

## 2006 ASSESSMENT REPORT FOR THE PHYSICS MS PROGRAM

### **Introduction and Context MS Program in Optics**

The physics MS program with specialty in either optics or medical physics is entirely vocational in nature. The optics specialty was introduced in 1983 to (i) upgrade the optics knowledge of scientists and engineers employed at the NASA-Glenn Research Center and its contractors, and (ii) to provide a source of new optical scientists and engineers to NASA-Glenn and its contractors. It has been relatively easy to handle assessment of the optics MS program and to evolve it to fit NASA's changing needs since four of the faculty in the CSU physics department who have taught six of the seven courses in the MS physics program have had long-standing research collaborations with various NASA-Glenn scientists and engineers. The optics program has graduated 60 students during the last 20 years, most of whom either worked at NASA at the time, or who were hired by NASA after their MS. The goals of the optics MS program were first developed in 1983 by the physics department graduate committee and have continued to evolve since then based on both changing trends in optics research at NASA-Glenn. The outcomes were also first developed in 1983 by the physics department graduate committee.

However, since NASA-Glenn has fallen on hard times in recent years, the optics MS program has greatly contracted. The final two students in the program will graduate in Aug. 2006, and to first approximation, there will likely be no more. As a result, the assessment of the optics program will not be discussed further in this document.

### **Introduction and Context MS Program in Medical Physics**

The MS medical physics specialty in collaboration with the Department of Radiation Oncology at the Cleveland Clinic Foundation (CCF) was begun in 2001 and has graduated 11 people, all of whom are employed as medical physicists either at CCF, or at other hospitals and regional cancer centers in Ohio, Pennsylvania, Colorado, and California. Medical physicists are responsible for the instrumentation and radioactive isotopes used in (i) various types of radiation therapy for cancer patients and (ii) during various radiation therapy surgeries. None of the CSU physics department faculty has detailed knowledge of these things. As a result the CSU physics faculty teaches 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 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 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 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 down-side of sorts. It means that the most important half of the medical physics MS program is outside of CSU's control. All we can do is politely ask the CCF staff to comply with various CSU administrative procedures such as faculty/course student evaluations and the collection and organization of materials for assessment. Since the medical physicists teaching in the program are CCF rather than CSU employees, CSU does not have the same authority over them as would be the case if CSU had a medical school and we were all under the same President and Provost. It is unlikely that CSU will be able to bring all aspects of the MS program in medical physics under its control since the CSU physics department is unable to hire a medical physicist as an assistant or associate professor. This is because a new PhD medical physicist employed by a research hospital starts at over 3 times the salary of a new assistant or associate professor here.

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 2004 and put into effect in 2005 is 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 is that (i) the student interns at CCF have much contact with patients, and must thus 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 too many 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 (Clouser, Gajdos, Muhieddine, Kolar, and Rybak) 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 is that beginning in the Fall 2006 Semester we are going from the open admissions we had in the past to selective admissions. This change is a direct result of the assessment process. We had open admissions in the past in order to keep the enrollment as large as possible, because being a small program, we had been under great pressure from past CSU administrations to do so or possibly face elimination. But in the classroom the open admissions policy has not worked well. There have been too many instances of students on academic probation, dismissal from the program by the Graduate Dean, and dismissal from the internship at CCF half way through due to poor performance. 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 the proper undergraduate preparation in physics and mathematics to successfully learn the material presented to them in the program's courses. As a result, it was felt that the most sensible way to generate consistently better student outcomes was to only admit potential students whose backgrounds indicated that they would likely be able to successfully make it through the program, and to greatly limit the acceptance of students we consider to be very high risk. Thus our first year enrollment for Fall 2006 will likely be 3 rather than the 9 it has been for the previous few years. We can only hope that the current CSU administration will continue to support this MS program in light of the significantly smaller number of students we will now have.

### **Program Goals**

#### **MS Medical Physics Program**

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.

### **Assessment Details**

#### **MS Medical Physics Program**

#### **Outcome Measures**

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 passed the medical physics licensing examination.

### **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 now employed 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.

### **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.

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.

### **Integration**

The graduate advisor confers with the student each semester about his/her progress in achieving the learning outcomes, and the CCF medical physics staff confers with the student at regular intervals about his/her progress in achieving the learning outcomes of the laboratory experience.

The CSU/CCF Medical Physics Steering Committee uses the performance of students currently in the program to assess and modify the admission criteria for selecting the next year's incoming class.

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