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
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 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:

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

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

<table>
<thead>
<tr>
<th>Semester</th>
<th>Rotation</th>
<th>Mentors</th>
<th>Coursework</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Orientation, Room design, radiation safety, machine acceptance, calibration, commissioning and quality assurance, Treatment planning computer algorithms, commissioning, data entry and QA</td>
<td>Albert Zacarias, Ph.D. John Bechtel, M.D. Betty Achino, CMD John Gavin, CMD Judy Turner, CMD</td>
<td>Stanford Dosimetry Training Tool</td>
<td>Michael Mills, Ph.D. and Physics Faculty</td>
</tr>
<tr>
<td>Semester Year 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>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</td>
<td>Albert Zacarias, Ph.D. M. El-Ghamry, M.D. John Bechtel, M.D. Joshua James, M.S. David Wilson, M.S.</td>
<td>Radiation Physics</td>
<td>Michael Mills, Ph.D. and Physics Faculty</td>
</tr>
<tr>
<td>Semester Year 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td>IMRT/IGRT treatment planning and dosimetry measurements TBI, TSE, IORT, Stereotactic Radiosurgery, Stereotactic Body Radiotherapy, Respiratory Gating</td>
<td>Tim Guan, Ph.D. Michael Mills, Ph.D. Craig Silverman, MD Dave Wilson, M.S. Keith Sowards, M.S.</td>
<td>Core Curriculum</td>
<td>William J. Spanos, M.D. and Physician Faculty</td>
</tr>
<tr>
<td>Semester Year 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>Diagnostic equipment, information management, RSO responsibilities, administration, budgets, staffing, space,</td>
<td>Michael Mills, Ph.D. Tim Guan, Ph.D. William Spanos, M.D.</td>
<td>Radiation Biology</td>
<td>Wayne Zundel, Ph.D.</td>
</tr>
</tbody>
</table>
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 except 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

<table>
<thead>
<tr>
<th>Resident Name</th>
<th>Residency Start Date</th>
<th>Finish Date</th>
<th>Graduate Degrees, University, Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joni Funseth, M.S.*</td>
<td>July, 2003</td>
<td>December, 2004</td>
<td>Univ. of Louisville, 2003</td>
</tr>
<tr>
<td>Yinghui Zhang, Ph.D.</td>
<td>October, 2004</td>
<td>July, 2006</td>
<td>Utah State Univ., 1998</td>
</tr>
</tbody>
</table>

*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:

<table>
<thead>
<tr>
<th>Resident Name</th>
<th>Residency Start Date</th>
<th>Anticipated Finish Date</th>
<th>Graduate Degrees, University, Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kate Dikeman, M.S.</td>
<td>July 2008</td>
<td>June 2010</td>
<td>Univ. of Kentucky, 2008</td>
</tr>
</tbody>
</table>
### Mentors – Faculty or Staff

<table>
<thead>
<tr>
<th>Mentors – Faculty or Staff</th>
<th>Fall 2008</th>
<th>Spring 2009</th>
<th>Fall 2009</th>
<th>Spring 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael Mills</td>
<td>TD</td>
<td>TD</td>
<td>KD</td>
<td>KD</td>
</tr>
<tr>
<td>Tim Guan</td>
<td>TD</td>
<td>TD</td>
<td>KD</td>
<td>KD</td>
</tr>
<tr>
<td>Dave Wilson</td>
<td>TD</td>
<td>TD</td>
<td>KD</td>
<td>KD</td>
</tr>
<tr>
<td>Albert Zacarias</td>
<td>KD</td>
<td>KD</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Keith Sowards</td>
<td>TD</td>
<td>TD</td>
<td>KD</td>
<td>KD</td>
</tr>
<tr>
<td>Joshua James</td>
<td>TD</td>
<td>TD</td>
<td>KD</td>
<td>KD</td>
</tr>
<tr>
<td>Joel Handley</td>
<td>TD</td>
<td>TD</td>
<td>KD</td>
<td>KD</td>
</tr>
<tr>
<td>Elizabeth Achino</td>
<td>TD</td>
<td>TD</td>
<td>KD</td>
<td>KD</td>
</tr>
<tr>
<td>Judy Turner</td>
<td>TD</td>
<td>TD</td>
<td>KD</td>
<td>KD</td>
</tr>
<tr>
<td>John Gavin</td>
<td>TD</td>
<td>TD</td>
<td>KD</td>
<td>KD</td>
</tr>
<tr>
<td>Lynn Osborne</td>
<td>TD</td>
<td>TD</td>
<td>KD</td>
<td>KD</td>
</tr>
<tr>
<td>Mellonie Brown</td>
<td>TD</td>
<td>TD</td>
<td>KD</td>
<td>KD</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Date</th>
<th>Category*</th>
<th>Hours</th>
<th>Time</th>
<th>Topic</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/3 Thu</td>
<td></td>
<td>1</td>
<td>1:00 PM – 4:00 PM</td>
<td>Machine Basics On-call duties, Coding</td>
<td>Kristi Owen 1:00 PM, B. Kelly P. Slone (2-4 PM)</td>
</tr>
<tr>
<td>4th Floor Lib</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/8 Tue</td>
<td>I</td>
<td>2</td>
<td>8:00 am – 10:00 am</td>
<td>Brachytherapy Overview</td>
<td>D. Wilson LDR, K. Sowards HDR</td>
</tr>
<tr>
<td>Lower Lib</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/8 Tue</td>
<td>I</td>
<td>1</td>
<td>10:00 am – 11:00 am</td>
<td>Resident Orientation I Radiation Oncology</td>
<td>Kristi Paris</td>
</tr>
<tr>
<td>Lower Lib</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/8 Tues</td>
<td>I</td>
<td>2</td>
<td>11:30 am – 1:30 PM</td>
<td>TomoTherapy Guest Lunch Lecture</td>
<td>Dr. Rock Mackie/Michael Mills</td>
</tr>
<tr>
<td>Lower Lib</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/8 Tue</td>
<td>I</td>
<td>1</td>
<td>2:00 PM – 3:00 PM</td>
<td>Research</td>
<td>Liz Wilson</td>
</tr>
<tr>
<td>Lower Lib</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/8 Tue</td>
<td>I</td>
<td>1</td>
<td>3:00 PM – 4:00 PM</td>
<td>Resident Orientation I Radiation Oncology</td>
<td>Dr. William Spanos</td>
</tr>
<tr>
<td>Lower Lib</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/9 Wed</td>
<td>I</td>
<td>2</td>
<td>8:00 am – 10:00 am</td>
<td>Nursing</td>
<td>Rosemary Wafford, Lisa Tobe</td>
</tr>
<tr>
<td>Lower Lib</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/9 Wed</td>
<td>I</td>
<td>2</td>
<td>10:00 am – 12:00 noon</td>
<td>Brachytherapy Laboratory</td>
<td>Keith Sowards HDR, Joel Handley LDR</td>
</tr>
<tr>
<td>Labs in Clinic</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>7/9 Wed</td>
<td>I</td>
<td>1</td>
<td>1:00 PM – 2:00 PM</td>
<td>RTT and Dosimetry Programs</td>
<td>Mellonie Brown, Judy Turner</td>
</tr>
<tr>
<td>Lower Lib</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/9 Wed</td>
<td>I</td>
<td>1</td>
<td>2:00 PM – 3:00 PM</td>
<td>Dosimetry</td>
<td>Betty Achino</td>
</tr>
<tr>
<td>Lower Lib</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>7/9 Wed</td>
<td>I</td>
<td>1</td>
<td>3:00 PM – 4:00 PM</td>
<td>Lab, X-ray Scheduling</td>
<td>Decora Coleman; Lakisha Phillips</td>
</tr>
<tr>
<td>Lower Lib</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/10 Thu</td>
<td>I</td>
<td>2</td>
<td>8:00 am – 10:00 am</td>
<td>External Beam Conventional</td>
<td>Albert Zacarias, Josh James</td>
</tr>
<tr>
<td>Otho ENT, 3rd Flr</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/10 Thu</td>
<td>I</td>
<td>2</td>
<td>10:00 am – 12:00 noon</td>
<td>External Beam Hand Calculations</td>
<td>Ted Steger, Joel Handley</td>
</tr>
<tr>
<td>4th Floor Lib</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/10 Thu</td>
<td>I</td>
<td>1</td>
<td>1:00 PM - 2:00 PM</td>
<td>Machine Safety</td>
<td>Wendall Sargent, Tim Schadt</td>
</tr>
<tr>
<td>4th Floor Lib</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/10 Thu</td>
<td>I</td>
<td>2</td>
<td>2:00 PM – 4:00 PM</td>
<td>Rad One Nomenclature BCC Standards</td>
<td>Michael Mills</td>
</tr>
<tr>
<td>Lower Lib</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/11 Fri</td>
<td>I</td>
<td>2</td>
<td>8:00 am – 10:00 am</td>
<td>External Beam IMRT/IGRT</td>
<td>Albert Zacarias – Trilogy</td>
</tr>
<tr>
<td>4th Floor Lib</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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 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 1:30 PM – 2:30 PM Coding Orders & Front Office JoAnn Ross & Penny Sloan
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 2 2 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 GYN Onc, 3rd Flr 2 2 8:00 am – 10:00 am Radiation Biology in Radiation Oncology Wayne Zundel
7/16 Wed Lower Lib 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.
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  2%
Program Director – Radiation Oncology
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    15%
  Chief of Physics, Program Director
  Radiation Oncology Physics
  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 Dosimetrist:
  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    3%
  Director, RTT Program

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:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salary (Support)</td>
<td>$45,000</td>
</tr>
<tr>
<td>Benefits (23%)</td>
<td>10,350</td>
</tr>
<tr>
<td>Travel</td>
<td>2,150</td>
</tr>
<tr>
<td>Books</td>
<td>500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$58,000</strong></td>
</tr>
</tbody>
</table>

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

Living expense Burden:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>$20,000</td>
</tr>
<tr>
<td>Utilities</td>
<td>$5,000</td>
</tr>
<tr>
<td>Health Care</td>
<td>$2,000 out of pocket</td>
</tr>
<tr>
<td>Books, etc.</td>
<td>500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$27,500</strong></td>
</tr>
</tbody>
</table>

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
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,

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

/bjr
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,

[Signature]

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

WJS:bjr
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
Vice President Operations & CFO

RB:bjr
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. Nahrevid, M.D.
Chairman of the Board

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.
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, 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

<table>
<thead>
<tr>
<th>Mentors – Faculty or Staff</th>
<th>Fall 2008</th>
<th>Spring 2009</th>
<th>Fall 2009</th>
<th>Spring 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael Mills</td>
<td>TS</td>
<td>TS</td>
<td>KD</td>
<td>KD</td>
</tr>
<tr>
<td>Tim Guan</td>
<td>TS</td>
<td>TS</td>
<td>KD</td>
<td>KD</td>
</tr>
<tr>
<td>Dave Wilson</td>
<td>TS</td>
<td>KD</td>
<td>KD</td>
<td>NR</td>
</tr>
<tr>
<td>Albert Zacarias</td>
<td>KD</td>
<td>KD</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Keith Sowards</td>
<td>TS</td>
<td>TS</td>
<td>KD</td>
<td>KD</td>
</tr>
<tr>
<td>Joshua James</td>
<td>TS</td>
<td>KD</td>
<td>KD</td>
<td>NR</td>
</tr>
<tr>
<td>Joel Handley</td>
<td>TS</td>
<td>TS</td>
<td>KD</td>
<td>KD</td>
</tr>
<tr>
<td>Elizabeth Achino</td>
<td>KD</td>
<td>NR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Judy Turner</td>
<td>KD</td>
<td>NR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>John Gavin</td>
<td>KD</td>
<td>NR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lynn Osborne</td>
<td>KD</td>
<td>NR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mellonie Brown</td>
<td>KD</td>
<td>NR</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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)
xxviii) 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
xliv) 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.

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
   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)
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 each 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 5 days:
   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:

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
10. NCRP Report 32, Radiation Protection in Educational Institutions (1966)
11. NCRP Report 105, Radiation Protection for Medical and Allied Health Personnel (1989)
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:

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
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:

5. AAPM Report 38 The Role of a Physicist in Radiation Oncology (1993) – TG – 1
7. AAPM Report 50 Fetal Dose from Radiotherapy with Photon Beams, Med Phys (22) 1 – TG 36
12. JA Sorenson and ME Phelps, Physics in Nuclear Medicine, Grune & Stratton (2003).
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

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
This is an example of the report of conferences attended by our Junior Resident. She has been in the residency program and in the system for six weeks:

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For the below: This is for our Junior Resident, who has been in our program six weeks. Blue indicates completed competencies, Red indicates competencies are yet to be completed.

### Allied Health Student Tracking - Administration Section

**COMPETENCY TOTALS**

**Facility:** University of Louisville SOM - Radiation Oncology  
(Facility #9025)

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**OPTIONAL FILTERS**

- **Student:** Dikeman, Kate  
  --All--
- **Grad. Class:** --All--
- **Group:**
- **Date Range:** From [ ] To [ ] mm/dd/yy  
  [Blank = All dates]
- **Semester:** --All--
- **Course:** --All--
- **Clinical Site:** --All--
- **Faculty/Preceptor:** --All--

**Sort by:** Item Category

- Check [ ] Show only critical competencies
- Check [ ] Show only competencies with minimum requirements

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**COMPETENCY TOTALS**

**View/Export Results to Excel**
Displays how many times a competency was marked as observed, assisted, or done. The "Minimum Required" numbers (optionally entered by the administrator) refer to the minimum of each competency that should actually be performed by a student (marked "Assisted" or "Done"). Items with minimums will appear in red if the minimum has not been met, and will turn to blue once the minimum has been met. Minimum requirements are only valid if you have filtered for a particular student.

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Rapid Arc (VMAT) DQA [IMRT / IGRT]
Rapid Arc (VMAT) Plan [IMRT / IGRT]
TSE Electron Plan
TSE Electron Annual Calibration
Treatment Record Verification (Written Chart)
Treatment Plan Verification
TomoTherapy IMRT Plan
TomoTherapy IMRT DAQ
TomoTherapy Annual Quality Assurance
TomoTherapy IMRT Plan
TomoTherapy Plan Verification [EXT BM TREATMENT PLANNING, VERIFICATION]
TomoTherapy Record Verification (Electronic Chart) [EXT BM TREATMENT PLANNING, VERIFICATION]
TSE Electron Annual Calibration [TBI PHOTONS, TSE ELECTRONS]
TSE Electron Plan [TBI PHOTONS, TSE ELECTRONS]
### Example of a Competency Completion Report

**Facility:** University of Louisville SOM - Radiation Oncology (Facility #9025)

**Case ID #:** 1149-20080814-004  **Date of Service:** 8/14/2008

**Student Information - Steger, Theodore R**

- **Semester:** Fall
- **Course:** Core Curriculum (Clinical)
- **Faculty/Preceptor:** Mills, Michael D.
- **Clinical Site:** James Graham Brown Cancer Center

**Patient Demographics**

**Clinical Information**

**Time with Patient:** 45 minutes

**Consult with Faculty/Preceptor:** 45 minutes

**Competencies (Observed/Assisted/Done) (Critical in Bold)**

- IMRT / IGRT - DQA with Portal Dosimetry (Done)
- IMRT / IGRT - Step and Shoot DQA (Done)
- Respiratory Gating - 4DCT DQA (Done)

**Other Questions About This Case**

**Clinical Notes**

Portal Imager DQA with Albert on Body Stereo

**Encounter Continuity**

- **Linked encounters:** N/A

---

**Example of a Resident’s Review of a Faculty Member**
Individual Responses Detail - "Faculty/Preceptor Evaluation by Resident"

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
Example of a Resident’s Semester Evaluation

Individual Responses Detail - "Semester Evaluation"
(Filter 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).
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.
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.   Betty Achino, C.M.D.  
Albert Zacarias, Ph.D.   David Wilson, M.S.  
Tim Guan, Ph.D.    William J. Spanos, M.D.  
Wayne Zundel, Ph.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 90th percentile. Commissioning of the “C” machine occupied two months of his third semester rotation. He is still a 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:

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<tr>
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<th>Tim Burns</th>
<th>Victor Jacome</th>
<th>N Remmes</th>
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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
The annual Physics Residency Committee Meeting for the Department of Radiation Oncology was held on February 15, 2007.

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

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<tr>
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<th>Zacarias</th>
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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.  Betty Achino, C.M.D.
Albert Zacarias, Ph.D.  David Wilson, M.S.
Tim Guan, Ph.D.  William J. Spanos, M.D.
Wayne Zundel, Ph.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)

<table>
<thead>
<tr>
<th></th>
<th>Spanos</th>
<th>Mills</th>
<th>Guan</th>
<th>Wilson</th>
<th>Zacarias</th>
<th>Zundel</th>
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<tbody>
<tr>
<td>1</td>
<td>Figueroa</td>
<td>Figueroa</td>
<td>Figueroa</td>
<td>Madani</td>
<td>Bernadin</td>
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<td>Hegseth</td>
<td>Wang</td>
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<td>Figueroa</td>
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<td>Hegseth</td>
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<td>Figueroa</td>
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<tr>
<td>4</td>
<td>Bernadin</td>
<td>Wang</td>
<td>Hegseth</td>
<td>Bernadin</td>
<td>Hegseth</td>
<td>Wang</td>
</tr>
</tbody>
</table>

Total Scores:

- Figueroa 9
- Hegseth 18
- Bernadin 19
- Madani 19

Submitted for approval,

Michael D. Mills, Chairman
Physical Concepts of Radiation Oncology

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

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Topic</th>
<th>Category</th>
<th>Instructor</th>
<th>Date</th>
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<tr>
<td>1</td>
<td>Structure of Matter</td>
<td>1</td>
<td>Guan</td>
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<td>2</td>
<td>Nuclear Transformations</td>
<td>1</td>
<td>Guan</td>
<td>2/13</td>
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<tr>
<td>3</td>
<td>Production of X-Rays</td>
<td>1</td>
<td>Guan</td>
<td>2/18</td>
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<td>Clinical Radiation Generators</td>
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<td>Guan</td>
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<td>3/3</td>
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<td>6</td>
<td>Measurement of Ionizing Radiation</td>
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<td>Guan</td>
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<td>7</td>
<td>Quality of X-Ray Beams</td>
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<td>Guan</td>
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<td>A System of Dosimetric Calculations</td>
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<td>16</td>
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<td>17</td>
<td>Quality Assurance</td>
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<td>Mills</td>
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<td>5/21</td>
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<td>18</td>
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<td>Three-Dimensional Conformal Radiation Therapy</td>
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<td>James</td>
<td>6/2</td>
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<tr>
<td>20</td>
<td>IMRT/IGRT</td>
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<td>James</td>
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<td>Stereotactic Radiosurgery</td>
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<td>Sowards</td>
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<td>6/18</td>
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<td>Assessment of Patient Setup and Verification</td>
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<td>Hyperthermia and Particle Therapy</td>
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<td>Imaging for Radiation Oncology</td>
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<td>Mills/Steger</td>
<td>6/30</td>
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<td>27</td>
<td>Imaging for Radiation Oncology</td>
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<td>Mills/Steger</td>
<td>7/2</td>
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<tr>
<td>Final</td>
<td>100 Questions, one point each</td>
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<td>Mills</td>
<td>7/7</td>
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</table>
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:  
- 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
  o Assays for DNA damage
  o sucrose gradient sedimentation, neutral and alkaline filter elution, pulsed field electrophoresis (PFGE), comet assay, plasmid-based assay
  o Types of DNA lesions and numbers per cell/Gy
  o Spurs & Blobs
  o Multiply damaged sites
  o Single lethal hits and accumulated damage (inter- and intra-track)
  o Role of oxygen in the generation of damage
• Role of LET and radiation quality 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
  o Classes of DNA Repair
  o 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
  o 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)
  o Measurement of hypoxia
  o Direct/Indirect Effects of Tumoral Hypoxia
  o Transient and chronic hypoxia
  o 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 O2 concentration
  - Time scale of oxygen effect
  - Mechanisms of oxygen effect
  - Reoxygenation following irradiation
- Solid Tumor Assay Systems
  - TD50 limiting dilution assay
  - Tumor regrowth assay
  - TCD50 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 \textit{(RR: Chapters 4, 5, 21)} Oct. 7\textsuperscript{th}. (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 9\textsuperscript{th}, 2008**

III. Classical Radiobiology

LET, RBE and $\alpha/\beta$ Ratios \textit{(RR: Chapter 3, 7)} Oct. 14\textsuperscript{th}. (Spanos)

- Linear Energy Transfer
- Relative Biological Effectiveness
- Linear-Quadratic Model (Linear-Quadratic Model)
- $\alpha/\beta$ Ratios

Normal Tissue Responses in XRT \textit{(RR: Chapters 9, 13, 19)} Oct. 16\textsuperscript{th} & 21\textsuperscript{st} (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 $\alpha/\beta$ 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
  o Gene expression profiling
  o Proteomics

Radiosensitizers, Bioreductive drugs, Radioprotectors \((RR: Chapter 25)\) Nov. 18th. (Zundel)
- Tumor radiosensitization
  o Halogenated pyrimidines, nitroimidazoles Radiation Sensitizers
- Hypoxic cell cytotoxins
  o tirapazamine
- Mechanisms of action, sulhydryl 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)
  o Alkylating agents
  o Antibiotics
  o Antimetabolites
  o Nucleoside analogs
  o Vinca Alkaloids
  o Taxanes
  o Miscellaneous agents
  o Topo inhibitors
  o Enzyme Inhibitors
  o Endocrine drugs
  o 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)

79
• 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
• Thermitolerence
• 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

<table>
<thead>
<tr>
<th>Name</th>
<th>Time in Program</th>
<th>Supervisor</th>
<th>Current Occupation</th>
<th>Board Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jodi Daves, MS</td>
<td>21</td>
<td>Michael Mills</td>
<td>Medical Physicist</td>
<td>Yes</td>
</tr>
<tr>
<td>Albert Zacarias, PhD</td>
<td>12</td>
<td>Michael Mills</td>
<td>Medical Physicist</td>
<td>Yes</td>
</tr>
<tr>
<td>Joni Funseth, MS</td>
<td>18</td>
<td>Michael Mills</td>
<td>Medical Physicist</td>
<td>In progress</td>
</tr>
<tr>
<td>Yinghui Zhang, PhD</td>
<td>24</td>
<td>Michael Mills</td>
<td>Medical Physicist</td>
<td>Yes</td>
</tr>
<tr>
<td>Eric Nelson, PhD</td>
<td>24</td>
<td>Michael Mills</td>
<td>Medical Physicist</td>
<td>In progress</td>
</tr>
<tr>
<td>John Hegseth</td>
<td>24</td>
<td>Michael Mills</td>
<td>Medical Physicist</td>
<td>In progress</td>
</tr>
</tbody>
</table>
Appendix E – Staff Biographical Sketches and Primary Clinical Interest in alphabetical order

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


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:


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:

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


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:


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:

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

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

Inter & Extra-mural Support:


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.


Research: Summary

Prostate therapies with image guided radiotherapy.
Selected Publications:


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:

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.
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:


<table>
<thead>
<tr>
<th>Academic Appointments:</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Appointments:</td>
<td>Medical Dosimetrist</td>
</tr>
<tr>
<td>Role in Residency Program:</td>
<td>Mentor for medical dosimetry</td>
</tr>
<tr>
<td>Rotation Mentor:</td>
<td>Support Mentor Junior Resident Fall Semester in medical dosimetry</td>
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<tr>
<td>Education:</td>
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</tr>
<tr>
<td>Post Graduate Training:</td>
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<td></td>
<td>Certified in Medical Dosimetry (MDCB), 2004</td>
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<tr>
<td>Clinical Responsibilities:</td>
<td>IMRT/IGRT Treatment planning</td>
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<tr>
<td>Research Interests:</td>
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<tr>
<td>Inter &amp; Extra-mural Support:</td>
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<td>Research: Summary</td>
<td>N/A</td>
</tr>
<tr>
<td>Selected Publications:</td>
<td>N/A</td>
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</table>
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:


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:


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:


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:


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:


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:
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:
