UNIVERSITY of CALIFORNIA, SAN DIEGO
RADIATION ONCOLOGY *Physics Division*

Medical Physics Residency Program Overview

Our Physics Residency Training is a 2-year program typically beginning July 1 each year. The first year resident will work closely with medical physicists responsible for clinical tasks in the Department of Radiation Oncology at the University of California, San Diego. A major goal during the second year is to develop independent thinking and confidence in making clinical decisions. One to four months will be spent on each clinical service to assure adequate experience in all clinical physics activities.

The UC San Diego Medical Physics Residency Program was inaugurated on July 1, 2007. We are currently in the final stages of accreditation through the Commission on Accreditation of Medical Physics Educations Programs, Inc. (CAMPEP). Our goal is to receive accreditation in the year 2010.

Mission Statement

The goal of our residency program is to provide clinical training and education in the specialty of radiation oncology physics. Residents will participate in the clinical physics duties under the supervision of board certified medical physicists.

Three major objectives of the program include:

1. Provide clinical training in radiation oncology physics within a structured clinical environment.

2. Provide a broad base of in-depth clinical training to develop the resident's competency in radiation oncology physics.

3. Prepare the resident to sit for the certification examination of the American Board of Radiology in Therapeutic Radiologic Physics.

Ultimately, it is part of our academic mission to train future leaders in the field of medical physics.

Program Curriculum

The training curriculum of the UCSD Medical Physics Residency Program consists of six broad and comprehensive rotation blocks and three *Special Topics* given during three of the rotations. Clinical rotations vary in length from two months to four months.

The overall approach of our residency program is to get the resident to 'practice' medical physics as soon, and as comprehensively as possible. Our approach is to include all the didactic-type defined rotations in the first year of the residency. In the second year, the resident becomes a 'fully functioning' physicist but still with direct oversight by a physics faculty. The residents will work closely with medical physics faculty responsible for clinical coverage in the Department of Radiation Oncology at the University of California, San Diego and at a UCSD satellite facility in Encinitas, CA (about 20 minutes drive north of the main campus).

Training Requirements

The requirements for program completion are as follows:

1. Complete 2 to 4 month training rotations over 24 months.
2. Demonstrate clinical competency in all training rotations as documented in the rotation evaluation form completed by the mentoring medical physicist for that rotation.
3. Give a presentation at the end of each rotation, which is assigned by the rotation mentor or residency director.
4. Attend at least 75% of the clinical and physics seminars, meetings and conferences.
5. Successfully complete didactic courses.
    a. Medical Radiation Physics
    b. Radiation Therapy Physics
    c. Radiation Biology
    d. Biostatistics
    e. Medical Training for Physicists
6. Pass year 1 oral exam.
7. Pass year 2 oral exam.

The Residency Training Program will commence each July and residents will participate in an orientation program (called *Special Topics* 1 – see below). This will serve to familiarize them with the equipment, techniques, and procedures in the Department of Radiation Oncology. Duties associated with clinical service rotations during the first year of residency will be under close supervision. For clinical rotations that overlap with a *Special Topics* rotation, the two mentors will coordinate the topic for the resident's assigned presentation at the end of the rotation. In the first year, two to four months will be spent on each clinical service to assure adequate experience in all clinical physics activities.

Duties performed for clinical service rotations during the second year of residency will be under reduced supervision. A major goal during the second year is to develop independent thinking and confidence in making clinical decisions. If necessary, the Program Director will augment training in areas that may not be covered adequately in the department, arranging for supervised training at other institutions or remedial work related to a specific rotation. Additional reading assignments may be given to strengthen theoretical understanding of various clinical procedures.

Resident training plan

Year 1 (Introduction to Clinical Medical Physics)	
July August September	Brachytherapy + *Special Topics* 1
October November December January	External Beam Planning + *Special Topics* 2
February March April	SRS & SRT + *Special Topics* 3
May June	IGRT & Motion Management

Year 2 (Full Clinical Participation)	
July August September	Academic Clinical Practice – La Jolla
October November December	Academic Clinical Practice – La Jolla
January February March	Community Clinical Practice – Encinitas

April May June	Academic Clinical Practice – La Jolla

Special Topics consist of information that the resident is required to learn over a specific time frame but not directly related to any specific rotation.

Rotations

Brachytherapy – The rotation is structured to provide the medical physics resident with knowledge of brachytherapy basics and brachytherapy applications. The resident will develop a knowledge base including radioactive decay, characteristics of radioactive sources, source calibration, and calculation of dose distributions, different systems of implant dosimetry and implantation techniques. Basic definitions in dose specification will be covered, along with an overview of remote afterloading systems. During the rotation the resident will observe the medical physicist during brachytherapy procedures, perform source calibration checks, and computerized and hand calculated low dose rate dosimetry, including fundamental calculation techniques. The resident will participate in the imaging and treatment planning of brachytherapy, along with patient-specific and system quality assurance. Additionally, the resident will learn the principles of permanent prostate seed implant brachytherapy as well as eye plaques. During the rotation the resident will assist the medical physicist during brachytherapy procedures and reproduce treatment plans and quality assurance tests for multiple procedures. They are not, however, required to perform a specific number of brachytherapy procedures.

External Beam Planning – This rotation is the resident's introduction into external beam treatment planning, which includes observing and taking direction from the medical dosimetrists during the treatment planning process of multiple anatomical sites (brain, head and neck, lung, GI, breast, abdomen, pelvis, bladder, prostate, GYN, and pediatric cases) and developing planning protocols for each site observed. Treatment plan checks and MU calculation are demonstrated to the resident and then observed by other physicists. Our residents additionally perform site-specific clinical treatment planning. The number and type of treatment plans is determined by the rotation mentor and Chief Dosimetrist. The number of each case is also partly determined by the available case load. The resident will also develop an understanding of the non-dosimetric calculations performed by the planning system (e.g., DRRs, contouring tools, etc.), and dose evaluation tools. The MU calculation portion is designed for residents to develop the knowledge base required for MU calculations. The concepts and terminology behind these calculations (TMR, PDD, PSF, CSF, ISF, OAR, WF, TF, etc., Clarkson integration, Day's method, etc., calculation Point's Eye View and multiple source models, surface irregularities, tissue inhomogeneities, electrons) are covered. During this learning experience, the resident checks with the therapists or chief dosimetrist for any sim-and-treat cases, performs the calculations from the field data in Aria, and independently verifies the results provided by the Eclipse treatment planning system. Resident training includes observing the treatment simulation process. Note that the resident also learns about the treatment simulation process during the weekly dosimetry case conference, where patient immobilizations and CT procedures are discussed in detail. This conference also serves as the external abeam case assignment and review of difficult cases. The resident will learn about and observe treatment plan checks and weekly chart checks. The resident will start treatment plan checks and weekly chart checks during the last month of this rotation, which they will participate in for the remainder of the residency. For IMRT, the medical physics resident will be introduced to optimization, critical organ doses, parallel vs. serial organs, typical dose-volume constraints, and planning approaches specific to IMRT and intensity modulated arc therapy. Lastly, the resident will also understand the commissioning of a total body irradiation program. The resident will acquire knowledge of the clinical basis for TBI, equipment, dosimetry issues in TBI, field uniformity, beam energy/penetration, blocking, beam data for TBI, and hand calculations. During the rotation the resident will observe/attend several TBI cases including simulation, fabricate the blocks perform in-vivo dose measurements for TBI, perform hand calculations and compare to diode results.

<u>SRS & SRT</u> – This rotation is designed to give the medical physics resident experience in stereotactic radiosurgery and radiotherapy both for cranial and extra-cranial cases. The resident first reviews the key principles of SRS/SRT. The resident will participate alongside a faculty physicist in clinical SRS/SRT treatments during this rotation. The resident will acquire knowledge of framed and frameless cranial SRS treatments. Familiarity with the patient simulation process and CT/MR image transfer and CT/MR fusion will be acquired. Both MLC-based (IMRS) and cone-based planning will be experienced. The resident will acquire knowledge of radiosurgery delivery options and work with therapists during treatment setup and delivery. In terms of extra-cranial radiosurgery, the resident will understand patient immobilization and the simulation process. The resident may also observe gated SBRT treatment for lung and liver sites but will be expected to learn the details of motion management in the next rotation.

<u>IGRT & Motion Management</u> – During the IGRT rotation, residents will participate in the clinical use of prospective and retrospective CT image acquisition, gated treatment delivery, treatment planning process for IGRT (including multi-modality image registration and fusion), and data export/import into each system. The resident will observe and participate in the IGRT treatment planning and delivery process and understand the functionality of the systems utilized. This rotation builds on the experience with extra-cranial SRS and SRT acquired in the previous rotation. Quality assurance of all aspects of each IGRT system will be studied from image acquisition through verification and treatment delivery. This rotation will also provide the resident with knowledge of portal imaging systems used either during the simulation/planning process or during treatment verification. The resident will develop knowledge in basic medical imaging physics and the terms that impact image quality, the design and application of different electronic portal imaging systems, and the necessary processes for commissioning and continuing quality assurance of portal imaging systems.

<u>Academic Clinical Practice</u> – During this rotation, the resident will be expected to perform the breadth of tasks performed by a clinical medical physicist in the academic setting. The residents will be assigned tasks and clinical coverage as if they were part of

the faculty. At no time, however, will the resident be working without an assigned mentor that is directly responsible for their clinical decisions. The resident's work is always second-checked by a faculty physicist. The mechanism to do checks varies on the type of work, e.g., monthly linear accelerator QA, treatment planning, etc. The academic clinical rotations will also address any remaining education deficiencies identified during the previous rotations, either from lack of understanding or lack or exposure.

<u>Community Clinical Practice</u> – During this rotation, the resident will be expected to perform the breadth of tasks performed by the clinical medical physicists in the community setting.

Special Topic 'rotations' are done in parallel with the clinical rotations. They are meant to be studied together with the resident's clinical study, much the same way a practicing clinical physicist keeps abreast of new technologies and procedures. A meeting between the resident and *Special Topics* mentor will occur within the first week of the rotation that the *Special Topics* is assigned. The resident and mentor will agree on a routine meeting day and time, which will depend on the clinical work during the rotation. Directed reading assignments will be assigned. The rotation concludes with a meeting by the faculty physicist and the resident specifically to assess their knowledge acquired during the rotation. A report on the residents' progress is provided to the residency director. The resident also evaluates the special topic rotation and mentor, and provides that evaluation to the residency director.

<u>*Special Topics* 1</u> – This experience is designed to get the new physics resident comfortable with the procedures, equipment, staff and layout of the department. It is intended to provide a high-level view of radiation therapy treatment. For example, the resident will be charged with verifying a physics equipment list, thus familiarizing themselves with our equipment and where it is located. Another goal of this rotation is to provide the resident close interaction with a radiation oncologist and the patient's point of view. We require that the resident follow five patients from consult to treatment (with at least two different radiation oncologists). The resident is assigned to an attending physician prior to consult. The resident joins the attending physician on the consult, then simulation, treatment planning, treatments, and on-treatment visits with the attending physician. This experience will give the resident a very important understanding of clinical medicine and the challenges of patient care since all decisions a physicist makes ultimately have an impact on patient care. Lastly, the resident will learn about linear accelerator quality assurance including the annual QA of the system. The resident will be the point person together with a faculty physicist to actually perform a linac annual QA during this rotation. At this time, the strategy behind routine annual, monthly, and daily QA will be discussed in detail. It is expected that the resident will learn about the use of the equipment, running the linear accelerators, and the limitations of the equipment.

<u>*Special Topics* 2</u> – During this learning experience, the resident develops a theoretical understanding of the design, characteristics, and clinical limitations of several radiation measurement systems: thermoluminescent dosimeters, ionization chambers, radiographic film, radiochromic film, MOSFETs, diodes, and amorphous silicon arrays. The resident will develop an understanding of the specifications and capabilities of

these systems. Residents will go into the theoretical and practical details of determining dose from ion chamber measurements. In particular, the AAPM's TG-51 protocol will be covered in detail. The resident will also develop an understanding of the different 3D photon beam dose algorithms, electron beam dose algorithms. An emphasis will be placed on the characteristics and limitations of modern treatment planning system dose calculation algorithms. The resident will be expected to know the accuracy of the algorithm being used when evaluating treatment plans and discussing the treatment plans with the physician. A meeting between the resident and *Special Topics* mentor will occur within the first week of the rotation that the *Special Topics* is assigned.

Special Topics 3 – This learning experience is structured to give the medical physics resident experience in designing facilities appropriate for radiation oncology equipment. The resident is asked to design the shielding for different types of rooms typically found in a radiation oncology department, such as a high-energy linear accelerator vault and an HDR vault. The resident consults with the physics mentor during the rotation to discuss the specifics of the design process. The mentor will propose alternate scenarios that force the resident to re-work the design using different clinical or occupancy criteria. The resident is also expected to perform portions of a radiation survey around existing vaults to gain practical experience in obtaining and analyzing low level radiation data. Also in this learning experience, the resident gains an understanding of total skin electron irradiation. The resident will reinforce their basic knowledge of electron beam dosimetry and develop knowledge in the clinical basis and beam data required for TSE, equipment, dosimetry issues in TSE, field uniformity, beam energy/penetration, field shaping, collimation and patient alignment, collimation and energy adjustment. Electron shielding using lead sheets versus cerrobend blocks will also be studied and/or measured.

Didactic Training

In addition to the rotations and study in special topics, a variety of departmental and divisional conferences take place on a regular basis and will help the resident to develop an in-depth understanding of the clinical problems associated with the practice of medical physics in radiation oncology. The In vivo Cancer and Molecular Imaging Center (ICMIC) working conferences and Brain Tumor Board Clinical Case Conferences are presented weekly for radiation oncologists but provide an opportunity for physics faculty and residents to learn current issues in radiation oncology. Chart rounds and clinical case conferences are scheduled on a weekly basis.

Clinical conferences, seminars, small discussion groups, and one-on-one instruction are all an integral part of the program. The resident will participate in the following:

- Physics Division Meetings
- Chart Rounds
- Dosimetry case conferences

- Clinical case conferences
- Resident Seminars
- Assigned readings

The following courses are required:

- Medical Radiation Physics
- Radiation Therapy Physics
- Radiation Biology
- Biostatistics
- Medical Training for Physicists

The didactic background of individuals entering residency program should be similar to that obtained in a CAMPEP accredited graduate program. As a rule, we try to make every effort to recruit individuals into our residency program with some background in radiotherapy, biology, or medicine (preferably from a CAMPEP accredited graduate program). For entering residents who have not graduated from an accredited medical physics graduate education program or equivalent, appropriate didactic training will be provided and successfully completed without compromising the two years of clinical training.

Timeline for meetings:

Meeting	**Day**	**Time**	**Occurrence**
Chart rounds	Mon	Noon	Weekly
Dosimetry case conference	Mon	9 am	Weekly
Physics division clinical meeting	Tue	8 am	Bi-Weekly
Clinical case conference	Thur	8 am	Weekly
Resident Seminar	Tue	8 am	Monthly
Physics Seminar Series	Fri	1 pm	Weekly