

## 2007 ASSESSMENT REPORT

### PHYSICS MS PROGRAM IN MEDICAL PHYSICS

#### **Introduction and Context**

The MS medical physics specialty in collaboration with the Department of Radiation Oncology and the Division of Radiology at the Cleveland Clinic Foundation (CCF) was begun in 2001 and has graduated 18 people, almost all of whom are employed either as medical physicists at CCF or at other hospitals and regional cancer centers in Ohio, Pennsylvania, Colorado, California, and Texas or by manufacturers of medical imaging equipment. Medical physicists are responsible for the instrumentation and radioactive isotopes used in (i) various types of radiation therapy for cancer patients and during various radiation therapy surgeries, and (ii) diagnostic imaging procedures.

None of the CSU physics department faculty has a detailed quantitative knowledge of medical physics. As a result the CSU physics faculty teach only the courses in related background material (computational physics, biophysics, imaging, and environmental physics), while all subject matter specific to medical physics is taught by the radiation oncology and diagnostic radiology medical physics staff at CCF (introduction to medical physics, radiation therapy physics, laboratory experience 1, and laboratory experience 2). The centerpiece of the MS medical physics specialty at CSU is a six month student internship in the Radiation Oncology Department (ROD) or the Division of Radiology at CCF (i.e. laboratory experience 1 and laboratory experience 2) where the students get hands-on training in what a medical physicist does on a day-to-day basis.

The CSU program is unusual in that most medical physics MS or PhD programs in the United States are taught at universities that have a medical school and associated teaching hospital, so knowledge of what a medical physicist is supposed to know is more widely distributed throughout the faculty, and laboratory training is done in-house. The division of duties in the CSU/CCF medical physics program, i.e. CSU teaching the related background material and CCF teaching specific medical physics material, has a great impact on assessment. Whereas the CSU physics faculty upgrade and evolve the background material courses in response to suggestions and input received from the CCF medical physicists, the CCF staff alone is responsible for the evolution of the specific medical physics content. The CCF staff is in the optimal position to do this because they are all practicing medical physicist whereas we are not. This is important because all medical physicists employed by hospitals and regional cancer centers, after working for nine months, must pass a certification examination given by the national medical physicist licensing board. Thus their education should be focused with the board certification examinations in mind.

But this division of duties also has a number of down-sides. It means that the most important half of the medical physics MS program is outside of CSU's control. Since the CCF staff are not CSU employees, all we can do is politely ask them to comply with various CSU administrative procedures such as faculty/course student evaluations and the

collection and organization of materials for assessment. It is unlikely that CSU will be able to bring all aspects of the MS program in medical physics under its control since, due to the vastly different salary structure at hospitals, the CSU physics department is unable to hire a medical physicist as an assistant or associate professor.

Another down-side of the division of duties became evident this past year. Due to changes in focus within the CCF Radiation Oncology Department, at least two of the three ROD staff members participating in our MS program informed CSU that they were considering seeking employment elsewhere or taking early retirement. To the best of my knowledge, this situation has not been totally resolved to date. But if these ROD staff members will no longer be able to participate in our MS program, a sizable portion of the program may cease to exist.

The goals of the medical physics MS program were first developed in 2001 by the Medical Physics Steering Committee which is a combination of the CSU physics faculty and the CCF medical physicists who teach in the program. The outcomes were developed at the same time by the same group.

A new outcome developed in 2005 was to make registration for each of the two semesters of the laboratory experience at CCF contingent on satisfactory past grades and on permission of the Medical Physics Steering Committee. The reason for this change was that (i) the student interns at CCF have much patient contact, and thus must be able to relate well to them and to both speak and understand English well, and (ii) they must demonstrate competency in a clinical setting. Students are informed of this as they enter the program. This change was put into place because problems were arising at CCF with a few of the students during their internship, and a measure of quality control had to be instituted. Recent graduates of the CSU medical physics MS program employed at CCF work with the student interns "showing them the ropes" and evaluate their progress along with the other CCF staff. This "alumni survey" constitutes an indirect research method, but it stays within CCF and affects only the laboratory experience.

Another new outcome developed in 2006 was converting from the open admissions the physics department had in the past to selective admissions. This change is a direct result of the assessment process. We had had open admissions in order to keep the enrollment in the program as large as possible so as to look good to the CSU administration. But in the classroom the open admissions policy had not worked well. There were too many instances of students on academic probation or dismissal from the program by the Graduate Dean. These growing problems were discussed at length by the CSU/CCF Medical Physics Steering Committee. It was concluded that neither the course material nor the way it was taught were inappropriate. Rather, many students who had been accepted into the program lacked either the proper motivation or the proper undergraduate preparation in physics and mathematics. As a result, it was felt that the most sensible way to generate consistently better student outcomes was to admit only students whose backgrounds indicated that they would likely be able to successfully make it through the program. Thus our first year enrollment for Fall 2006 was 4 rather than the 9 it has been for the previous few years, and for Fall 2007 the first year

enrollment will likely be 3. We hope the CSU administration will continue to support this MS program in light of the significantly smaller number of students we now have.

### **Program Goals**

Prepare MS students for employment as a medical physicist in a hospital or a regional cancer center.

Students will be conversant with the basic concepts of biophysics, computational physics, environmental physics, and imaging physics.

Students will be facile with the details of calculating patient radiation dose and managing radioactive isotope inventories for the various radiation therapies for cancer patients or for diagnostic imaging.

### **Outcomes**

A student successfully demonstrates competency in the basic concepts of computational physics, biophysics, environmental physics, imaging physics, medical physics, and radiation therapy physics. This is determined by the student's performance on a comprehensive examination given at the end of each course. An affirmation that the student has acquired sufficient mastery of the material is the receipt of a grade of B or higher in the course.

A student successfully demonstrates a detailed knowledge of the duties of a medical physicist employed by a hospital or regional cancer center. This is determined by a student's performance on each of the ten medical physics projects the student must complete under the direction of a CCF staff member during each semester of the internship. An affirmation that the student has acquired sufficient mastery of the material is the receipt of a grade of B or higher for each semester of the internship.

### **Research Methods**

The performance of each student on the comprehensive examination in every course is recorded at the end of each semester in the student's file which is maintained by the graduate student faculty advisor. The student's performance on weekly homework is monitored and evaluated by each instructor, communicated to the graduate student advisor, but is not included in the file.

The student's performance on each project in the internship is monitored weekly by the CCF medical physics staff. A student is prompted if he or she falls behind in submitting completed project reports. Unacceptable project reports are returned to the student with comments for improvement. Revised project reports must then be resubmitted by the student to the CCF staff until they are judged to be acceptable. If the revised project report remains unacceptable, the student fails that laboratory project.

Contact is maintained, if possible, with the program graduates to determine whether they have found employment in the field, and then whether they have passed the medical physics licensing examination. This has become somewhat tricky in the last two years. Certainly the most visible and practical outcome of the MS program is to have our graduates find employment in the field of medical physics. However, there are currently, to first approximation, no jobs open in this field in the Cleveland area. Thus in order to find employment, a student must leave Cleveland. This prospect is a source of concern for many of our students. In addition, though there are many openings in other parts of the country, employer hospitals now prefer to hire people with three or so years of experience rather than freshly minted graduates who they will have to train. When they can't fill their openings with experienced medical physicists after three months or so, they then hire new graduates. Thus our students are taking longer after graduation to find suitable employment. This has been determined not to be due to any deficiency in our MS program, but due to recent changes in the hiring patterns in the field.

### **Findings and Review**

The student's file is reviewed by the graduate advisor at the end of each semester in order to make sure the student is making satisfactory progress in the MS program. The progress of each student is discussed each semester at a meeting of the CSU/CCF Medical Physics Steering Committee.

Though it has been difficult getting information from some of the program graduates, all 5 of the program graduates hired as permanent staff by CCF have passed the medical physics licensing examination. This provides an indirect indication that the material taught to them in the MS program is in fact important to their success as a practicing medical physicist.

Since employment is the major outcome of the program, information on changing hiring practices in medical physics is communicated to the CSU physics faculty by the CCF staff involved in the program. They are the people that actually do the hiring at CCF, and they keep up to date on such issues by reading medical physics trade journals and attending national medical physics meetings.

### **Actions**

The content of each course is continually updated and adjusted in response to student difficulties with the course material and in response to the needs of the medical physics community.

The laboratory experience is continually updated and adjusted by the CCF staff to reflect new advances in the practice of medical physics.

Since the continued participation of the CCF Department of Radiation Oncology is less secure than it was a year ago, we have begun to work on expanding the participation of

the CCF Division of Radiology. To date, one person from the Division of Radiology (i.e. the head of the Diagnostic Medical Physics Department there) actively participates in our MS program. We are seeking a wider participation with them. This may likely evolve the MS program in the direction of diagnostic medical physics and somewhat away from radiation oncology. This shift in emphasis also is in line with an increased student interest in diagnostic medical physics. However, a source of future concern is that, at the moment, about 75% of the job openings for MS medical physicists in the United States are in radiation oncology, whereas only about 25% are in diagnostic medical physics.

The CSU/CCF Medical Physics Steering Committee will develop a rubric, i.e. a standardized check sheet, for evaluating the medical physics projects in both semesters of the laboratory experience in diagnostic medical physics.

This information was provided by  
James A. Lock  
Professor of Physics and  
Physics MS Program Director  
July 06, 2007