimetry, Adam Hilger, 1981.

Rotation 2; 6 months - Task List for Radiation Oncology Physics Residents

Rotation in Room Design and Radiation Safety, Machine Acceptance, Calibration, Commissioning and QA
Mentors: Albert Zacarias, Ph.D.; David Wilson, M.S.

Learning Objectives:

1. Participate in all Quality Assurance activities. These will familiarize the resident with the operations and performances of common equipment found in radiation oncology.
2. Learn aspects of equipment selection, including performance specification, feature comparison, mechanical/architectural considerations, and performance test designs.
3. Learn aspects of personnel and patient protection, including room design and shielding calculations, licensure of sources by Nuclear Regulatory Commission or state agency, construction supervision and site planning, and radiation surveys – including on low photon energy (6 MV) and one high photon energy (18 MV).
4. Perform one acceptance test for a linear accelerator, including mechanical, safety and radiation tests. Learn to enter information into a 3-D treatment planning computer and to check that information. Validate treatment planning data for one treatment planning computer.
5. Assist in an annual calibration for one linear accelerator. This will allow the resident to experience the level of precision and range of activities to certify a linear accelerator for continuing clinical use. Learn Protocols AAPM TG-51, TG-61, and TG-25.
6. Learn to commission and develop a QA program for a virtual simulator, linear accelerator and a 3-D treatment planning system. Include daily, weekly, monthly, and annual QA tasks and procedures, based on AAPM TG-40.
7. Learn to commission a monitor-unit calculation program for clinical use.

During the six-month rotation, the radiation oncology physics resident should complete the following tasks:

1. Generate a Room Design, documenting the shielding specifications for the following equipment units:
   a. Linear Accelerator
   b. Simulator
   c. CT Simulator
   d. HDR unit

   The report will be reviewed, corrected and graded by the Rotation Mentor. If possible, actual clinical installations will be used and the shielding results compared with those in place.
2. Participate in the monthly QA checks of the following equipment units for <u>each</u> of the six months:
   a. Linear Accelerators
   b. Simulators
   c. CT unit
   d. HDR unit

   The Rotation Mentor will monitor performance and completeness of these tasks.
3. Participate in the daily QA of the following units for at least <u>5 days</u>:
   a. Linear Accelerators
   b. Simulators
   c. CT Simulator
   d. HDR unit
4. Serve two week rotation in Radiation Safety Office
5. Assist in performing an annual calibration (using TG-51) on at least one linear accelerator. Write up the report.

6. Work through all daily, weekly, monthly and quarterly quality assurance procedures in the QA manual.
7. Prepare one seminar on a topic assigned by the Rotation Mentor.
    a. Complete Data sheets to enter physics data into a 3-D treatment-planning computer for: Photons, low and high energy
    b. Electrons, low and high energy
    c. Cs-137 sources
    d. Ir-192 sources
    e. I-125 sources
    f. Pd-103 sources

    Rotation Mentor will review and compare to those used to commission the TP system.
8. Verify the information in the 3-D treatment-planning computer according to protocols provided by the manufacturer and developed in house.
9. Develop a program for Quality Assurance for the treatment-planning system according to existing Quality Assurance Protocols and in-house QA standards.
10. Generate a comprehensive Acceptance, Commissioning and Quality Assurance report for the 3-D treatment-planning system.
11. Commission a commercial photon and electron monitor-unit calculation program for clinical use.
12. Prepare a sample data book for use by the dosimetry section.
13. Assist in performing an annual calibration (using TG-51) on at least one linear accelerator. Enter the information into Argus.

Readings:

1 AAPM Report 21, Specification of Brachytherapy Source Strength (1987) – TG 32
2 AAPM Report 32, Clinical Electron Beam Dosimetry, Med Phys (18) 1 – TG 25
3 AAPM Report 46, Comprehensive QA for Radiation Oncology, Med Phys (21) 4 – TG 40
4 AAPM Report 47, AAPM Code of Practice for Linear Accelerators, Med Phys (21) 7 – TG 45
5 AAPM Report 51, Dosimetry of Interstitial Brachytherapy Sources, Med Phys (22) 2 – TG 43
6 AAPM Report 56, Medical Accelerator Safety Considerations, Med Phys (20) 4 – TG 35
7 AAPM Report 62, QA for Clinical Radiotherapy Treatment Planning, Med Phys (25) 10 – TG 53
8 AAPM Report 67, Protocol for Clinical Dosimetry of High Energy Photon and Electron Beams Med Phys (26) 9 – TG 51
9 AAPM Report 72, Basic Applications of Multileaf Collimators (2001) – TG 50
10 NCRP Report 32, Radiation Protection in Educational Institutions (1966)
11 NCRP Report 105, Radiation Protection for Medical and Allied Health Personnel (1989)
12 NCRP Report 107, Implementation of the Principle of ALARA for Medical and Dental Personnel (1990)
13 PH McGinley, Shielding Techniques for Radiation Oncology Facilities, Medical Physics Publishing (1998)
14 AAPM OR-01, Information Transfer from Beam Data Acquisition Systems, TG – 11

Rotation 3 – Task List for Radiation Oncology Physics Residents

Rotation in Brachytherapy, High Dose Rate Brachytherapy, Prostate Brachytherapy, Therapeutic Nuclear Medicine, IMRT Treatment Planning, Delivery Quality Assurance Measurements, and Radiation Safety Officer Duties and Responsibilities

Mentors: Tim Guan, Ph.D., Michael Mills, Ph.D.

Learning Objectives:

1 Learn to plan LDR brachytherapy cases using Patterson-Parker rules and a 3-D treatment planning system.
2 Learn acceptance, commissioning, and annual calibration tasks for a High Dose Rate afterloading system.
3 Learn to plan HDR cases.
4 Learn physics and dosimetry procedures for prostate seed brachytherapy.
5 Learn physics and dosimetry procedures for endovascular brachytherapy
6 Learn procedures for the ordering and administration of therapeutic radionuclides.
7 Learn to enter information into an IMRT treatment-planning computer and to check that information.
8 Learn to commission and develop a QA program for an IMRT treatment-planning computer.
9 Learn to Plan IMRT for a number of clinical sites.
10 20 hour rotation in Radiation Safety
11 The radiation oncologist must approve all brachytherapy, IMRT and IGRT plans for patient use. The Rotation Mentor will train and test the resident in brachytherapy, IMRT/IGRT commissioning and IMRT/IGRT QA procedures.

During the six-month rotation, the radiation oncology physics resident should complete the following tasks:

1. Plan one of the following brachytherapy case types with the 3-D treatment planning system:
   a. Tandem and Ovoids
   b. Vaginal Cylinder
   c. Iridium Base of tongue
   d. Prostate seed implant
2. Review Patterson-Parker Rules. Assist in all brachytherapy procedures for three months, including source ordering, source transport and loading, and room surveys.
3. Perform Acceptance and Commissioning tasks to begin a High Dose Rate afterloading program.
4. Participate in the quarterly source exchange and perform all of the associated QA procedures for the HDR unit.
5. Plan one of the following HDR cases:
   a. Tandem and Ovoids
   b. Vaginal Cylinder
   c. Single catheter lung
   d. Multiple catheter lung
6. Assist in performing the annual calibration of the HDR unit. Write up the report.
7. Assist in prostate brachytherapy procedures for three months.
8. Participate with physics staff to order radionuclides for therapeutic use.
9. Participate in the administration of therapeutic radionuclides (Strontium, Samarium and Iodine) for three months.
10. Assist in performing an annual calibration (using TG-51) on at least one linear accelerator. Write up the report.

11. Verify the information in the IMRT treatment-planning computer according to protocols provided by the manufacturer and developed in house.
12. Develop a program for Quality Assurance for the IMRT treatment-planning system according to existing Quality Assurance Protocols and in-house QA standards.
13. Generate a comprehensive Acceptance, Commissioning and Quality Assurance report for the IMRT treatment-planning system.
14. Plan one of the following external beam case types with the IMRT treatment planning system:
    a. Prostate
    b. Head and Neck
    c. Lung
    d. Other sites as assigned
15. Participate in the physics weekly chart review schedule for all patients on one machine each week.
16. Twenty hour rotation in Radiation Safety to include review of regulations, mock inspection, wipes tests, radioactive material license management and other associated duties.
17. Participate in teaching the Residents Physics Course for Radiation Oncology Residents.

Readings:

1 AAPM Report 41 Remote Afterloading Technology (1993) – TG – 41.
2 AAPM Report 59 Code of Practice for Brachytherapy Physics, Med Phys (24) 10 – TG – 56.
3 AAPM Report 61 High Dose-Rate Brachytherapy Treatment Delivery, Med Phys (25) 4 – TG – 59.
4 AAPM Report 68 Permanent Prostate Seed Implant Brachytherapy, Med Phys (26) 10 – TG – 64.
5 AAPM Report 69 Recommendations of the AAPM on 103-Pd Interstitial Source Calibration and Dosimetry: implications for dose specification and prescription, Med Phys (27) 4
6 AAPM Report 71 A Primer for Radioimmunotherapy and Radionuclide Therapy (2001) TG – 7.
7 P Tripuraneni, S Jani, E Minar, M Leon, Intravascular Brachytherapy, ReMedica, (2001).
8 Interstitial Collaborative Working Group, Interstitial Brachytherapy, Raven Press, (1990).
9 J Van Dyk, The Modern Technology of Radiation Oncology, Medical Physics Publishing (1999).
10 DR Wigg, Applied Radiobiology and Bioeffect Planning, Medical Physics Publishing (2001).
11 JA Purdy and G Starkschall, 3-D Planning and Conformal Radiation Therapy, Adv. Med. Pub. (1999).
12 JA Purdy, WH Grant, JR Palta, EB Butler, & CA Perez, 3-D Conformal and Intensity Modulated Radiation Therapy: Physics & Clinical Applications, Adv. Med. Pub. (2001).

Rotation 4 – Task List for Radiation Oncology Physics Residents

External Beam Special Procedures Including Total Body Irradiation, Total Skin Electron Treatments, Intra-Operative Radiation Therapy, Rotation in Diagnostic Equipment, Information Management, Administration, Budgets, Staffing, Space, Professional Responsibilities and Board Preparation

Mentors: Michael Mills, Ph.D. and Keith Sowards, M.S.

Learning Objectives:

1 Learn to commission a total-body photon special procedure, both with and without a Mick Frame.
2. Plan total body photon irradiation, both with and without a Mick Frame.
3. Learn to commission a Stanford total skin electron technique.
4. Plan total skin electron treatments.
5. Learn QA procedures for Intra-Operative Radiation Therapy.
6. Plan assist, and calculate MU for IORT Cases
7. Learn Stereotactic Radiosurgery and Fractionated Stereotactic Radiotherapy procedures and set-up.
8. Plan Stereotactic cases, perform patient quality assurance, and assist in the treatment of patients.
9. Learn the use of medical imaging equipment in radiation oncology.
10. Learn the role of the radiation oncology physicist.
11. Learn to administrate a radiation oncology physics practice.
12. Learn to prepare for board examination.

During the six-month rotation, the radiation oncology physics resident should complete the following tasks:

1. Participate in conventional and Mick Frame TBI procedures for six months. Review all commissioning data for these procedures.
2. Plan one conventional and one Mick Frame TBI cases.
3. Participate in all Total Skin Electron procedures for six months. Review all commissioning data for these procedures.
4. Participate in all Intra-Operative Radiation Therapy procedures for six months, including warm-up and quality assurance. Review all commissioning data for these procedures.
5. Participate in the annual calibration of the IORT unit. Prepare the report.
6. Participate in all Stereotactic Radiosurgery and Fractionated Stereotactic Radiotherapy patient procedures for six months. Perform all QA procedures and plan at least one case.
7. Participate in the physics weekly chart review schedule for all patients on one machine each week.
8. Participate in teaching the Residents Physics Course for Radiation Oncology Residents.
9. Review acceptance, commissioning, quality assurance, annual calibration and performance testing of the following diagnostic equipment:
   a. Radiation therapy simulator
   b. CT and CT-simulator
   c. Ultrasound unit
   d. MRI unit
   e. PET scanner
10. Review computer system management operation with Computer Network Manager. Review the record and verify system, billing system and tumor registry system.
11. Review all appropriate Local, State and Federal regulations respecting the use of radioactive materials, diagnostic and therapeutic equipment, and quality management programs for hospitals and universities.
12. Review the duties of the Radiation Safety Officer and the duties of the Chairman of the Radiation Safety Committee.

13. Prepare a mock budget, staffing and space needs estimate based on projected increases in patient load.
14. Review the professional activities of the medical physicist with the Rotation Mentor; design a short special project to be completed within the six-month rotation.
15. Perform fetal dose calculations from exposure to diagnostic (1 calc) and therapeutic (1 calc) radiation.
16. Outline, with the Rotation Mentor, a complete Board preparation study schedule.
17. Participate in the physics weekly chart review schedule for all patients on one machine each week.

Readings:

1. AAPM Report 17 The Physical Aspects of Total and Half Body Photon Irradiation (1986) – TG – 29.
2. AAPM Report 23 Total Skin Electron Therapy: Technique and Dosimetry (1987).
3. LL Gunderson, Intraoperative Irradiation: Techniques & Results, Humana Press (1999).
4. AAPM Report 54 Stereotactic Radiosurgery (1995) – TG – 42.
5. AAPM Report 38 The Role of a Physicist in Radiation Oncology (1993) – TG – 1
6. AAPM Report 42 The Role of the Clinical medical Physicist in Diagnostic Radiology (1994)
7. AAPM Report 50 Fetal Dose from Radiotherapy with Photon Beams, Med Phys (22) 1 – TG 36
8. LK Wagner, RG Lester, LR Saldana, Exposure of the Pregnant Patient to Diagnostic Radiations, Medical Physics Publishing (1997).
9. TS Curry, JE Dowdey, RC Murry, Christensen's Introduction to the Physics of Diagnostic Radiology, Lea and Febiger, (1990).
10. P Sprawls, Physical Principles of Medical Imaging, Medical Physics Publishing (1995).
11. W Hendee, R Ritenour, Medical Imaging Physics, Mosby Year Book (1992).
12. JA Sorenson and ME Phelps, Physics in Nuclear Medicine, Grune & Stratton (2003).
13. P Sprawls, Magnetic Resonance Imaging, Medical Physics Publishing (2000).
14. JT Bushberg, Essential Physics of Medical Imaging, Lippincott Williams & Wilkins (2001).
15. KR Hogstrom and JL Horton, Introduction to the Professional Aspects of Medical Physics, University of Texas MD Anderson Cancer Center (1999).
16. RJ Shalek and DS Gooden, Medical Physicists and Malpractice, Medical Physics Publishing

Books for Medical Physics Residency Program

Radiation Therapy Planning, Second Edition
By: Gunilla Bentel
Publisher: McGraw-Hill

The Physics of Radiation Therapy, Third Edition
By Faiz M. Khan
Publisher: Lippincott Williams & Wilkins

Radiation Oncology Physics: A Handbook for Teachers and Students
By: Ervin B Podgorsak, Editor
Publisher: International Atomic Energy Agency
http://www-pub.iaea.org/MTCD/publications/PDF/Pub1196_web.pdf

The Modern Technology of Radiation Oncology Vol. 1 & Vol. 2
Editor: Jacob Van Dyk
Publisher: Medical Physics Publishing

Physics of Radiology, Second Edition
By: Anthony Brinton Wolbarst
Publisher: Medical Physics Publishing

Radiobiology for the Radiologist, Fourth Edition
By: Eric Hall
Publisher J.B. Lippincott Company

Principals and Practice of Radiation Oncology
By: Edward C. Halperin, Carlos A. Perez, and Luther W. Brady
Publisher: Lippincott, Williams & Wilkins

Medical Physicists and Malpractice
By: Robert J. Shalek and David S. Gooden
Publisher: Medical Physics Publishing

Shielding Techniques – Radiation Oncology Facilities, Second Edition
By: Patton H. McGinley
Publisher: Medical Physics Publishing

Introduction to Health Physics – Third Edition
By: Herman Cember
Publisher: McGraw-Hill

Physics in Nuclear Medicine, Third Edition
By: Simon Cherry, James A. Sorenson, and Michael E. Phelps
Publisher: Saunders

Content Removed Due to Copyright

Individual Responses Detail - "Faculty/Preceptor Evaluation by Resident"

(Filters currently OFF)

TOTAL RESPONSES: 4

Evaluation by:	Students (Steger, Theodore R)
Evaluation of:	Clinical Supervisors (James, Joshua)
Evaluation Period:	7/3/2008
Survey Completed:	7/3/2008 8:21:50 AM

1.

Rotation Semester

- Fall

2.

Year

- 2007

3.

Mentor's ability to teach materials in objectives

- Excellent

4.

Mentor's knowledge of material in objectives

- Good

5.

Learning environment created by mentor

- Excellent

6.

Effective and timely feedback regarding performance

- Good

7.

Mentor's availability to assist the residents

- Excellent

8.

Overall teaching ability

- Excellent

Responses as of 8/15/2008 5:35:04 PM CT

Example of a Resident's Semester Evaluation

Individual Responses Detail - "Semester Evaluation"

(Filters currently OFF)
TOTAL RESPONSES: 2

Evaluation by:	Students (Theodore R Steger)
Evaluation of:	Program
Evaluation Period:	7/18/2008
Survey Completed:	7/18/2008 3:31:23 PM

1.

Indicate the Semester for which you are completing the evaluation.

- Spring, Year 1

2.

Estimate the percentage of your time performing clinical physics activities associated with a specific patient(treatment preparation, brachytherapy, clinical dosimetry, etc).

- 30%

3.

Estimate the percentage of time performing clinical competencies not associated with a specific patient (machine based: shielding design, radiation safety, monthly QA, annual QA, etc.).

- 30%

4.

Estimate the percentage of your time performing clinical development projects (not for a specific patient).

- 20%

5.

Estimate the percentage of time reading, in courses and conferences, and teaching.

- 20%

6.

Interactions with faculty and teaching staff - friendliness and accessibility of staff.

- Excellent

7.

Interactions with faculty and teaching staff - Preparation, meaningfulness and time for mentoring / teaching sessions.

- Excellent

8.

Comprehensiveness of exposure to the clinical objectives of this semester.

- Good

9.

Overall effectiveness of this rotation.

- Excellent

10.

Identify the strengths of this rotation.

- Was able to spend more time planning due to completion of Linac commissioning. Dosimetrists were very helpful and willing to teach.

11.

Identify the weaknesses of this rotation.

- The amount of structure was improved from the Fall, and even from the beginning of the semester.

12.

Please make any other comments or suggestions for improvement of this rotation.

- No response

Responses as of 8/15/2008 5:38:00 PM CT

Example of a Resident's General Performance Evaluation

Individual Responses Detail - "General Performance Evaluation"

(Filters currently OFF)
TOTAL RESPONSES: 9

Evaluation by:	Clinical Supervisors (Michael D. Mills)
Evaluation of:	Students (Steger, Theodore R)
Evaluation Period:	7/2/2008
Survey Completed:	7/2/2008 3:35:18 PM

1.

Interactions with others

- Excellent

2.

Oral and written communication

- Excellent

3.

Anticipation, analysis and reaction to problems

- Superior

4.

Seeks advice and guidance when appropriate

- Excellent

5.

Contribution of innovative ideas

- Superior

6.

Initiative

- Excellent

7.

Motivation

- Excellent

8.

Interest and enthusiasm

- Excellent

9.

Effort

- Excellent

10.

Preparation

- Excellent

11.

Time management

- Excellent

12.

Documentation

- Excellent

13.

Multitasking

- Excellent

---

14. Compliance with established policies and procedures

- Superior

---

15. Equipment handling

- Excellent

16.

Skill Development

- Excellent

17.

Professional development

- Superior

18.

Participation in meetings/discussions

- Excellent

19.

Teaching preparation and delivery

- Superior

20.

Teaching effectiveness

- Superior

Responses as of 8/15/2008 5:41:58 PM CT

Department Of Radiation Oncology
Physics Residency Committee Minutes

The annual Physics Residency Committee Meeting for the Department of Radiation Oncology was held on January 17, 2008.

Present: Michael Mills, Ph.D.
Albert Zacarias, Ph.D.
Tim Guan, Ph.D.
Wayne Zundel, Ph.D.
Betty Achino, C.M.D.
David Wilson, M.S.
William J. Spanos, M.D.

Minutes from Feb, 2007 were reviewed and approved.

Old Business

1 Results of Resident Position Offer – The first choice from our last ranking, Ted Steger, accepted the position and began on June 1, 2007. Ted came to us from a CAMPEP accredited PhD Program at MD Anderson, Houston. He has exceeded expectations as a highly competent medical physicist and professional.
2 Wayne Zundel reported the completion of the Radiobiology Course with everyone receiving a passing grade.

New Business

1 Review of Resident Progress
   a. Eric Nelson: Eric received his certificate and graduated the program April 30, 2007. At that time he had completed all his competencies, including all the final semester competencies, and all course work with satisfactory scores. Courses include the Radiation Biology Course, the Physics course, and the Dosimetry Training Tool. Competencies completed included all of the administrative, stereotactic and IGRT as well as HDR. Eric is working at Norton Suburban in Louisville, and will begin the board certification process later this year.
   b. John Hegseth: John has completed the HDR and IMRT / IGRT competencies and is working on Stereotactic Cranial. He has made good progress completing the work expected of a resident by the end of the third semester. He has completed all coursework with acceptable scores on the final exam. Dosimetry Training Tool scores are all acceptable. His RAPHEX score was acceptable, but not above the 90^{th} percentile. Commissioning of the "C" machine occupied two months of his third semester rotation. He is still al little early in the stereo rotation; it is hoped we will begin stereotactic body procedures early enough for him to have some exposure to them. We will plan our first case both for TomoTherapy and Varian Trilogy and attempt to involve John. He is on schedule to graduate at the end of June, 2008. He should begin the job search process as it is anticipated he will graduate on schedule. He has a desire to remain in Louisville for family reasons, but there are no anticipated openings at the Brown Cancer Center.
   c. Ted Steger: Ted also worked to commission the "C" machine. Although this experience was unique for the residency program (new machines only come along so often), it has put him behind completing the treatment planning competencies. However, he is significantly ahead completing the second semester competencies. Also, he has finished the entire Dosimetry Training Tool review with acceptable scores. He also completed the Radiobiology course with an acceptable score on the final.
2 Ranking of Resident Applicants

Residents were ranked as follows:

	M Blakey	Tim Burns	Victor Jacome	N Remmes
WZ	2	4	3	5
MM	4	4	2	5
WS	4	3	2	5
DW	5	3	2	4
BA	5	3	2	4
TG	5	3	2	5
Total	25	20	13	28

Alternate candidate not ranked, Kate Dikeman

3 Search for a Residency Management Tool – Michael Mills is continuing a search for a Web-based tool to facilitate residency management. The New Innovations Software used by all physician residency programs at the University of Louisville offers some promise, but it is very heavy with complexity and features we do not use. In addition, there may be some political complications associated with the use of this program.

Submitted for approval,

Michael D. Mills, Chairman

Department Of Radiation Oncology
Physics Residency Committee Minutes

The annual Physics Residency Committee Meeting for the Department of Radiation Oncology was held on February 15, 2007.

Present: Michael Mills, Ph.D.
Albert Zacarias, Ph.D.
Tim Guan, Ph.D.
Wayne Zundel, Ph.D.
Betty Achino, C.M.D.
David Wilson, M.S.
William J. Spanos, M.D.

Minutes from Mar, 2006 were reviewed and approved.

Old Business

1 Results of Resident Position Offer – The second choice from our last ranking, John Hegseth, accepted the position and began on July 1, 2006. John is a full Professor in physics from the University of New Orleans. He has an imaging background, but not medical imaging.
2 Joni Funseth-Smotzer did not pass the Part II Written Examination. We are working with her to design a study program to give her greater confidence and preparation for the next examination.

New Business

1 Review of Resident Progress
   a. YH Zhang: YH graduated the program on July 31, 2006. He is currently working in Brookline, MA with several senior physicists. He passed Parts I and II written, and is scheduled to take the oral examination in Therapeutic Radiological Physics in June of 2007.
   b. Eric Nelson: Eric is on track to complete his residency program by May of this year. He has demonstrated competence in some special procedures, including stereotactic radiosurgery, HDR, and TomoTherapy. He has completed all of the DTT course work and testing, as well as Radiation Biology and Physics. Eric was a valuable asset to our RTT program, as he took responsibility for teaching the physics lectures. Eric demonstrated initiative and resourcefulness helping us solve some networking and IT issues. We anticipate no problems for him to complete the program and successfully complete the ABR examination process.
   c. John Hegseth: John has made some progress toward completing the Dosimetry Training Tool modules, but need encouragement to go ahead and finish them. He needs to spend more time in dosimetry finishing all of the required dosimetry planning competencies. He shows a substantial physics knowledge base, but is a little weak in the biological sciences. He performed well in the radiation physics course. He has made some progress in the machine QA competencies scheduled for the second quarter. He needs to complete an annual calibration on all equipment this semester to stay with the program. He seems to be a little behind, but at this point there is no reason for concern.

3 Ranking of Resident Applicants

Physics Residency Candidate Ranking

	Mills	**Guan**	**Zacarias**	**Achino**	**Zundel**	**Total**	
STEGER	1	1	5	1	1	9	**(1)**
LIAO	2	2	3	4	4	15	**(2)**
BOWERS	3	5	5	5	2	20	
WOCH	4	4	2	2	5	17	**(3)**
FU	5	5	1	5	5	21	
NIVEN	5	5	5	5	5	25	
VOGDS	5	3	4	3	3	18	**(4)**

Steger is by far the most qualified candidate. We plan to make an early offer to him.

4 Search for a Residency Management Tool – Michael Mills is going to start looking for an appropriate residency management tool. This tool would ideally be web-based, but could also be standalone in the department. It is possible something could be written in-house, but that would involve a substantial amount of effort. A prototype Excel-based Clinical Activity Report for the Residency Program was reviewed.

Submitted for approval,

Michael D. Mills, Chairman

Department Of Radiation Oncology
Physics Residency Committee Minutes

The annual Physics Residency Committee Meeting for the Department of Radiation Oncology was held on March 21, 2006.

Present: Michael Mills, Ph.D.
Albert Zacarias, Ph.D.
Tim Guan, Ph.D.
Wayne Zundel, Ph.D.
Betty Achino, C.M.D.
David Wilson, M.S.
William J. Spanos, M.D.

Minutes from Feb, 2006 were reviewed and approved.

Old Business

1 Results of Resident Position Offer – The second choice from our last ranking, John Hegseth, accepted the position and began on July 1, 2006. John is a full Professor in physics from the University of New Orleans. He has an imaging background, but not medical imaging.

New Business

1 Review of Resident Progress
   a. Joni Funseth-Smotzer: Joni graduated in December, and was offered a position as a staff medical physicist here in our Department. Joni has assumed some responsibility for HDR treatments and TomoTherapy DQA. She passed the part I Written ABR examination and is preparing to take Part II Written this fall. Joni was offered an abbreviated residency program since she is a trained medical dosimetrist.
   b. YH Zhang: YH continues to make progress as a resident. He passed the Part I written examination for the ABR. He has completed his coursework and is on track to finish by this September. He began our program two months late as our first choice for this position backed out of the July 1 start date the last week in June. YH has completed most competencies in machine quality assurance, dosimetry and annual calibrations. He is now fulfilling competencies in stereotactic radiosurgery, TomoTherapy DQA and HDR. He struggled a little with the brachytherapy and nuclear medicine procedures, and has yet to complete certain competencies for these.
   c. Eric Nelson: Eric has assumed some responsibility for teaching RTT students. He has completed most of the dosimetry competencies and is working on machine QA. Eric is very pleasant and seems well motivated. He does everything we request without comment and seems to be enthusiastic about the program. He has completed all coursework to date without any problems. He is making progress completing the Dosimetry Training Tool modules.

2 Ranking of Resident Applicants

Ratings by Committee Members (Achino and Zundel elected not to score candidates)

	Spanos	**Mills**	**Guan**	**Wilson**	**Zacarias**	**Zundel**
1	Figueroa	Figueroa	Figueroa	Madani	Bernadin	Figueroa
2	Madani	Hegseth	Wang	Hegseth	Figueroa	Bernadin
3	Hegseth	Madani	Bernadin	Figueroa	Madani	Hegseth
4	Bernadin	Wang	Hegseth	Bernadin	Hegseth	Wang

Total Scores:

Figueroa 9
Hegseth 18
Bernadin 19
Madani 19

Submitted for approval,

Michael D. Mills, Chairman

Physical Concepts of Radiation Oncology
Text: The Physics of Radiation Therapy, Third Edition, by Faiz M. Khan
Mondays 7:30 – 9:00 A.M., Wednesday 12:00 noon -1:30 P.M.
Monday - 4th Floor Conference Room
Wednesday, ENT Conference Room, except for the days below:
2nd floor Administrative Room - 2/13, 3/12, 4/2, 5/7, 6/4, 7/9, 8/6, 9/3, 10/1, 11/5, 12/3
Course Director: Michael D. Mills, Ph.D.

Read the assigned Chapter before class. Each class will have short review test or homework assignment. Each Lecturer will test at the end of his lecture series, **80 is passing**. A failing grade on a test will result in additional assignments and testing. Each physicist is responsible for approximately 100 pages of material, 5-7 lectures and 1-2 tests. Grading: Each Test is 10% of final grade, Final is 50% of final grade. A failing grade in the course will result in additional assignments and testing. Categories: 1 Radiation Physics and Instrumentation; 2 Radiation Protection; 3 Mathematics Pertaining to the Use and Measurement of Radioactivity

Chapter	Topic	Category	Instructor	Date
1	Structure of Matter	1	Guan	2/11
2	Nuclear Transformations	1	Guan	2/13
3	Production of X-Rays	1	Guan	2/18
4	Clinical Radiation Generators	1	Guan	2/20
4	Clinical Radiation Generators	1	Guan	2/25
5	Interactions of Ion. Radiation	1	Guan	2/27
5	Interactions of Ion. Radiation	1	Guan	3/3
6	Measurement of Ionizing Radiation	1	Guan	3/5
7	Quality of X-Ray Beams	1	Guan	3/10
8	Measurement of Absorbed Dose	1	Guan	3/12
8	Measurement of Absorbed Dose	1	Guan	3/17
Test, 1-8	Test, 1-8	1	Guan	3/19
9	Dose Distribution and Scatter Analysis	3	Zacarias	3/24
10	A System of Dosimetric Calculations	3	Zacarias	3/26
11	Treatment Planning I, Isodose Distributions	1	Zacarias	3/31
12	Treatment Planning II: Patient Data, Corrections and Setup	1	Zacarias	4/2
12	Treatment Planning II: Patient Data, Corrections and Setup	1	Zacarias	4/7
13	Treatment Planning III: Field Shaping, Skin Dose, Field Sep.	1	Zacarias	4/9
15	Brachytherapy	1	Wilson	4/14
15	Brachytherapy	1	Wilson	4/16
15	Brachytherapy	1	Wilson	4/21
15	Brachytherapy	1	Wilson	4/23
15	Brachytherapy	1	Wilson	4/28
Test 9-13, 15	Test, 9-13, 15	1	Wilson	4/30
16	Radiation Protection	2	Sowards	5/5
17	Quality Assurance	2	Sowards	5/7
14	Electron Beam Therapy	1	Mills	5/12
14	Electron Beam Therapy	1	Mills	5/14
14	Electron Beam Therapy	1	Mills	5/19
Test, 14,16,17	Test, 14, 16, 17	2	Mills/Sowards	5/21
18	TBI	1	James	5/28
19	Three-Dimensional Conformal Radiation Therapy	1	James	6/2
20	IMRT/IGRT	1	James	6/4
21	Stereotactic Radiosurgery	1	James	6/9
22	High Dose Rate Brachytherapy	1	Sowards	6/11
23	Prostate Implants	1	Sowards	6/16
Test 18-23	Test, 18-23	1	James/Sowards	6/18
	Assessment of Patient Setup and Verification	3	Zacarias/Hegseth	6/23
	Hyperthermia and Particle Therapy	1	Zacarias/Hegseth	6/25
	Imaging for Radiation Oncology	1	Mills/Steger	6/30
	Imaging for Radiation Oncology	1	Mills/Steger	7/2
Final	100 Questions, one point each	1	Mills	7/7

Radiation and Cancer Biology

For Radiation Oncology Residents 2008 Schedule

Tues & Thurs from 3:30-5:30 pm.

BCC 4th Floor Conference Room

Please note that class time is protected and the clinical faculty are aware of this. You are expected to be on time for lectures. Any absences due to vacation that conflict with test dates MUST be rescheduled well in advance of that date. On exam dates, please arrive promptly and please arrange for NO interruptions with phones/beepers on vibrate.

INSTRUCTORS: **DR. WAYNE ZUNDEL (UL – RAD. ONC.) COURSE COORDINATOR**
DR. LU CAI (UL – MEDICINE & RAD. ONC.) LECTURER
DR. WILLIAM SPANOS (UL – RAD. ONC.) LECTURER
DR. CRAIG SILVERMAN (UL – RAD. ONC.) LECTURER
DR. JOHN BECHTEL (UL – RAD. ONC.) LECTURER
DR. ANTHONY DRAGON (UL – RAD. ONC.) LECTURER
DR. EL- GHAMRY (UL – RAD. ONC.) LECTURER
DR. A. BEN JENSON (UL – PATHOLOGY) LECTURER
DR. ROBERT MITCHELL (UL –MEDICINE) LECTURER
DR. DOUG DEAN (UL–OPHTHALMOLOGY) LECTURER
DR. DONALD NERLAND (UL – PHARMACOLOGY) LECTURER
DR. W. GLENN MCGREGOR (UL – PHARMACOLOGY) LECTURER
DR. J. CHRISTOPHER STATES (UL – PHARMACOLOGY) LECTURER
DR. CHI LI (UL –MEDICINE) LECTURER
DR. SUCHETA TELANG (UL – MEDICINE) LECTURER

TEXTBOOKS: - Radiobiology for the Radiologist *(RR)*, Hall & Giaccia 6th Edition (Required).
- The Biology of Cancer *(BC)*, Robert A. Weinberg (Required, copies of the relevant chapters will be provided).
- Radiobiology Practice Examinations (compilation), Chapman et al. (Recommended).
- Current literature reviews will also be provided for each topic when available.

Recommended Ancillary Courses:

- "Radiation Biology Refresher Course for Residents in Radiation Oncology", sponsored by the Department of Radiation Oncology at the University of Maryland, Baltimore. Late April, 3 day course. Recommended for senior residents.
- The Ostler Institute Review Course for Radiation Oncology Written & Oral Boards (CME credit available).

Radiation Biology Course Goals: This course will cover the fundamentals of the biological effects of ionizing radiation in living tissues, including specific cell and tissue radiosensitivity, radiation syndromes and related effects, as well as basic biological mechanisms that bring about somatic and genetic effects. Research applications and clinical radiation biology will be highlighted.

Strategy: This course will be didactic lectures in each topic listed below followed by discussion of problems frequently seen on certification board exams.

Grading: While there will be no formal grade given for this course, five exams will be to gauge your progress and likelihood of passing the radiation biology component of your board exams. If you are able to achieve a 90% or higher on the final exam, you will be excused from radbio classes the following year provided that you challenge that year's final exam successfully (>90%).

Exam Schedule:

Exam I - September 25th, 2008.
Exam II - October 9th, 2008.
Exam III - November 11th, 2008.

Exam IV - December 16th, 2008.
Comprehensive Exam - December 18th, 2008.

I. Cell & Cancer Biology

Brief Organizational Meeting Aug. 26th **(Zundel)**

- Discussion of Syllabus
- Expectations

Molecular Biology – Techniques and Concepts *(RR: Chs. 2, 16; BC: Ch. 1)* Aug. 28th. **(Zundel)** **Molecular Biology**

- Central Dogma
- Recombinant DNA
- Cloning
- Gene Expression/Repression
- Knock-out/in
- Promotor Analysis
- Genomic Arrays
- Protein Analysis
- Other 'Omics'
- *In silico* Analysis

Signaling Pathways Impacting Radiation Sensitivity. (*RR: Ch. 17; BC: Chs. 5, 6)* Sept. 2nd. **(Mitchell)** **Cellular Signaling**

- Receptor/ligand interactions
- Phosphorylation/dephosphorylation reactions
- Major mitogenic & survival signaling pathways
- Transcriptional activation
- Radiation-induced signals
- Radiation-induced gene expression

Cell cycle *(RR: Chs. 2, 4, 17; BC: Ch. 8)* Sept. 4th. **(Dean)** **Cell Cycle**

- Cycle Overview
- Rb Pathway & Regulation
- Cyclins
- Cyclin dependent kinase inhibitors
- DNA damage sensitive checkpoints
    - G1 Checkpoint
    - G2 Checkpoint
    - Spindle Checkpoint
        - Checkpoint misregulation resulting in altered chromosome segregation (**Fukasawa 2007**).

Mechanics of Cell Death and Cell Fate (*RR: Chs. 3, 17; BC: Ch. 9)*. (**Brown & Attardi 2005**). Sept. 9th. **(Li)**

- Apoptotic death
    - Developmental and stress induced
    - Morphological and biochemical features of apoptosis
    - Molecular pathways leading to apoptosis
- Radiation-induced apoptosis in normal tissues and tumors
- Necrotic death
    - Morphological, pathological, and biochemical features of necrosis
- Mitotic death following irradiation
- Cell division post-radiation and time to clonogenic cell death
- Autophagy

- Radiation-induced senescence
- Bystander Effect

Hereditary Effects of Radiation (*RR: Chs. 2, 3, 5*) Sept. 11th. **(States)**

- Types of XRT-induced Damage **DNA Damage**
  - Assays for DNA damage
  - sucrose gradient sedimentation, neutral and alkaline filter elution, pulsed field electrophoresis (PFGE), comet assay, plasmid-based assay
  - Types of DNA lesions and numbers per cell/Gy
  - Spurs & Blobs
  - Multiply damaged sites
  - Single lethal hits and accumulated damage (inter- and intra-track)
  - Role of oxygen in the generation of damage
- Role of LET and radiation quality
- Radiation-Sensitive Syndromes **Cancer Syndromes**

DNA Repair Mechanisms (*RR: Chs. 5*) *Also need a good review(s) of DNA double-strand break repair.* Sept. 16th. **(McGregor)**

- DNA Repair **DNA Repair**
  - Classes of DNA Repair
  - Molecular Mechanisms of DNA Repair
    - Mechanisms involved in repair of base damage and DNA single strand breaks
    - Mechanisms involved in repair of double strand breaks (**Kobayashi 2008 or similar review**).

Introduction to Molecular Cancer Biology (*RR: Ch. 17; BC: 2, 4, 7, 10, 11*) Sept. 18th. **(Zundel)**

- Tumorigenesis
- Genomic Imprinting
- Oncogenes & Tumor Suppressors
- Gatekeepers & Caretakers
- Telomeric changes in cancer
- Signaling abnormalities in cancer
- Tumor Heterogeneity
- Epigenetic changes in cancer
  - e.g. hypermethylation
- Tumor Progression
- Local Invasion
- Distant Metastases

Tumor Vasculature & Hypoxic Environment (*RR: Ch. 6, 17; BC: Ch. 13*) Sept. 23rd. **(Zundel)**

- Tumoral Hypoxia **(need a decent review here)**
  - Measurement of hypoxia
  - Direct/Indirect Effects of Tumoral Hypoxia
  - Transient and chronic hypoxia
  - Hypoxia as a factor in tumor progression
- Hypoxia-induced signal transduction
- Angiogenesis
- Tumor vasculature

****Exam I September 25th, 2008****

II. Basic Concepts & Predictive Models in Radiation Therapy (XRT)

Introduction to Radiation Biology *(RR: Ch. 1, 3, 4, 6, 7, 18, 20)* Sept. 30th **(Zundel)**

- Direct and indirect action of ionizing radiation
- Generation of free radicals
- Definition of LET and quality of ionizing radiation
- Definition of RBE
- RBE as a function of LET
- Endpoint dependence of RBE
- Models & Techniques used in Radiobiology
    - Dose Response Assays
    - Calculation of plating efficiency and surviving fraction
    - In vitro clonogenic assays
    - Effect of LET on cell survival
    - Effects of dose, dose rate, cell type
    - In vivo clonogenic assays
        - Bone marrow stem cell assays, jejunal crypt stem cell assay, skin clones, kidney tubules
    - Functional endpoints
- Oxygen Effects on Cell Survival
    - Definition of OER **OER**
    - Effect of dose, dose rate, cell type
    - OER as a function of LET
    - Impact of O_2 concentration
    - Time scale of oxygen effect
    - Mechanisms of oxygen effect
    - Reoxygenation following irradiation
- Solid Tumor Assay Systems
    - TD_{50} limiting dilution assay
    - Tumor regrowth assay
    - TCD_{50} tumor control assay
    - Lung colony assay
    - *In vitro/in vivo* assay
    - Monolayers vs. 3-D spheroid cultures

Radiation-induced Chromosomal Damage (*RR: Chs. 2, 3)*. Oct. 2nd **(Zundel)**

- Radiation-induced Chromosome Damage
    - Assays
        - Conventional smears
        - banding
        - comparative genomic hybridization (CGH)
        - FISH/SKY
    - Stable and unstable chromatid and chromosome aberrations
    - Dose response relationships
    - Use of peripheral blood lymphocytes in *in vivo* dosimetry
- Relation to Survival Curves
- Random nature of cell killing and Poisson statistics
- Doses for inactivation of viruses, bacteria, and eukaryotic cells after irradiation
- Single hit, multi-target models of cell survival
- Two component models
- An Introduction to the Linear-Quadratic Model
- Calculations of cell survival with dose
- Effects of dose, dose rate, cell type

Cell, Tissue & Tumor Kinetics in XRT (*RR: Chapters 4, 5, 21*) Oct. 7th . **(Bechtel)**

- Mitotic Index
  - Measurement of cell cycle parameters by 3H-thymidine
  - Measurement by flow cytometry, DNA staining and BrdU
  - Cell cycle synchronization techniques and uses
- Cell Cycle and Radiosensitivity
- 4 Rs of XRT
- Tissue Kinetics
- Sub-lethal damage repair
- Potentially lethal damage repair
- Half-time of repair
- Effects of dose, dose rate, and cell type
- Effect of dose fractionation
- Effect of LET
- Dose-Rate Effects
- Inverse Dose-Rate Effects
- Measuring cell cycle transition
- Potential tumor doubling time (T_{pot})
- Growth fraction
- Cell loss factor
- Cell loss
- Volume doubling times
- Growth kinetics of clinical and experimental tumors

****Exam II October 9th, 2008****

III. Classical Radiobiology

LET, RBE and α/β Ratios *(RR: Chapter 3, 7)* Oct. 14th. **(Spanos)**

- Linear Energy Transfer
- Relative Biological Effectiveness
- Linear-Quadratic Model (Linear-Quadratic Model)
- α/β Ratios

Normal Tissue Responses in XRT *(RR: Chapters 9, 13, 19)* Oct. 16th & 21st **(Silverman)**

- Responses in skin, oral mucosa, oropharyngeal and esophageal mucous membranes, salivary glands, bone marrow, lymphoid tissues, bone and cartilage, lung, kidney, testis, ovary, eye, central and peripheral nervous tissues
- Scoring systems for tissue injury
- LENT and SOMA
- Acute vs Late Responses
- Casarett's Classification of tissue sensitivity
- H & F type populations
- Radiation-induced effects of growth factors
- Tolerance
- Differences between slowly and rapidly proliferating tissues
- Molecular and cellular responses in slowly and rapidly proliferating tissues
- Regeneration
- Remembered dose

- Functional subunits
- Mechanisms underlying clinical symptoms
- Latency
- Inflammatory changes
- Cell killing
- Radiation fibrosis
- Vascular damage
- Volume effects
- Pharmacological modification of XRT responses (Normal tissue radioprotection)
- Cataractogenesis

Total Body Irradiation *(RR: Chapter 8)* Oct. 23rd. **(El-Ghamry)**

- Acute Radiation Syndrome
- Early Lethal Effects
- Prodromal radiation syndrome
- Cerebrovascular syndrome
- Gastrointestinal syndrome
- Hematopoietic syndrome
- Mean lethal dose and dose/time responses
- Immunological effects
- Assessment and treatment of radiation accidents or terrorism
- Bone marrow transplantation

ASTRO – October 28th – November 1st

Therapeutic Ratio *(RR: Chapter 18)* Nov. 4th. **(Bechtel)**

- Tumor control probability (TCP) curves
    - Calculation of TCP
    - Factors affecting shape and slope of TCP curves
    - Influence of tumor repopulation/regeneration on TCP
- Normal tissue complication probability (NTCP) curves
- Influence of normal tissue regeneration on responses
- Response of subclinical disease
- Causes of treatment failure
- Factors determining tissue tolerance
- Normal tissue volume effects
- Dose-volume histogram analysis
- Effect of adjuvant or combined treatments on therapeutic ratio

Time, Dose & Fractionation (*RR: Chapter 3, 22)*. Nov. 6th. **(El-Ghamry)**

- The 4 R's (Effect of time)
- Fractionated vs single dose
- Strandquist plot & the Ellis nominal standard dose system
- Fractionation size/time and the influence on early- and late-responding tissues
- Accelerated repopulation
- Therapeutic Ratio (Effect of tissue/tumor types on α/β ratios & responses to dose fractionation)
- Power-Law Models
- Target-Cell Hypothesis
- Quantitation of multifraction survival curves
- Effects of multifraction survival curves on the Linear-Quadratic Model

- BED and isoeffect dose calculations

****Exam III November 11th, 2008****

IV Adjuvant XRT Therapies and Exposure Considerations

Tumor Pathology *(BC: 16.0-16.2)* Need a really good review or chapter. Nov. 13th **(Jenson)**

- Genetic Abnormalities in XRT-treated Cancers (website - Cancer staging, Epidemiology)
- Correlations between Oncogene/Tumor Suppressor Expression & XRT Sensitivity
- Biomarkers of XRT-sensitivity
- Hypoxic Biomarkers
- Molecular profiling and staging of cancer
    - Gene expression profiling
    - Proteomics

Radiosensitizers, Bioreductive drugs, Radioprotectors *(RR: Chapter 25)* Nov. 18th. **(Zundel)**

- Tumor radiosensensitization
    - Halogenated pyrimidines, nitroimidazoles Radiation Sensitizers
- Hypoxic cell cytotoxins
    - tirapazamine
- Mechanisms of action, sulfhydryl compounds, WR series, dose reduction factor (DRF)
- Biological response modifiers Radiation modulators

Predictive Assays *(RR: Chapter 23)*

- Intrinsic Radiosensitivity
- Hypoxic content
- Proliferation
- Repair capacity

Chemotherapeutic agents and radiation therapy *(RR: Chapter 5, 27)* Nov. 20th. **(Nerland)**

- Classes of agents & mechanisms of action (Chemotherapy drugs)
    - Alkylating agents
    - Antibiotics
    - Antimetabolites
    - Nucleoside analogs
    - Vinca Alkaloids
    - Taxanes
    - Miscellaneous agents
    - Topo inhibitors
    - Enzyme Inhibitors
    - Endocrine drugs
    - Cytokines and immunomodulators
- Dose-Response relationships
- Sublethal & Potentially Lethal Damage Repair
- Chemotherapy combinations
- The oxygen effect in chemotherapy
- Multiple drug resistance
- Interactions of chemotherapeutic agents with radiation therapy (chemoradiation therapy)

Happy Thanksgiving Holiday – November 25th

Alternative Modalities *(RR: Chapters 24)* Nov. 27th **(Dragon)**

- BNCT
- Fast Neutrons
- Proton Beam (Proton Therapy)
- Carbon Ions
- Stereotactic radiosurgery/radiotherapy
- IORT
- Radioimmunotherapy
- Photo Dynamic Therapy
- Ultrasound

Brachytherapy *(RR: Chapters 5)* Nov. 27th **(Dragon)**

- Dose rate effects (HDR and LDR)
- Choice of isotopes
- Interstitial and intracavitary use
- Radiolabeled antibodies
- BED and Isoeffective dose calculations

Low dose radiation Need a really good review or chapter Dec. 2nd. **(Cai)**

Hyperthermia (Zundel) *(RR: Chapter 28)* Dec. 4th. **(Zundel)**

- Delivery modalities
- Cellular response to heat
- Heat shock proteins
- Thermotolerance
- Response of tumors and normal tissues to heat
- Combination with radiation therapy

Therapeutic targets and novel strategies *(RR: Chapter 26; BC: Ch. 16.2-16.16)*

- It's still all about the target,…
- Nanodevices
- Monoclonals
- Small molecule inhibitors
- Gene therapy
- Immunotherapy

Radiation Exposure & Protection *(RR: Chapter 10, 11, 14, 15)* Dec. 9th. **(Cai)**

- Definitions and Stages of Carcinogenesis
- Sources of human data
- Stochastic and deterministic effects
- Latent Period
- Specific malignancies
- Risk Estimates
- Calculations based on risk estimates
- Effective dose - relative weighting factors (W_r)
- Equivalent dose – tissue weighting factor
- Committed dose
- Collective exposure dose
- Dose limits for occupational and public exposure
- Hereditary Effects of Mutation
- Single gene mutation
- Chromosome aberrations
- Relative vs. absolute mutation risk

- Doubling dose
- Heritable effects in humans
- Risk estimates for hereditable effects
- ICRP and NCRP
- Dose response for radiation-induced cancers
- Importance of age at exposure and time since exposure
- Malignancies in prenatally exposed children
- Second tumors in radiation therapy patients
- Risk estimates in humans
- Risk when G2/M is compromised

Radiation Teratology – *(RR: Chapter 12)*. Dec. 11th. **(Telang)**

- Effects on developing embryo and fetus
- Intrauterine death
- Congenital abnormalities and neonatal death
- Microcephaly, mental retardation
- Growth retardation
- Dose, dose rate, and stage in gestation
- Human experience of pregnant women exposed to therapeutic dose

****Exam IV December 16th, 2008****

****Comprehensive Exam. December 18th, 2008****

Useful Websites:

- Web-Rad-Train (Practice Exam from Hall website)
- http://radonc.wikidot.com/ (A very useful and amusing blog from an escapee of a RadOnc Residency)
- http://www.uic.edu/com/uhrd/manual/Contents.html (Course notes MJ Blend)
- Cancer Mortality Maps & Graphs Web site – provides interactive maps, graphs text, tables and figures showing geographic patterns and time trends of cancer death rates for more than 40 cancers.

Ongoing Clinical Trials

- http://www.cancer.gov/clinicaltrials
- http://www.nccn.org/clinical_trials/default.asp
- Medical Oncology Clinical Trials - Stanford
- Radiation Oncology Clinical Trials - Stanford

RadBio-related Organizations

- American Association for Cancer Research
- Radiation Research Society
- Radiological Society of North America
- ASTRO

Course Module Titles

1. Fundamentals of the Medical Management of Cancer
2. Anatomy for Medical Dosimetrists
3. Radiobiology for Medical Dosimetrists
4. Fundamentals of Radiation Safety
5. Physics Fundamentals for Radiation Therapy
6. Production of Teletherapy Radiation
7. Sources for Brachytherapy Radiation
8. Introduction to Radiological Imaging
9. Dosimetry Instrumentation
10. Measurement of Dose in Radiation Oncology
11. Introduction to Teletherapy Dose Calculations
12. Introduction to Brachytherapy Dose Calculations
13. Introduction to Teletherapy Treatment Planning
14. Brachytherapy Treatment Planning
15. Practice Dosimetry Problems
16. Radiographic and Virtual Simulation
17. Treatment Planning for Three-Dimensional Conformal Radiotherapy
18. High Dose-Rate Brachytherapy
19. Treatment Planning for Seed Implants
20. Treatment Planning for Stereotactic Radiosurgery
21. Treatment Planning for Intensity-Modulated Radiotherapy
22. Dosimetric Quality Assurance for Radiation Oncology
23. Professional Issues for Medical Dosimetrists
24. Basic Math Skills for Dosimetry

Appendix D – Program Graduates

Reverse Chronological List of Residency Program Graduates – Past 10 Years

Name	Time in Program (m)	Supervisor	Current Occupation	Board Certification
Jodi Daves, MS	21	Michael Mills	Medical Physicist	Yes
Albert Zacarias, PhD	12	Michael Mills	Medical Physicist	Yes
Joni Funseth, MS	18	Michael Mills	Medical Physicist	In progress
Yinghui Zhang, PhD	24	Michael Mills	Medical Physicist	Yes
Eric Nelson, PhD	24	Michael Mills	Medical Physicist	In progress
John Hegseth	24	Michael Mills	Medical Physicist	In progress

Appendix E – Staff Biographical Sketches and Primary Clinical Interest in alphabetical order

Elizabeth Achino, BS, CMD	Dosimetry Supervisor, IGRT
John Bechtel, MD	Lung
Mellonie Brown, MS	RTT and Dosimetry Program Director, IGRT
Anthony Dragun, MD	Breast
Moataz El-Ghamry, MD	Brachytherapy
John Corey Gavin, BS, CMD	IGRT
Tim Guan, PhD	Stereotactic Radiosurgery
Joel Handley, MS	Brachytherapy
Joshua James, MS	TomoTherapy
Baby Jose, MD	Prostate
Michael Mills, PhD	Residency Program Director, IGRT
Lynn Osborne, CMD	IGRT Planning
Craig Silverman, MD	Stereotactic Radiosurgery
Keith Sowards, MS	HDR Brachy and Prostate Brachy
William Spanos, MD	Department Chairman, H&N Cancer
Judith Turner, BS, CMD	IGRT Planning
David Wilson, MS	Brachytherapy and electrons
Albert Zacarias, PhD	IGRT and Respiratory Gating
Wayne Zundel, PhD	Radiation Biology

Biographical Sketch – Elizabeth Achino, BS, CMD

Academic Appointments:	N/A
Clinical Appointments:	Chief of Medical Dosimetry, Brown Cancer Center
Role in Residency Program:	Mentor for medical dosimetry
Committee:	Physics Residency Committee Member
Rotation Mentor:	Support Mentor Junior Resident Fall Semester in medical dosimetry
Education:	BA, Biology Spalding College
Post Graduate Training:	N/A
Certification:	Certified in Medical Dosimetry (MDCB), August 1988

Clinical Responsibilities:	IMRT/IGRT Treatment planning
Research Interests:	N/A
Inter & Extra-mural Support:	N/A
Research: Summary	N/A
Selected Publications:	N/A

Biographical Sketch – John H Bechtel, M.D.

Academic Appointments:	Assistant Professor, University of Louisville
Clinical Appointments:	Radiation Oncologist, Brown Cancer Center
Role in Residency Program:	Core Curriculum Lecturer, Primary Physician Support for Physics Residents
Committee:	Physics Residency Committee
Rotation Mentor:	N/A
Education:	M.D., University of Missouri-Columbia School of Medicine
Post Graduate Training:	Residency, University of North Carolina, Chapel Hill
Certification:	ABR Certification in Radiation Oncology, 2005
Clinical Responsibilities:	Lung, IGRT, HDR
Research Interests:	N/A
Inter & Extra-mural Support:	N/A
Research: Summary	N/A

Selected Publications:

1 Stinchcombe TE, Morris DE, Moore DT, Bechtel JH, Halle JS, Mears A, Deschesne K, Rosenman JG, Socinski MA. “Post-chemotherapy gross tumor volume is predictive of survival in patients with stage III non-small cell lung cancer treated with combined modality therapy.” Lung Cancer. 2006Apr;52(1):67-74.

2 Bechtel J and Tepper J. "Adjuvant radiation therapy of patients with rectal cancer" Clinical Colorectal Cancer. 2003 Feb;2(4):213-22.

Biographical Sketch – Mellonie Fisher Brown, CMD, R.T.(T.)

Academic Appointments:	None
Clinical Appointments:	Program Director for Radiation Therapy School and Medical Dosimetrist
Role in Residency Program:	Mentor for medical dosimetry
Committee:	None
Rotation Mentor:	Support Mentor Junior Resident Fall Semester in medical dosimetry
Education:	BS, Biology; BS, Radiation Therapy, Medical University of South Carolina
Post Graduate Training:	MS in Educational Technology, Boise State University expected December 2008
Certification:	Registered in Radiation Therapy (ARRT), May 1990 Certified in Medical Dosimetry (MDCB), August 1993
Clinical Responsibilities:	IMRT/IGRT Treatment planning
Research Interests:	N/A
Inter & Extra-mural Support:	N/A
Research: Summary	N/A
Selected Publications:	N/A

Biographical Sketch – Anthony E. Dragun, M.D.

Academic Appointments:	Assistant Professor, University of Louisville
Clinical Appointments:	Radiation Oncologist, Brown Cancer Center
Role in Residency Program:	Core Curriculum Lectures
Committee:	N/A
Rotation Mentor:	N/A
Education:	M.D. MCP-Hahnemann University School of Medicine
Post Graduate Training:	Residency, Medical University of South Carolina
Certification:	ABR – Radiation Oncology 2008
Clinical Responsibilities:	Breast, IGRT Prostate, HDR, LDR and Stereotactic
Research Interests:	N/A
Inter & Extra-mural Support:	N/A
Research: Summary	N/A

Selected Publications:

1 **Dragun AE**, Jenrette JM, Pope TL *et al*. Mammographic surveillance after MammoSite breast brachytherapy: architectural patterns and additional interventions. *Am J of Clin Oncol.* 2007; 30(6).

2 **Dragun AE**, Jenrette JM, Harper JL *et al*. Predictors of Cosmetic outcome following MammoSite breast brachytherapy. *International Journal of Radiation Oncology*Biology*Physics.* 2007; 68(2): 354-58

3 **Dragun AE.** Accelerated Partial-Breast Irradiation: A Viable Choice. *RT-Image* 2007; 20 (37).

4 Harper JL, **Dragun AE**. Patient positioning during breast brachytherapy. *Radiation Therapist.* Spring 2007

5 Zauls JA, **Dragun AE,** Sharma AK. Intensity modulated radiation therapy for unresectable solid pseudopapillary tumor of the pancreas: a case report. *Am J of Clin Oncol* 2006; 29(6):639-640.

6 Bhandari RN, **Dragun AE,** Aguero EG, *et al.* External beam radiotherapy for perirectal angiomyxoma results in dramatic clinical response and allows a patient to avoid abdominoperineal resection. *Am J of Clin Oncol* 2006; 29(3): 318-319.

7 **Dragun AE,** Aguero EG, Harmon JF, *et al.* Chest wall dose in MammoSite breast brachytherapy: radiobiologic estimations of late complication risk based on dose-volume considerations. *Brachytherapy* 2005; 4 (4): 259-63.

8 Vu KN, **Dragun AE**, Cole DJ *et al*. Accelerated partial breast irradiation using the MammoSite breast brachytherapy technique: a multidisciplinary approach to breast conservation therapy. *Commun Oncol* 2005; 2: 477-90.

9 **Dragun AE,** Harmon JF, & Aguero EG. Defining the target and protecting normal tissue in inverse-planned intensity-modulated radiation therapy (IMRT) for head and neck, prostate and gynecologic cancers: a comparative review. *Commun Oncol* 2005; 2:299-306.

Biographical Sketch – Moataz N. El-Ghamry, M.D.

Academic Appointments:	Assistant Professor, University of Louisville
Clinical Appointments:	Radiation Oncologist, Brown Cancer Center
Role in Residency Program:	Core Curriculum Lectures
Committee:	N/A
Rotation Mentor:	N/A
Education:	M.D., University of Alexandria, Alexandria, Egypt
Post Graduate Training:	Residency, Ohio State University
Certification:	ABR Radiation Oncology, July 2008

Clinical Responsibilities:	HDR and LDR Brachytherapy
Research Interests:	Prostate LDR Brachytherapy
Inter & Extra-mural Support:	N/A
Research: Summary	Treatment of Rectal Cancer

Selected Publications:

1 Ho, P. et al: Repair with collagen tubules linked with brain-derived neutrophic factor and ciliary neutrophic factor in rat sciatic nerve injury model. Arch Otolaryngology H&N Surg. 124(7), 1998.

2 El-Ghamry, M., Willett C.: Local excision and postoperative radiation therapy for rectal cancer. Seminars Colon & Rectal Surg. 12(4):209-13, 2001.

3 Biographical Sketch – John Corey Gavin, CMD, R.T.(T.)

Academic Appointments:	None
Clinical Appointments:	Medical Dosimetrist
Role in Residency Program:	Mentor for medical dosimetry
Committee:	None
Rotation Mentor:	Support Mentor Junior Resident Fall Semester in medical dosimetry
Education:	AS in Radiologic Technology, University of Louisville, 1996
	BS in Health Arts, University of St. Francis, 2001
Post Graduate Training:	Trainee in Medical Dosimetry, University of Louisville Hospital, 2002
Certification:	Registered in Radiation Therapy (ARRT), May 1997 Certified in Medical Dosimetry (MDCB), August 2002
Clinical Responsibilities:	IMRT/IGRT Treatment planning
Research Interests:	N/A
Inter & Extra-mural Support:	N/A
Research: Summary	N/A
Selected Publications:	N/A

Biographical Sketch – Yuhua Timothy Guan, PhD

Academic Appointments:	Clinical Associate Professor, Radiation Oncology
Clinical Appointments:	Physicist, Brown Cancer Center
Role in Residency Program:	Mentor for Stereotactic and HDR training
Committee:	Member of Physics Residency Committee
Rotation Mentor:	Primary mentor Senior Resident Fall Semester in Stereotactic

Fall Second Year

Education:	PhD, 1986, Texas Tech University, Lubbock, Texas
Post Graduate Training:	Postdoctoral Research Associate, Brown Cancer Center, 1991 - 1993.
Certification:	American Board of Radiology in Therapeutic Radiological Physics, 1996
Clinical Responsibilities:	Primary physicist: stereotactic radiosurgery, Tomotherapy & HDR brachytherapy
Research Interests:	Stereotactic radiosurgery
Inter & Extra-mural Support:	N/A
Research: Summary	N/A

Selected Publications:

1 Y. Guan and C. R. Quade, "Curvilinear Coordinate Formulation for -Rotation-Large Amplitude Internal Motion Interactions. I. The General Theory", J. Chem. Phys., 84, 5624 (1986).
2 Y. Guan and C. R. Quade, "Curvilinear Coordinate Formulation for Vibration-Rotation-Large Amplitude Internal Motion Interactions. II. Application to the Water Molecule", J. Chem. Phys., 86, 4808 (1987).
3 Y. Guan, G. C. Lynch, and D. L. Thompson, "Intramolecular Energy Transfer and Cis-Trans Isomerization of HONO", J. Chem. Phys., 87, 6957 (1987).
4 Y. Guan and D. L. Thompson, "Relaxation of Excited Normal Modes in Benzene", J. Chem. Phys., 88, 2355 (1988).
5 T. Uzer, B. MacDonald, Y. Guan, and D. L. Thompson, "Theoretical Studies of Mode Specificity in the Dissociation of Overtone-Excited Hydrogen Peroxide", Chem. Phys. Lett., 152, 405 (1988).
6 Y. Guan and D. L. Thompson, "Mode Specificity and the Influence of Rotation in Cis-Trans Isomerization and Dissociation in HONO", Chemical Physics, 139, 147 (1989).
7 Y. Guan and D. L. Thompson, "Relaxation of Excited CH Stretching Mode in Toluene", J. Chem. Phys., 92, 313 (1990).
8 Y. Guan, J. T. Muckerman, and T. Uzer, "Desorption of Vibrationally Excited Adsorbates in Competition with Relaxation: A Classical Picture", J. Chem. Phys., 93, 4383 (1990).
9 Y. Guan, J. T. Muckerman, and T. Uzer, "Desorption of Vibrationally Excited * Adsorbates in Competition with Relaxation: A Quantal Picture", J. Chem. Phys., 93, 4400 (1990).
10 Y. Guan and J. T. Muckerman, "Calculation of the Vibrational Levels of the Electronically Excited Ar-OH Using a Proposed Potential Energy Surface and Analytic Discrete Variable Representations", J. Phys. Chem., 95, 8294 (1991).
11 T. Y. Guan, P. R. Almond, H.C. Park, R.D. Lindberg, C.B. Shields: Image of Radiation Dose for Stereotactic Radiosurgery, Medical Dosimetry, 18(3):135-142, (Fall,1993).
12 Zhigang Xu, Hui Li, P.R. Almond, and T.Y. Guan: Verification of absorbed dose determined with plane-parallel chambers in clinical electron beams following AAPM Task Group 39 protocol using ferrous sulphate dosimetry. Medical Physics. Vol. 23-3, 377 (1996).

Biographical Sketch – Joel Handley, MS

Academic Appointments:	N/A
Clinical Appointments:	Physics Assistant, Department of Radiation Oncology, Brown Cancer Center
Role in Residency Program:	Support Brachytherapy Mentor
Committee:	None
Rotation Mentor:	Support Mentor Senior Resident, Fall and Spring Semesters in Brachytherapy
Education:	BS Physics, University of Kentucky, 2002
	MS Physics, University of Kentucky, 2006
Post Graduate Training:	OJT Trainee in Therapy Physics, Brown Cancer Center
Certification:	N/A
Clinical Responsibilities:	LDR Brachytherapy, Unsealed source radiation therapy
Research Interests:	N/A
Inter & Extra-mural Support:	N/A
Research: Summary	N/A
Selected Publications:	N/A

Biographical Sketch – Joshua A. James, MS

Academic Appointments:	N/A
Clinical Appointments:	Physicist, Brown Cancer Center
Role in Residency Program:	Mentor for TomoTherapy
Committee:	N/A
Rotation Mentor:	Support Mentor Senior Resident Fall Semester TomoTherapy
	Support Mentor Junior Resident Spring Semester
Education:	BS Physics, Western Kentucky University 2003
	MS Medical Physics, University of Wisconsin, Madison, 2005
Post Graduate Training:	N/A
Certification:	Passed ABR Part 1
Clinical Responsibilities:	TomoTherapy, Intraoperative Radiotherapy, Stereotactic
Research Interests:	N/A
Inter & Extra-mural Support:	N/A
Research: Summary	N/A

Selected Publications:

1 JD Fenwick, WA Tome, HA Jaradat, SK Hui, JA James, JP Balog, CN DeSouza, DB Lucas, GH Olivera, TR Mackie, BR Paliwal. "Quality Assurance of a Helical Tomotherapy Machine." *Phys. Med. Biol.* 49 (2004) 2933-2953

2 MW Kissick, J Fenwick, JA James, R Jeraj, JM Kapatoes, H Keller, TR Mackie, G Olivera, ET Soisson. "The Helical Tomotherapy Thread Effect." *Medical Physics.* 32:5 (May 2005) 1414-1423

3 SA Boswell, R Jeraj, KJ Ruchala, GH Olivera, HA Jaradat, JA James, A Gutierrez, D Pearson, G Frank, TR Mackie. "A Novel Method to Correct for Pitch and Yaw Patient Setup Errors in Helical Tomotherapy." *Medical Physics.* 32:6 (June 2005) 1630-1639

Biographical Sketch – B. Oliapuram Jose, M.D.

Academic Appointments:	Professor, University of Louisville
Clinical Appointments:	Radiation Oncologist, Brown Cancer Center
Role in Residency Program:	Core Curriculum Lectures
Committee:	N/A
Rotation Mentor:	N/A
Education:	(M.B.B.S.) from Medical College Kottayam, University of Kerala, India
Post Graduate Training:	Radiation Oncology Residency, University of Wisconsin, Madison
Certification:	ABR Therapeutic Radiology, 1978
Clinical Responsibilities:	Prostate, Lung
Research Interests:	Prostate

Inter & Extra-mural Support:

1. The University of Pittsburgh Subcontract under NIH Contract N01-CB-23867. NASBP: The Treatment of Primary Breast Cancer. Subcontract #7666-140 (Protocol B-06), Co-PI, 1980.

2. The University of Pittsburgh Subcontract under NIH Contract #n01-77177-NSABP, Colo-rectal Protocol. Subcontract #39926-87. (Protocol R-01), Co-PI, 1980.

3. SECSG - Cooperative Agreement. **Dr. Jose (Co-PI)** was the Coordinating Radiation Oncologist for SECSG which is a multi-institutional group and the University of Louisville was receiving a grant from this group, 1982.

4. A multi-center maintenance study with pilocarpine for the relief of xerostomia. Khan, Z., **Jose, B. (Co-PI)** and Barr, C. MGI Pharmaceuticals, Inc., 1991, $34,860.

5. A comparison study of the use of RSR13 in patients receiving cranial radiation for glioblastoma multiforme, $19,994. Allos Therapeutics, 8/2000. Spanos WJ, **Jose B.O**., **(Co-PI),** Paris KJ.

6. Funding from Novoste for use of Beta Cath System in Clinical Phase III trial to prevent re-stenosis in coronary arteries. **Jose BO (Co-PI),** Spanos WJ, 2003.

7. Comparison of IntraOperative MRI-Guided Procedures to Standard Procedures. National Institute of Health Grant. Thomas M. Moriarty, M.D.; John Harpring, M.D., George Raque M.D., Gregory Postel, M.D., Ronaldy D. Caruso, M.D., Brian Aronson, M.D, Albert Seo, M.D., T. Jeffery Wieman, M.D., Celia Chao, M.D., Michael Edwards, M.D., B. **Oliapuram Jose, M.D. (Co-PI)** NIH Grant August 2001, $1,300,000.

8. American College of Radiology National Clinical Trials to Test Effectiveness of Treatment Modalities on Cancer in Humans, Kristie J. Paris, M.D., **B. O Jose, M.D. (Co-PI),** William J. Spanos, M.D. $19,925, 1998.

Research: Summary

Prostate therapies with image guided radiotherapy.

Selected Publications:

1. **Jose B**, Duncan A, Lindberg RD, Spanos Jr. WJ, Paris KJ: Glioblastoma multiforme in adults - results of treatment. J Ky Med Assn, 88:650-652, Dec 1990.

2. **Jose B**, Banis J, Flynn M, Lindberg RD, Spanos Jr. WJ, Paris KJ: Irradiation and free tissue transfer in head and neck cancer. Head and Neck, 13:784-787, May/June 1991.

3. Paris KJ, Spanos Jr. WJ, Day TG, **Jose B**, Lindberg RD: Incidence of complications with mini vaginal culpostats in carcinoma of the uterine cervix. Intl J Rad Oncol Biol Phys, 21:(4)911-917, Sept 1991.

4. Spanos Jr. WJ, Day TG, Abner A, **Jose B**, Paris KJ, Pursell S: Complications in the use of intra-abdominal P-32 for ovarian carcinoma. Gyn Oncol, 45:243-247, June, 1992.

5. Paris K, Spanos Jr. WJ, Lindberg RD, **Jose B**: Phase I-II study of multiple daily fractionation for palliation of advanced head and neck malignancies. Int J Rad Oncol Biol Phys, 25:657-660, March, 1993.

6. **Jose B**, Lindberg RD, Paris KJ, Spanos Jr. WJ: Irradiation in the management of anal carcinoma. J Ky Med Assn, 91:236-241, June, 1993.

7. Spanos Jr. WJ, Day T, **Jose B**, Paris KJ, Lindberg RD: Use of P-32 in stage III epithelial carcinoma of ovary, Gyn Oncol, 54:35-39, 1994.

8. Butler D, **Jose B**, Lindberg RD, Paris KJ, Spanos Jr., WJ: Pediatric astrocytoma -The Louisville Experience: 1978-1988. Am J Clin Oncol, 17(6)475-479, 1994.

9. **Jose B**, Lindberg RD, Spanos Jr. WJ, Paris KJ: Use of Magnetic Resonance Imaging (MRI) in Central Nervous System Tumors. J of KY Med Assn, 93:88-92, March 1995.

10. Tisdale B, Paris KJ, Lindberg RD, **Jose B**, Spanos WJ - Radiation Therapy for Pancreatic Cancer: A retrospective study of the University of Louisville experience, Southern Medical Journal 88(7):741-744, July 1995.

11. Seither RB, **Jose B**, Paris KJ, Lindberg RD, Spanos Jr., WJ: Results of irradiation in patients with high-grade gliomas evaluated by magnetic resonance imaging, Am J of Clin Oncol 18(4):297-299, August 1995.

12. Butler D, Lindberg RD, **Jose B**, Paris KJ, Spanos Jr., WJ: Adult Wilms' tumor - case report and review of the literature, J of KY Med Assn, Vol 95, May '97, P. 191-196.

13. Bradford W, **Jose B**, Butler D, Lindberg RD, Paris KJ, Spanos Jr., WJ, Patel C.C., Bertolone SJ: Rhabdomyosarcoma - ten year review. J of KY Med Assn, 96:399-402, October 1998.

14. **Jose B**, Bailen JL, Albrink FH, Steinbock GS, Cornett MS, Benson DC, Schmied WK, Medley RN, Spanos WJ, Paris KJ, Koerner PD, Gatenby RA, Wilson DL, Meyer R, Brachytherapy in Early Prostate Cancer - Early Experience , J of KY Med Assn 97:12-19, January 1999.

15. Butler DF, Bolton ME, Spanos WJ, Day TG, Paris KJ, **Jose BO**, Ackerman DM, Cornett MS, Lindberg RL: Retrospective Analysis of Patients With Primary Fallopian Tube Carcinoma. J of KY Med Assn, 97:154-164, April 1999.

16. Butler D, Lindberg RD, **Jose B**, Paris KJ, Spanos WJ, Goldsmith J - Analysis Of Late Effects Of Radiation Therapy In Pediatric CNS Tumor - J of KY Med Assn, 97:463-471, October 1999.

17. Mills MD, Spanos WJ, **Jose BO**, Kelly BA, Brill JP: Preparing a cost analysis for the section of medical physics—guidelines and methods, J of Appl Clin Med Phys 1(2)76-85, March 2000.

18. Robinson, KA, et al Results of BETACATH TRIAL, Multi-center trial, randomized multi-center trial for radiation vs. sham radiation in patients with de novo re-steonosis after angioplasty (Participating trial) Vascular Radiotherapy Monitor, 3(3)81-82, 2001.

19. Randomized Trial of 90Sr/90YB Radiation vs. Placebo Control for Treatment of In-Stent Restenosis – START TRIAL, Multi-center Trial. Circulation – 106:1090-1096, 2002.

20. Carrascosa, LA, **Jose, BO**, Spanos, Jr. WJ: Synchronous primary bilateral breast lymphoma. Am J of Clin Oncol, 27(6):635, 2004.

21. **Jose, BO**, Koerner P, Spanos Jr, WJ, Paris KJ, et al: Pediatric Hodgkin's Disease, J of KY Med Assn 102(3):104-106, March 2004.

22. **Jose BO**, Bradford, W, Koerner P, Paris KJ , Spanos Jr, WJ, et al: Hodgkin's Lymphoma in Adults – Clinical Features, J of KY Med Assn, 103:15-17, January 2005.

23. Minor GI, Yashar CM, Spanos Jr, WJ, **Jose BO**, Silverman CL, et al: The relationship of radiation pneumonitis to treated lung volume in breast conservation therapy, Breast Journal, 12(1):48-52, January-February 2006.

Biographical Sketch – Michael D. Mills, PhD, MSPH

Academic Appointments:	Associate Professor (Tenure) University of Louisville
Clinical Appointments:	Chief of Physics, Brown Cancer Center
Role in Residency Program:	Program Director, Mentor for Professional and Administrative Training
Committee:	Chair of Physics Residency Committee
Rotation Mentor:	Primary Mentor: Senior Resident Spring Semester Professional/Administrative
Education:	BS Physics, Georgia Institute of Technology, 1974
	MS Applied Nuclear Science, Georgia Institute of Technology, 1975
	PhD Biomedical Sciences, University of Texas, Houston, 1980
	MS Public Health, University of Louisville, 2002
Post Graduate Training:	Postdoctoral Research Assistant, MD Anderson Cancer Center, 1980-81
Certification:	ABR Therapeutic Radiological Physics, 1983
	ABR Diagnostic and Medical Nuclear Physics, 1991
	ABMP, Radiation Oncology Physics, 1992
Clinical Responsibilities:	Chief of Physics for all routine and special procedures
Research Interests:	Cost-effectiveness of radiotherapy, solid modulator IMRT

Inter & Extra-mural Support:

1 CA-06294, Co-Investigator, Significance of heterogeneity corrections in electron beam treatment planning using CT Scans, 1986-1991, National Cancer Institute, $215,199.
2 NCI Contract CM-57775-21, Co-Investigator, Evaluation of high energy electron external beam treatment planning, 1986-1989, National Cancer Institute $516,000.
3 PCF # 00-930, Co-Project Director, Evaluation of the vascular effects of single treatment dose of Gadolinium Texaphyrin, 2000-2001, Pharmacyclics, Inc. $11,689.
4 PCF # 01-307, Principal Investigator, Shielding assessment of a mobile electron accelerator for intraoperative radiotherapy, 2000-2001, Intra-Op, Incorporated. $22,044.
5 PCF # 03-0154, Co-Project Director, Is X-irradiation a viable therapy for spinal cord injury? Kentucky Spinal Cord Injury Research Trust, 2003-2005, $298,362.
6 Project Director, Development of a radiation oncology terminology and a cost effectiveness tool for evaluation of new radiation oncology technology – funded by TomoTherapy Corporation 7/05, 2005-2006, $100,000.

Research: Summary

My career interests have included: Determination of neutron spectrum and dose for leakage neutrons produced in high-energy linear accelerators, demonstration of the molecular basis for radiation-hyperthermia cell killing synergy, and application of pencil-beam theory to the calculation of electron dose in heterogeneities using CT data. I developed a theory and algorithm to predict electron beam output factors for rectangular electron fields I evaluated the relationship between instantaneous dose rate and electron beam Relative Biological Equivalence, predicted dose to lymphoma patients treated with combination electrons and photons to minimize cord dose, and determined the exposure rate constant for an I-125 seed. In other projects, I optimized the treatment protocol for electron total scalp irradiation, designed the shielding for an operating room based electron linear accelerator for intra operative radiotherapy, and tested the current protocol for the treatment of pediatric

meduloblastoma patients by verifying the dosimetry of electron total spine irradiation abutted to lateral photon cranial fields. I participated in a collaborative NCI-contract effort to define state-of-the-art electron pencil beam treatment planning using a three dimensional treatment planning system with three dimensional heterogeneity corrections.

I am designing and implementing a new type of technology evaluation study that will be able to track cost and benefit information for emerging cancer therapeutic technologies. This informatics project is in collaboration with Dr. Robert Esterhay, MD, in the School of Public Health. The project is supported by a grant from the TomoTherapy Corporation. This project involves contributing concept-based terminologies to a public repository of information, and using this information infrastructure to build a research tool to allow real-time collection of cost, treatment and outcomes data. Ultimately, it will be possible to use this tool to perform cost-utility studies of emerging medical technologies in real time

Selected Publications:

1. McGinley PH, Wood M, Mills M, Rodriguez R: Dose levels due to neutrons in the vicinity of high energy medical accelerators. Medical Physics 3(6):397-402, 1976.
2. Mills MD, Meyn RE: Effects of hyperthermia on the repair of radiation induced DNA strand breaks. Radiation Research 87:314-328, 1981.
3. Hogstrom KR, Mills MD, Almond PR: Electron beam dose calculations. Physics in Medicine and Biology 26:445-459, 1981. [Physics in Medicine and Biology has published over 5000 articles since 1956. This article was reported as the tenth most cited article and the most cited radiation oncology article in the history of Physics in Medicine and Biology, with 199 citations. Patterson MS: Physics in Medicine and Biology top ten. Letter to the Editor. Physics in Medicine and Biology 49:L1-L4, 2004.]
4. Mills MD, Hogstrom KR, Almond PR: Prediction of electron beam output factors. Medical Physics 9(1):60-68, 1982.
5. Mills MD, Meyn RE: Hyperthermic potentiation of unrejoined DNA strand breaks following irradiation. Radiation Research 95:327-338, 1983.
6. Hogstrom KR, Mills MD, Meyer JA, Palta JR, Mellenberg DE, Meoz AT, Fields RS: Dosimetric evaluation of a pencil-beam algorithm for electrons employing a two-dimensional heterogeneity correction, International Journal of Radiation Oncology Biology Physics 10:561-569. 1984.
7. Mills MD, Hogstrom KR, Fields RS: Determination of electron beam output factors for the Therac 20. Medical Physics 12(4):473-476, 1985.
8. Sinesi C, McNeese MD, Peters LJ, Goepfert H, Mills MD: Electron beam therapy for eyelid carcinomas. Head and Neck Surgery 10(1):31-37, 1987.
9. Mills MD, Fuller LF, Zagars GK, McNeese MD: Spinal cord dose reduction using an anterior 13 MeV electron field situated between a split anterior ^{60}Co field. International Journal of Radiation Oncology Biology Physics 13(10):1571-1575, 1987.
10. Hashemi AM, Mills MD, Hogstrom KR, Almond PR: The exposure rate constant for a silver-wire ^{125}I seed. Medical Physics 15(2):228-234, 1988.
11. Mills MD, Almond PR, Boyer AL, Ochran TG, Madigan WP, Rich TV, Dally EB: Shielding considerations for an operating room based intra-operative electron radiotherapy unit. International Journal of Radiation Oncology, Biology, Physics, 18(5):1215-1221, 1990.
12. Able CM, Mills MD, Hogstrom KR, McNeese MD: Evaluation of a total scalp irradiation technique. International Journal of Radiation Oncology, Biology, Physics, 21(4):1063-1072, 1991.
13. Mills MD, Spanos WJ, Jose BO, Kelly BA, and Brill JP: Preparing a cost analysis for the section of medical physics, guideline and methods. Journal of Applied Clinical Medical Physics, Vol. 1, (2): 76-85, 2000. (Principal author)

14. King RP, Anderson RS and Mills MD: Geometry function of a linear brachytherapy source. Journal of Applied Clinical Medical Physics, Vol. 2 (2): 69-72, 2001. (Project Supervisor)
15. Mills MD, Fajardo LC, Wilson DL, Daves JL, and Spanos, WJ: Commissioning of a mobile electron accelerator for intraoperative radiotherapy. Journal of Applied Clinical Medical Physics, Vol. 2, (3): 121-130, 2001. (Principal Author)
16. Daves JL and Mills MD: Shielding assessment of a mobile electron accelerator for intraoperative radiotherapy. Journal of Applied Clinical Medical Physics, Vol. 2, (3): 165-173, 2001. (Project Supervisor)
17. Loy DN, Zhang YP, Onifer SM, Mills MD, Cao QL, Darnall JB, Fajardo LC, Burke DA, Magnuson, DSK, and Whittemore SR: Functional redundancy of ventral spinal locomotor pathways. Journal of Neuroscience, Vol. 22, (1): 315-323, 2002. (Co-PI)
18. Loy DN, Talbott JF, Onifer SM, Mills, MD, Burke DA, Dennison, JB, Fajardo LC, Magnuson DSK, and Whittemore SR: Both dorsal and ventral spinal cord pathways contribute to overground locomotion in the adult rat. Experimental Neurology, Vol 177, (2): 575-580, 2002. (Co-PI)
19. Herman MG, Mills MD, and Gillin, MT: Reimbursement versus effort in medical physics practice in radiation oncology. Journal of Applied Clinical Medical Physics, Vol. 4, (2): 178- 187, 2003.
20. Wysoczynski M., Reca R, Ratajczak J, Kucia M, Shirvaikar N, Honczarenko M, Mills M, Wanzeck J, Janowska-Wieczorek A, and Ratajczak M: Incorporation of CXCR4 into membrane lipid rafts primes homing-related responses of hematopoietic stem/progenitor cells to an SDF-1 gradient. Blood, Vol. 105, (1): 40-48, 2005.
21. May N. Tsao, MD, Minesh P. Mehta, MD, Timothy J. Whelan, M.D., David E. Morris, M.D., James A. Hayman, M.D., John C. Flickinger, M.D., Michael Mills, Ph.D., C. Leland Rogers, M.D., and Luis Souhami, M.D.: The American Society for Therapeutic Radiology and Oncology (ASTRO) Evidence-Based Review of the Role of Radiosurgery for Malignant Glioma. Int. J. Radiation Oncology Biol. Phys., Vol. 63(1):47-55, 2005.
22. T. Minesh P. Mehta, M.D., May N. Tsao, M.D., Timothy J. Whelan, M.D., David E. Morris, M.D., James A. Hayman, M.D., John C. Flickinger, M.D., Michael Mills, M.D., C. Leland Rogers, M.D., and Luis Souhami, M.D.: The American Society for Therapeutic Radiology and Oncology (ASTRO) Evidence-Based Review of the Role of Radiosurgery for Radiosurgery for Brain Metastases, Int. J. Radiation Oncology Biol. Phys., Vol 63(1):37-26, 2005.
23. Mills MD: Analysis and practical use - The Abt study of medical physicist work values for radiation oncology physics services: round II. Journal of the American College of Radiology, Vol 2(9):782-789, 2005 (Principal Author)
24. Mills MD, Spanos WJ, and Esterhay RJ: Considerations of cost-effectiveness for new radiation oncology technologies. J Am Coll Radiol Vol 3(4): 278-288, 2006. (Principal Author)
25. Beddar AS, Biggs PJ, Chang S, Ezell GA, Faddegon BA, Hensley FW, and Mills, MD: Intraoperative radiation therapy using mobile electron linear accelerators: Report of AAPM Radiation Therapy Committee Task Group No. 72. Med. Phys Vol 33(5):1476-1489, 2006.
26. Talbott JF, Cao Q, Enzmann GU, Benton RL, Achim V, Cheng XX, Mills MD, Rao MS and Whittemore SR: Schwann Cell-Like Precursor Cells Following Engraftment into the Demyelinated Spinal Cord is BMP-Dependent. Glia Vol 54:147-159, 2006.
27. Zacarias A, Balog J, and Mills M: Radiation Shielding Design of a New Tomotherapy Facility. Health Physics Vol 91(4):289-295, 2006. (Project Supervisor)
28. Mills MD, Esterhay RJ, and Thornewill J: Using a Tetradic Network Technique and a Transaction Cost Economic Analysis to illustrate an economic model for an open access medical journal. First Monday Vol 12(10):1-14, 2007. (Principal Author)

Biographical Sketch – Lynn M. Osborne CMD, R.T.(R.)(T.)

Academic Appointments:	None
Clinical Appointments:	Medical Dosimetrist
Role in Residency Program:	Mentor for medical dosimetry
Committee:	None
Rotation Mentor:	Support Mentor Junior Resident Fall Semester in medical dosimetry
Education:	RTT Program, University of Kentucky, 2000
Post Graduate Training:	N/A
Certification:	Registered in Radiation Therapy (ARRT), 2000 Certified in Medical Dosimetry (MDCB), 2004
Clinical Responsibilities:	IMRT/IGRT Treatment planning
Research Interests:	N/A
Inter & Extra-mural Support:	N/A
Research: Summary	N/A
Selected Publications:	N/A

Biographical Sketch – Craig L. Silverman, MD

Academic Appointments: Clinical Professor, University of Louisville

Clinical Appointments: Radiation Oncologist, Brown Cancer Center

Role in Residency Program: Core Curriculum Lecturer

Committee: N/A

Rotation Mentor: N/A

Education: MD, Northwestern University School of Medicine

Post Graduate Training: Residency in Radiation Oncology, Washington University School of Medicine

Certification: ABR Therapeutic Radiology, 1982

Clinical Responsibilities: Pediatric Radiation Oncology, Stereotactic Radiosurgery, Respiratory Gating

Research Interests: Stereotactic Radiosurgery

Inter & Extra-mural Support: N/A

Research: Summary N/A

Selected Publications:

1. **Silverman,C.L.**, and Marks,J.E.: "Prognostic Significance of Contrast Enhancement in Low Grade Astrocytomas of the Adult Cerebrum". Radiology 1981; 139:211-213.

2. Walker,S.J., Whiteside,L.A., McAllister,W.H., **Silverman,C.L.,** Thomas,P.R.: "Slipped Capital Epiphysis Following Radiation and Chemotherapy". Clinical Orthopedics 1981;159:186-193.

3. **Silverman,C.L.,** Thomas,P., McAllister,W., Walker,S., and Whiteside,L.: "Slipped Capital Femoral Epiphysis in Irradiated Children – Age, Dose, Volume Relationships". Int J of Rad Onc, Bio & Phys 1981; 7:1357-1363.

4. **Silverman,C.L.,** and Wasserman,T.: "Cutaneous Hodgkin's Disease". Arch of Dermatology, 1982; 118:918-921.

5. **Silverman,C.L.,** and Simpson,J.: "Cerebellar Medulloblastoma – Importance of Posterior Fossa Dose to Survival and Patterns of Failure". Int J of Rad Onc, Bio & Phys 1982;8:1869-1876.

6. **Silverman,C.L.,** and Marks,J.E.: "Epidermoid and Undifferentiated Carcinomas from Occult Primaries". Sem in Onc 1982:9:435-441.

7. **Silverman,C.L.,** Marks,J.E., Lee,F., and Ogura,J.H.: "Epidermoid and Less Undifferentiated Carcinoma Presenting in Cervical Lymph Nodes from Occult Primaries". Laryngoscope 1983:93:645-648.

8. **Silverman,C.L.,** Palkes,H., Talent,B., Koval,E., Clouse, J., and Thomas, P.: "Late Effects of Radiotherapy on Patients with Cerebellar Medulloblastoma". Cancer 1984; 54:35-40.

9. Blatt,J., Wollman,M.R., Albo,V.C., Orlando,S., and **Silverman,C.L.**:

"Recurrent Testicular Infiltrates Following Radiation Therapy for Lymphoid Malignancy". Med Ped Onc 1984;12(5):335.

10. Cook,B., Yries,J.K., Martinex,A.J. and **Silverman,C.L.**: "Malignant Fibrous Histiocytoma of the Clivus in a Two and One-Half Year Old Child". J Neurosurgery:1985;61:547-549.

11. **Silverman,C.L.,** and Marks,J.E.: "Squamous Cell Carcinomas of the Hypopharynx". Clinics in Onc 1986;5:505-524.

12. Charkes,N.D., and **Silverman,C.L.**: "Does Radiotherapy Affect Regional Bone Formation?" Ed. – J of Nucl Med 992:33(10):1780-1782.

13. Andrews,D.W., **Silverman,C.L.,** Glass,J., Downes,B., Riley,R.J., Corn, B.W., Werner-Wasik,M., Curran,W.J., McCune,C.E., Rosenwasser,R.H., Buchheit,W.A.: "Preservation of Cranial Nerve Function after Treatment of Acoustic Neurinomas with Fractionated Stereotactic Radiotherapy". Stereotact Funct Neurosurg 1995:64:165-182.

14. Glass,J., **Silverman,C.L.**, Axelrod,R., Corn,B.W., Andrews, D.W.: "Fractionated Stereotactic Radiotherapy with Cis-platinum Radiosensitization in the Treatment of Recurrent, Progressive or Persistent Malignant Astrocytoma". Amer J Clin Onc 1997;20:226-229.

15. Phan,C., Mindrum,M., **Silverman,C.L**., Paris,KJ., Spanos,WJ,Jr., : "Matched Control Retrospective Study of the Acute and Late Complications in Patients with Collagen Vascular Diseases Treated with Radiation Therapy". The Cancer Journal 2003; Vol 9, 6:461-466.

16. Kalapurakal,JA., **Silverman,CL**., Akhtar,N., etal: "Acute Hperthermia following SRS for Pituitary Adenoma", British Journal of Radiology 72(864)1218-1221,1999.

17. Kalapurakal,JA.,**Silverman,CL**.,Akhtar,N.,etal:"Improved Trigeminal and Facial Nerve Tolerance following Fractionated Stereotactic Radiotherapy for large Acoustic Neuromas, British Journal of Radiology,72:864)1202-1207,1999.

18. Kalapurakal,JA.,**Silverman,CL**.,Akhtar,N.: "Intracranial Mengiomas: Factor that influence the Development of Cerebral Edema after Stereotactic Radiosurgery and Radiation Therapy; Radiology 204(2) 461-465,1997.

19. Phan,C., Mindrum,M.,**Silverman,CL**,Paris,KJ.,Spanos,WJ: "Matched-Control Retrospective Study of the Acute and Late Complications in Patients with Collagen Vascular Diseases Treated with Radiation Therapy; The Cancer Journal, Vol 9, (6) Nov/Dec 2003.

20. Jose,BO.,Koerner,P.,Bertolone,S.,Patel,CC.,Spanos,WJ.,Paris,KJ., **Silverman,CL.**,Yashar,CM.: "Pediatric Hodgkin's Disease". J Kentucky Med Assoc; 2004;Vol 102,(3),104-107,2004.

21. Jose,BO.,Koerner,P.,Spanos,WJ.,Paris,KJ.,**Silverman,CL**.,Yashar,CM.,

Carrascosa,LA.,"Hodgkin's lymphoma in adults—clinical features". J Ky Med Assoc;Vol 103,(1),15-17,January 2005.

22. Minor,G.I.,Yashar,CM,Spanos,WJ,Jose,B.O.,**Silverman,CL**, Carrascosa,L.A.,Farmer,M.,Paris,K.J.: "The Relationship of Radiation Pneumonitis to Treated Lung Volume in Breast Conservation Therapy; The Breast Journal, Vol 12,(1)48-52,2006.

23. Cheerva,C.,Raj,A.,Bertolone,SJ.,Bertolone,K.,**Silverman,CL:** "BK Virus-associated Hemorrhagic Cystitis in Pediatric Cancer Patients Receiving High-dose Cyclophosphamide; J Pediatr Hematol Oncol, Vol 29,(9)617-621,September 2007.

Biographical Sketch – Keith T. Sowards, MS

Academic Appointments:	N/A
Clinical Appointments:	Clinical Physicist, James Graham Brown Cancer Center
Role in Residency Program:	Mentor for HDR Brachytherapy
Committee:	N/A
Rotation Mentor:	Support Mentor Senior Resident Fall and Spring Semesters HDR Brachytherapy
Education:	BS Physics, University of Kentucky 1995
	MS Health Physics, University of Kentucky 1999
Post Graduate Training:	Medical Physics Residency Program University of Kentucky 2001
Certification:	ABR Certification in Therapeutic Radiological Physics, 2005
Clinical Responsibilities:	HDR Brachytherapy, Stereotactic Radiosurgery
Research Interests:	Brachytherapy source characterization
Inter & Extra-mural Support:	N/A

Research: Summary

I have published multiple articles characterizing a number of commercially available brachytherapy sources.

Selected Publications:

1. A.S. Meigooni, K. Sowards, M. Soldano: Dosimetric Characteristics of the InterSource ^{103}Palladium Brachytherapy Source. Medical Physics 27(5), 1093-1100 (2000).

2. C. Popescu, J. Wise, K. Sowards, A.S. Meigooni, and G. S. Ibbott: Dosimetric Characteristics of the PharmaSeed TM Model BT-125-1 Source. Medical Physics 27(9), 2174-2281 (2000).

3. Ali S. Meigooni, K. Sowards, D. Gearheart: Experimental Determination of Dosimetric Characteristics of Best ^{125}I Brachytherapy Source. Medical Physics 27(9), 2168-2173 (2000).

4. D. Gearheart, A. Drogin, K. Sowards, A.S. Meigooni, and G.S. Ibbott: Dosimetric Characteristics of a New ^{125}I Brachytherapy Source. Medical Physics 27(10), 2278-2285 (2000).

5. A.S. Meigooni, S.A. Dini, K. Sowards, J.L. Hayes, and A. Al-Otoom: Experimental Determination of the TG-43 Dosimetric Characteristics of EchoSeed™ Model (6733 Brachytherapy Source. Medical Physics 29(6), 939-942 (2002).

6. A. Meigooni, K. Sowards, G. Myron: Evaluation of the QZ Veridose Patient Monitoring Phantom. Medical Dosimetry Journal 29:49-54 (2003).

7. A. Meigooni, G. Myron, K. Sowards: Evaluation of the Veridose Invivo Dosimetry System. Medical Dosimetry 27:29-36 (2002).

8. A.S. Meigooni, M.M. Yoe-Sein, A.Y., Al-Otoom, and K.T. Sowards: Determination of the Dosimetric Characteristics of InterSource ^{125}Iodine Brachytherapy Source. Applied Rad & Isotopes 56:589-599 (2002).

9. Ali S. Meigooni, Joshua Hayes, Hualin Zhang, and Keith Sowards: Experimental Determination of IsoAid ADVANTAGE™ ^{125}I Brachytherapy Source. Medical Physics 29(9):2152-2158 (2002).

10. A.S. Meigooni, Z. Bharucha, M. Yoe-Sein, and K.T. Sowards: Dosimetric characteristics of the Best® double-wall ^{103}Pd brachytherapy source. Med Phys 28(12):2568-2575 (2001).

11. K.T. Sowards, A.S. Meigooni: A Monte Carlo evaluation of the dosimetric characteristics of the Best ® Model 2301 ^{125}I Brachytherapy Source. Applied Radiation and Isotopes 57:327-333 (2002).

12. A.S. Meigooni, K.T. Sowards: A Qualitative and Quantitative Evaluation of the Dose Distribution for Prostate Implants Using Various Designs of ^{125}I and ^{103}Pd Sources. Medical Physics (In Press 2003).

13. K.T. Sowards, A.S. Meigooni: A Monte Carlo evaluation of the dosimetric characteristics of the Amersham model 6733 ^{125}I brachytherapy source. Brachytherapy Vol. 1(4):227-232 (2002).

14. K.T. Sowards: Monte Carlo Dosimetric Characterization of the IsoAid ADVANTAGE™ ^{103}Pd Brachytherapy Source. Journal of the American College of Medical Physics, Vol 8, No 2, (2007).

Biographical Sketch – William J. Spanos, MD

Academic Appointments: Professor, University of Louisville

Clinical Appointments: Chairman, Department of Radiation Oncology, Brown Cancer Center

Role in Residency Program: Clinical Director, Lecturer in Core Curriculum

Committee: Physics Residency Committee

Rotation Mentor: N/A

Education: MD, Loma Linda University

Post Graduate Training: Residency, MD Anderson Cancer Center

Certification: ABR in Therapeutic Radiology, 1977

Clinical Responsibilities: Head & Neck, Breast

Research Interests: Combination Therapies

Inter & Extra-mural Support:

Research: Summary

Selected Publications:

1. Jose B, Duncan A, Paris KJ, Lindberg RD, **Spanos Jr. WJ**: Glioblastoma multiforme in adults - results of treatment. J Ky Med Assoc, 88:650-652, December 1990.

2. Jose B, Banis J, Flynn M, Lindberg RD, **Spanos Jr. WJ**, Paris, KJ, Rohm, J: Irradiation and free tissue transfer in head and neck cancer. Head and Neck, 13:213-216, May/June, 1991.

3. Paris KJ, **Spanos Jr. WJ**, Day TG, Jose B, Lindberg RD: Incidence of complications with mini vaginal culpostats in carcinoma of the uterine cervix. Int J Rad Oncol Biol Phys, 21☹4)911-917, September 1991.

4. **Spanos Jr. WJ**, Day T, Abner A, Jose B, Paris KJ, Pursell S: Complications in the use of intra-abdominal P-32 for ovarian carcinoma. Gynecol Oncol, 45:243-247, 1992.

5. Fu KK, Cox JD, Pajak TF, Nelson DF, Sause WT, **Spanos Jr. WJ**, Russell AH, Marcial VA, Komaki R: RTOG altered fractionation trials. Congress Proceedings, 2:567-572, 1992.

6. **Spanos Jr. WJ**, Perez CA, Marcus S, Poulter CA, Doggett RLS, Steinfeld AD, Grigsby PW: Effect of rest interval on tumor and normal tissue response - a report of phase III study of accelerated split course palliative radiation for advanced pelvic malignancies RTOG-8502, Int J Rad Oncol Biol Phys, 25:399-403, February 1993.

7. Paris KJ, **Spanos Jr. WJ**, Lindberg RD, Jose B, Albrink F: Phase I-II study of multiple daily fractionation for palliation of advanced head and neck malignancies, Int J Rad Oncol Biol Phys, 25:657-660, March 1993.

8. Jose B, Lindberg RD, Paris KJ, **Spanos Jr. WJ**: Irradiation in the management of anal cancer with literature review, J Ky Med Assoc, 91:236-241, June 1993.

9. **Spanos Jr. WJ**, Day T, Jose B, Paris KJ, Lindberg RD: Use of P-32 in Stage III epithelial carcinoma of

the ovary, Gynecol Oncol, 54:35-39, July 1994.

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19. **Spanos Jr. WJ**, Pajak TJ, Emami B, Rubin, P, Cooper JS, Russell AH, Cox JD: Radiation Palliation of Cervical Cancer, J Nat'l Cancer Inst Monogr, 21:127-130, December 1996.

20. Bradford WB, Jose BO, Butler D, Lindberg RD, Paris K, **Spanos Jr, WJ**, Patel CC, Bertolone SJ: Rhabdomyosarcoma in Children-A Ten Year Review, J of KY Med Assoc 96:399-402, October 1998.

21. Jose BO, Bailen JL, Albrink FH, Steinbock GS, Cornett MS, Benson DC, Schmied WK, Medley RN, **Spanos Jr. WJ**, Paris KJ, Korner PD, Gatenby RA, Wilson DL, Meyer, R.: Brachytherapy in Early Prostate Cancer--Early Experience, J of KY Med Assoc, 97:8-12, January 1999.

22. Butler DF, Bolton ME, **Spanos Jr. WJ**, Day, Jr. TG, Paris KJ, Jose BO, Ackerman DM, Cornett MS, Lindberg RD: Retrospective Analysis of Patients with Primary Fallopian Tube Carcinoma Treated at the University of Louisville, J of KY Med Assoc, 97:154-164, April 1999.

23. Butler D, Lindberg RD, **Jose B**, Paris KJ, Spanos WJ, Goldsmith J - Analysis Of Late Effects Of Radiation Therapy In Pediatric CNS Tumor – J of KY Med Assn, October 1999.

24. Mills MD, **Spanos Jr. WJ,** Jose BO, Kelly BA, Brill JP: Preparing a cost analysis for the section of medical physics -- guidelines and methods, J of Appl Clin Med Phys, 1(2):76-85, March 2000.

25. Spencer S, Harris J, Wheeler R, Machtay M, Shultz C, **Spanos Jr. WJ,** Rotman M, and Meredith R: RTOG 96-10: Phase I Study of Reirradiation (RRT) with Concurrent Hydroxyurea (HU) and 5-Fluorouracil (FU) in Patients (PTS) with Squamous Cell Cancer of the Head and Neck (SCH&N). Int J Radiat Oncol Biol Phys, 51(5):1299-1304, 2001.

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33. Minor GI, Yashar CM, **Spanos, Jr. WJ**, Jose BO, Silverman CL et al: The relationship of radiation pneumonitis to treated lung volume in breast conservation therapy, Breast Journal 12(1):48-52, January-February 2006.

34. Carrascossa LA, Yashar CM, Paris KJ, LaRocca RVl, Faught SR and **Spanos, Jr. WJ**: Palliation of pelvic and head and neck cancer with paclitaxel and a novel radiotherapy regimen. J of Palliative Medicine 10(4):877-881, August 2007.

35. Spencer SA, Harris J, Wheeler RH, Machtay M, Schultz C, **Spanos, Jr. WJ**, Rotman M, Meredith R, Ang K: Final Report of RTOG-9610, A Multi-institutional trial of re-irradiation and chemotherapy for unresectable recurrent squamous cell carcinoma of the head and neck, Head & Neck DOI: 10.1002:281-287, March 2008.

Biographical Sketch – Judith Marie Turner, BS, CMD, R.T.(R.)(T.)

Academic Appointments:	None
Clinical Appointments:	Medical Dosimetrist
Role in Residency Program:	Mentor for medical dosimetry
Committee:	None
Rotation Mentor:	Support Mentor Junior Resident Fall Semester in medical dosimetry
Education:	BS, Interdisciplinary Studies
Post Graduate Training:	N/A
Certification:	Registered in Radiation Therapy (ARRT), 1972 Certified in Medical Dosimetry (MDCB), 1993
Clinical Responsibilities:	IMRT/IGRT Treatment planning
Research Interests:	N/A
Inter & Extra-mural Support:	N/A
Research: Summary	N/A
Selected Publications:	N/A

Biographical Sketch – David L. Wilson, MS

Academic Appointments:	Assistant Clinical Professor, Department of Radiation Oncology
Clinical Appointments:	Clinical Physicist, Brown Cancer Center
Role in Residency Program:	Mentor for IGRT and Machine Commissioning / Calibration
Committee:	Member of Physics Residency Committee
Rotation Mentor:	Support Mentor Senior Resident Fall Semester, Junior Resident Spring Semester
Education:	BS Physics, Georgia Institute of Technology, 1975
	MS Physics, University of Kentucky 1978
Post Graduate Training:	Passed PhD qualifying examination at University of Kentucky 1990
Certification:	ABR Therapeutic Radiological Physics 1986
	ABMP Radiation Oncology Physics 1992
Clinical Responsibilities:	LDR Brachytherapy, IGRT
Research Interests:	Brachytherapy, electron beam therapy

Inter & Extra-mural Support: N/A

Research: Summary

Research interests include source characterization and electron beam calculations

Selected Publications:

1. Sharma, S.C., Wilson, D.L., and Jose, B.: Variation of output with atmospheric pressure and ambient temperature for Therac-20 linear accelerator. Medical Physics 10:15, 712, 1983.
2. Sharma, S.C., Wilson, D.L. and Jose, B.: Iridium seed implantation procedures and safety guidelines. AAMD Journal VIII:4, 1983.
3. Sharma, S.C., Wilson, D.L. and Jose, B.: Dosimetry of small fields for Therac-20 electron beams. Medical Physics 11:5, 697-702, September/October 1984.
4. Sharma, S.C., Wilson, D.L. and Jose, B.: Radioactive cesium implantation procedures and safety guidelines. AAMD Journal IX:3, 14-18, 1984.
5. Dodd, D.T., George, D.I., Farman, A.G., Sharma, S.C. and Wilson, D.L.: Backscatter radiation from restorative materials during Co-60 therapy, Journal of Oral Medicine, Vol. 40:2, 72-75, 100, 1985.
6. Farman, A.G., Sharma, S.C., George, D.I., Wilson, D.L., Dodd, D., Figa, Robert, Haskell, Bruce: Backscattering from dental restorations and splint materials during therapeutic radiation. Radiology, 156:523-526, 1985.
7. Sharma, S.C., and Wilson, D.L.: Depth dose characteristics of elongated fields for electron beams from a 20 MeV accelerator. Medical Physics, 12(4):July/August, 1985.
8. Shorton, D.L., Farman, A.G., George, D.I., Sharma, S., and Wilson, D.: Radiation exposure to critical structures during transfacial and transcranial TMJ radiography. Dentomaxillofacial Radiology, 14:93-96, 1985.
9. Wilson, D.L., Sharma, S.C., Jose, B., and Lindberg, R.D.: An intracavitary cone system for electron beam therapy using Therac-20 linear accelerator. Int. J. of Radiation Oncology/Biology, Physics, 12:1007-1011, 1986.
10. Sharma, S.C. and Wilson, David L.: Dosimetric study of total skin irradiation with a scanning beam electron accelerator. Medical Physics 14(3), May/June, 1987.
11. B. Olipauram, Jose, M.D.; James L. Bailen, M.D.; Frederick H. Albrink, M.D.; Greg S. Steinbock, M.D.;

Mark S. Cornett, M.D.; David C. Benson, M.D.; William K. Schmied, M.D.; Richard N. Medley, M.D.; William J. Spanos, M.D.; Kristie J. Paris, M.D., Paul D. Koerner, M.D.; Richard A Gatenby, Ph.D., David L. Wilson, M.S.; Richard Meyer, M.S.: Brachytherapy in Early Prostate Cancer--Early Experience. Kentucky Medical Association Journal July 1999/Vol. 97, pgs. 12-16.

Biographical Sketch – Albert D. Zacarias, PhD

Academic Appointments:	Assistant Professor, Department of Radiation Oncology
Clinical Appointments:	Physicist, Brown Cancer Center
Role in Residency Program:	Mentor for IGRT, Respiratory Gating and Intraoperative Radiotherapy
Committee:	Member of Physics Residency Committee
Rotation Mentor:	Primary Mentor Junior Resident, Fall and Spring Semester
Education:	BS Physics, Concordia University, 1978
	MS Physics, University of Connecticut 1982
	PhD Physics, University of Notre Dame 1990
Post Graduate Training:	Medical Physics Resident, University of Louisville, 2003
Certification:	ABR Therapeutic Radiological Physics 2006
Clinical Responsibilities:	IGRT, Respiratory Gating, Intraoperative Radiotherapy
Research Interests:	IGRT plan optimization, Decimal solid modulators
Inter & Extra-mural Support:	N/A

Research: Summary

I developed a new method of plan optimization allowing for higher quality IGRT plans for Varian Trilogy.

Selected Publications:

1 **Zacarias AS.,** Livingston AE., Lu YN., and Ward RF., Berry HG., and Dunford RW.: Measurement of 2s-2p transition energies in helium-like and lithium-like nickel. Nucl. Instr. Meth. Physics Research B31, 41-42, 1988.

2 Lu YN., Livingston AE., **Zacarias AS.,** and Ward RF., Mazure AJ., Galvez EJ., and Engstrom L.: Structure of hydrogenic transitions in high-z beryllium-like ions. Nucl. Instr. Meth. Physics Research B31, 157-160, 1988.

3 AE., Serpa FG., **Zacarias AS.,** Curtis LJ., Berry HG., and Blundell SA.: Lifetime measurements in highly ionized silicon. Phys Rev A 44: (11) 7820-7822, 1991.

4 **Zacarias AS.,** Lane RG., and Rosen II.: Assessment of a linear-accelerator for segmented conformal radiation-therapy. Med Phys 20: (1) 193-198, 1993.

5 Bhatnagar A., Ansari NH, **Zacarias A.,** and Srivastava SK.: Digital image-analysis of cultured rat lens during oxidative stress-induced cataractogenesis. Exp Eye Res 57: (4) 385-391, 1993.

6 Livingston AE., Buttner R., **Zacarias AS.,** Kraus B., Schartner. KH, Folkmann F., and Mokler PH.: Extreme-Ultraviolet spectrum of Ne III. J Opt Soc Am B 14: (3) 522-525, 1997.

7 Lui S-Q., Jin H., **Zacarias A**., Srivastava S., and Bhatnagar A.: Binding of pyridine nucleotide coenzymes to the voltage-sensitive K+ channel. Chem Biol Interact. 2001 Jan 30;130-132(1-3):955-62.

8 Srivastava S, Dixit BL, Ramana KV, Chandra A, Chandra D, Zacarias A, Petrash JM, Bhatnagar A, Srivastava SK.,: Structural and kinetic modifications of aldose reductase by S-nitrosothiols, Biochem J. 2001 Aug 15;358(Pt 1):111-8.

9 Liu, SQ., Jin, H., **Zacarias, A.,** Srivastava, S., and Bhatnagar A.: Binding of pyridine coenzymes to the beta-subunit of the voltage-sensitive potassium channels. Chem Biol Interact. 2001 Jan 30;130-132(1-3):955-62.

10 Srivastava S, Liu SQ, Conklin DJ, **Zacarias A**, Srivastava SK, Bhatnagar A.: Involvement of aldose reductase in the metabolism of atherogenic aldehydes. Chem Biol Interact. 2001 Jan 30;130-132(1-3):563-71.

11 **Zacarias A.,** Bolanowski D, Bhatnagar A.: Comparative measurements of multicomponent phospholipid mixtures by electrospray mass spectroscopy: relating ion intensity to concentration. Anal Biochem. 2002 Sep 1;308(1):152-9.

12 Zacarias A, Balog J, Mills M.: Radiation shielding design of a new tomotherapy facility. Health Phys. 2006 Oct;91(4):289-95.

Biographical Sketch – Wayne S. Zundel, PhD

Academic Appointments:	Assistant Professor, University of Louisville
Clinical Appointments:	Radiation Biologist, Brown Cancer Center
Role in Residency Program:	Radiation Biology Lecturers
Committee:	Physics Residency Committee
Rotation Mentor:	N/A
Education:	PhD in Cancer Biology, Stanford University
Post Graduate Training:	Lecturer, Department of Radiation Oncology, Stanford University
Certification:	N/A

Clinical Responsibilities: N/A

Research Interests: Hypoxia, oxygen pathways

Inter & Extra-mural Support:

1 NIH / NCI - RO-1 2004 – 2008. Analysis of CSN5 Interaction with the HIF-α/VCB Complex and Mechanistic Characterization of HIF-α Stabilization.

2 GRID Computing Grant. Virtual screen for small molecule inhibitors of several molecular targets.

Research: Summary

Regulation of hypoxic mechanisms and their affects on cancer therapies.

Selected Publications:

1 **Zundel W**, Giaccia A. Inhibition of the anti-apoptotic PI(3)K/Akt/Bad pathway by stress. **Genes and Development** 1998 Jul 1;12(13):1941-6.

2 **Zundel W**, Swiersz LM, Giaccia A. Caveolin-1 mediated regulation of receptor tyrosine kinase-associated PI(3)K activity by ceramide. **Molecular & Cellular Biology.** 2000 Mar; 20(5):1507-14.

3 **Zundel W**, Schindler C, Koong A, Haas-Kogan D, Kaper F, Chen E, Shalev N, Ryan HE, Johnson RS, Jefferson AB, Stokoe D, Giaccia A. PTEN controls angiogenic and glycolytic gene expression by hypoxia and growth factors. **Genes and Development** 2000 Feb 15;14:341-48. (Paper alert – Current Opinion in Genetics & Development Vol. 10.3, 235-334, June 2000).

4 Bemis L, Chan DA, Finkielstein CV, Sutphin PD, Qi L, Chen X, Stenmark K, Giaccia A, **Zundel W**. Distinct Aerobic and Hypoxic Mechanisms of HIF-1 Regulation by CSN5. **Genes and Development**. 2004 Apr 1;18(7):739-44.

5 Mikus P & **Zundel W**, COPing with Hypoxia. **Seminars in Cell & Developmental Biology.** 2005 Aug-Oct;16(4-5):462-73.

6 Richardson K & **Zundel W**. The Emerging Role of the COP9 Signalosome in Tumor Progression. **Molecular Cancer Research.** 2005 Dec 1; 3(12).

7 Winner M, Koong AC, Rendon BE, **Zundel W**, Mitchell RA. Amplification of tumor hypoxic responses by macrophage migration inhibitory factor-dependent hypoxia-inducible factor stabilization. **Cancer Research** 2007 Jan 1;67(1):186-93.

8 Winner M, Leng L, **Zundel W**, Mitchell RA. Macrophage migration inhibitory factor manipulation and evaluation in tumoral hypoxic adaptation. **Methods in Enzymology** 2007 435:355-69.