Academic Medical Physics at Mary Bird Perkins Cancer Center

A university and community cancer center partner to train medical physicists

by Kenneth R. Hogstrom, PhD

In Brief

A commitment to having a strong medical physics program to complement a highly experienced radiation oncology team led to a unique partnership between Mary Bird Perkins Cancer Center and Louisiana State University (LSU). The goal: to build a nationally acclaimed medical physics program. Here is how we used multiple coordinated components to accomplish our goal.

Medical physics graduate education in Baton Rouge began in 1981, when an MS degree was offered as part of the LSU Nuclear Science and Engineering Program. Mary Bird Perkins became a clinical partner in the program with medical physicist Oscar Hidalgo, PhD, and radiation oncologist Sheldon Johnson, MD, serving as LSU adjunct faculty. In 1999 LSU moved this program into the Department of Physics and Astronomy, establishing the MS in Medical Physics and Health Physics Program. Along with this new program name came two key requisites from the state—national accreditation and a minimum graduation rate of 25 per five years.

In 2004 Mary Bird Perkins and LSU took a major step forward by entering into a formal contractual agreement that facilitated the operation of this joint program. Shortly thereafter, I came to LSU as its new program director of Medical Physics with LSU contracting 40 percent of my time to Mary Bird Perkins to allow me to serve as chief of Physics. My 16 years as chair of the Department of Radiation Physics at The University of Texas M.D. Anderson Cancer Center and 20 years as director of The University of Texas Health Sciences Center Medical Physics Graduate Program prepared me well for these roles.

Medical Physics Graduate Program

The LSU-Mary Bird Perkins graduate program in medical physics consists primarily of our MS in Medical Physics and Health Physics Program, which is one of 18 Commission on Accreditation of Medical Physics Education Programs (CAMPEP)-accredited medical physics graduate programs in the U.S. Our MS in Medical Physics and Health Physics Program requires a publishable-quality research thesis in addition to its curricula and clinical rotations at Mary Bird Perkins Cancer Center. Since restructuring in 2004, the LSU-Mary Bird Perkins medical physics program has graduated 27 students. Twenty-six of those graduates have become medical physicists in radiation oncology centers or continued in PhD or residency programs in medical physics.

Two attributes that differentiate our MS program from most other programs are our research requirement and the program support jointly provided by Mary Bird Perkins and LSU. The research requisite helps students decide whether they should continue to pursue a PhD in medical physics, thereby including research as part of their future medical physics career. Also, students' theses contribute to our adjunct faculty efforts to improve patient care through research. Such activities are consistent with our program's long-term goal for half of our students to be pursuing their PhDs. Presently, 2 of the 24 students in our program are working on PhD degrees in physics with specialization in medical physics.

Any program's quality is dependent upon adequate resources to be successful, and our program is equally well-supported by Mary Bird Perkins and LSU. The University provides teaching assistantships for our first-year students, who benefit our Department of Physics and Astronomy by teaching undergraduate physics labs and tutoring undergraduate students in physics. Mary Bird Perkins and LSU share the cost of graduate assistantships for the second year of the program during which students complete their coursework and clinical rotations and develop a research plan for their MS theses. Mary Bird Perkins provides research assistantships for third-year students while they perform research and write and defend their theses.

A New Paradigm: Medical Physics Residency Education

Upon graduation, students have typically taken positions as junior medical physicists where they receive on-the-job clinical training under the supervision of a qualified medical physicist. Three years of such clinical experience is presently required to sit for the final, oral component of the certification exam in therapeutic radiologic physics offered by the American Board of Radiology (ABR). However, this training path will end in 2014, after which the ABR will require that students must graduate from a CAMPEP-accredited medical physics residency program to be eligible for the ABR certification exam. This new requirement, similar to the training path of our physician colleagues, will improve the quality of junior medical physicists entering the workforce.

At present, the national capacity of residency programs is inadequate for the number of medical physicists entering the field, including those graduating from MS or PhD programs in medical physics. Hence, in the near future, graduate education programs will be under pressure to affiliate with a residency program until such time as residency programs have adequate capacity. To accomplish this strategic goal, Mary Bird Perkins has established a Radiation Oncology Physics Residency Program led by Program Director Brent Parker, PhD, and Chief of Clinical Physics John Gibbons, PhD. The residency program will replace on-the-job

training. During training, residents will perform clinical medical physics services under the supervision of a staff medical physicist, which will help offset the costs of the program. The program matriculated its first resident in July 2009 and its second in July 2010.

To meet the needs of our graduate program, six new resident positions are required annually, equaling 12 resident positions for the two-year program. The Mary Bird Perkins clinic can accommodate six residents, so our strategy is to partner with medical physicists at other radiation oncology centers in Louisiana who will have one or two radiation oncology physics residents. We will provide the administrative infrastructure for the partner sites. Together we will be contributing to the responsibility of medical physicists to train our own. Our first partner, Ochsner Clinic Foundation in New Orleans, is expected to accept its first resident in summer 2010. Discussions with other medical physics groups in Louisiana are in progress.

Medical Physics Research

Medical physics research at Mary Bird Perkins Cancer Center is a thriving enterprise that has been made possible by the LSU Medical Physics and Health Physics Program, which provides access to graduate students and many research resources at LSU. Much of our research is applied in the sense that it offers potential patient benefits in the short term. This research usually includes access to new technology and is funded by industry research grants. Currently, Mary Bird Perkins has research grants with TomoTherapy, Inc., .decimal, Inc., BrainLab, Inc., and Elekta Ltd.

Some of our research is basic science, which is longer term and in which patient benefit is less predictable. Mary Bird Perkins was recently awarded a $2.215 million grant from the U.S. Army Medical Research Acquisition Activity, for which I serve as principal investigator. The grant supports basic research of Auger electron therapy and proton therapy. Auger electron therapy is a new paradigm that is meant to preferentially target individual cancer cells as opposed to current radiation therapy techniques that irradiate a volume consisting of a mixture of cancer cells and normal tissue. Future major gains in radiation therapy require looking at new paradigms, and Auger electron therapy is one of them. This research would not be possible without resources at LSU, particularly the LSU synchrotron light laboratory, known as CAMD, and the cell culture laboratory at the LSU Pennington Biomedical Research Facility.

A second project involves researching methods for calculating dose and performing quality assurance of proton therapy using a new type of accelerator, the dielectric wall proton accelerator (DWPA). This research will allow us to become a contributor in the proton therapy research arena. Our initial project will focus on a new proton accelerator technology that is being developed by Compact Particle Accelerator Corporation, a subsidiary of TomoTherapy, Inc. Because of our expertise in radiation physics, our existing research partnership with TomoTherapy, and Mary Bird Perkins' plans to acquire clinical proton therapy capability in the near future, this is an ideal area of research in which to get involved.

The success of medical physics research at Mary Bird Perkins can be appreciated by looking at what has been accomplished in the past six years. During this time, medical physics research has grown from no grant funding or publications to having seven research grants with funding in excess of $3 million and 12 articles published in peer-reviewed scientific journals with many other articles currently in preparation for journal review.

Impact on the Clinic

Research activities and the availability of graduate students result in improved technology for our clinical practice. Research on our TomoTherapy grant has led to use of a new technology, helical tomotherapy, for post-mastectomy chest wall radiation therapy. This modality offers improved normal tissue sparing and more homogenous dose to the radiation target, the latter providing greater cosmesis for the patient.

Research with BrainLab led to developing a unique method for evaluating the uncertainty in the volume of irradiated brain when using image-guided radiotherapy (IGRT), important to the radiation onologist in specifying the target volume. This method is currently being used to measure the accuracy of TomoTherapy and Elekta IGRT systems.

More recently, Mary Bird Perkins has been the academic partner for .decimal, Inc., which is making bolus electron conformal therapy (ECT) technology clinically available to the world. Bolus ECT is the electron beam equivalent of intensity-modulated radiation therapy (IMRT) with X-rays and is based on research by my former research team at The University of Texas M.D. Anderson Cancer Center in Houston. Bolus ECT benefits treatment of cancer within 6 cm of the surface, particularly head and neck cancers and special conditions of the post-mastectomy chest wall.

Results of our research activities continue to be published in peer-reviewed medical journals, making them available for others to use, which extends their impact to radiation therapy facilities throughout the world.

Locally, academic activities impact our ability to recruit and sustain a high-quality medical physics staff. We are able to attract both graduates of our program, as well as medical physicists who are interested in supplementing their clinical medical physics duties with research and teaching. Graduates of our program are also employed in many medical physics positions in Louisiana and throughout the United States. Presently, five of our 12 clinical medical physics staff at Mary Bird Perkins are graduates of our program, and approximately 17 of 59 medical physicists in the state are program graduates.

Future Plans

A good academic program continually evolves and that is the case for our programs. Over the next year, our goal is to achieve CAMPEP accreditation of our PhD Program in Medical Physics at LSU and our Radiation Oncology Physics Residency Program at Mary Bird Perkins. As our research programs at Mary Bird Perkins continue to grow, we hope to increase the number of PhD students. We are working to add a research program in brachytherapy, while maintaining the momentum of our existing research programs. As part of these efforts, we expect to grow our academic medical physics staff.

Kenneth R. Hogstrom, PhD, is chief of Physics at Mary Bird Perkins Cancer Center and professor and director of the Medical Physics Program in the Department of Physics and Astronomy at Louisiana State University.