

Medical University of South Carolina
College of Graduate Studies &
Center for Biomedical Imaging



Program Planning Summary

Ph.D. in Biomedical Imaging

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Date

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Program Planning Summary New Program

Institution: Medical University of South Carolina

Academic Unit: College of Graduate Studies

Name of Program: Ph.D. in Biomedical Imaging

CIP Code: 26.1103

Proposed date of implementation: Fall 2014

Qualification for Palmetto Fellows Scholarship or LIFE Scholarship: No

Delivery mode: Traditional

Justification

Need for the Program. There is a growing need for experts in the application and development of engineering and scientific training in biomedical imaging technologies both for medicine and biological sciences generally. The Bureau of Labor Statistics estimates that nationally, “Employment of biomedical engineers is projected to grow by 62 percent from 2010 to 2020, much faster than the average for all occupations” (<http://www.bls.gov/ooh/architecture-and-engineering/biomedical-engineers.htm>). Further, the South Carolina Department of Employment and Workforces estimates that by 2020 employment of biomedical engineers will grow in South Carolina by 75% (<http://lmi.dew.sc.gov/lmi%2osite/Documents/CommunityProfiles/01000000.pdf>). These employment opportunities require a wide variety of engineering skills but digital imaging is an increasing component of all aspects of modern technology. Thus, as healthcare, biomedical research, and biotechnology industries all become increasingly invested in using imaging technologies, the demand for individuals with expertise in this area will grow.

Currently no university in South Carolina offers a graduate degree in Biomedical Imaging at either the M.S. or Ph.D. level. Although both M.S. and Ph.D. programs are ultimately needed, we propose to establish a new program for a Ph.D. in Biomedical imaging and will independently address the need for an M.S. degree in Biomedical Imaging in a separate document as a new concentration in our existing M.S. in Biomedical Sciences program. While both degrees would enable a graduate to work in industry and academia at advanced levels, the Ph.D. is specifically designed to establish its graduates as independent, creative scientists. Establishing such a program falls within the mission of MUSC to “educate students to become creative biomedical scientists” and addresses its strategic initiative area of innovation.

Relationship with Existing Programs Within MUSC: The proposed Ph.D. program in Biomedical Imaging will expand the successful and long-standing academic programs in biomedical sciences at MUSC. That is, the Ph.D. in Biomedical Imaging will be a new program at MUSC that stands beside other Ph.D. programs in Biochemistry, Physiology, Neuroscience, and Cellular/Molecular Biology. The inclusion of the Ph.D. in Biomedical Imaging program will also afford students in those other Ph.D. programs to enroll in courses offered in the Biomedical Imaging program, so it will supplement (and complement) the coursework for existing Ph.D. programs.

Relationship with Existing Programs at Other Institutions: There is no duplication with other Ph.D. programs in the state. Most closely related yet separate is the bioengineering graduate program at Clemson University. Since 2003, MUSC has collaborated with Clemson to provide a learning site for faculty and both M.S. and Ph.D. graduate students in Clemson’s Bioengineering program. Clemson’s bioengineering students take courses from Clemson faculty on the MUSC

campus as well as via distance learning modalities from Clemson University. The program covers a broad spectrum of applied and basic research opportunities that include biomaterials science and tissue engineering. However, there is no specific focus within the bioengineering program on biomedical imaging. There is some overlap in the set of quantitative skills required to be successful in both bioengineering or biomedical imaging; the latter emphasizes an understanding of certain physical principles and systems-level biological phenomena that are better suited to serve the needs of students specifically interested in the applications-oriented field of biomedical imaging.

Program Demand and Productivity

Based on our experience with present MUSC graduate students (both Ph.D. and M.D./Ph.D. students), we anticipate recruiting three to five students in the first year of the program with potentially increase in enrollment in subsequent years as we engage in recruitment efforts. We expect that within four years, the program may admit six to eight students per year, depending on grant funding. Once the program is established we will apply for training grants to support the students. These grants would be supplemented by individual research grants to the faculty which would support individual students during their dissertations. This would bring the anticipated number of students to complete the program after its fourth year to five to eight per year although this would be limited by the number of successful grants our faculty receive.

Employment Opportunities for Graduates

The proposed Ph.D. in Biomedical Imaging will train graduates for careers using basic, translational, and clinical research methodologies. Graduates from the Biomedical Imaging program will be highly skilled and well marketable for careers in industry (specifically biotechnology and pharmaceutical industries, both are growth industries), medicine, and research. The Bureau of Labor Statistics Occupational Outlook Report (2010-2020) reports that medical science, biomedical engineering, and biophysics (all fields in which graduates from the Ph.D. in Biomedical Imaging program might seek employment) are growth fields, with faster than average rates of growth expected (between 31% and 62%, references below).

<http://www.bls.gov/ooh/life-physical-and-social-science/medical-scientists.htm>

<http://www.bls.gov/ooh/architecture-and-engineering/biomedical-engineers.htm>

<http://www.bls.gov/ooh/life-physical-and-social-science/biochemists-and-biophysicists.htm>

Curriculum

The proposed program will require at least 57 didactic credit hours plus experiential work commensurate with the College of Graduate Studies' expectations for doctoral research. Typically, this requires at least nine semesters following the first year of course work (at approximately 15 credit hours per semester).

The curriculum begins with a biomedical science core, required of all doctoral degree students, of 45 credit hours in the first year which includes courses in foundations of biomedical sciences, essential scientific practices, laboratory rotations, important unanswered questions in biomedical sciences, and various electives (Spring semester).

Students in the Biomedical Imaging program will replace three of these courses with courses specifically related to developing expertise in Biomedical Imaging (a total of 15 credit hours). In the second year students in the Ph.D. for Biomedical Imaging will also take three didactic courses (9 credit hours) related to imaging. In total, the Biomedical Imaging-specific didactic

courses include imaging methods, quantitative physiology using imaging, mathematical methods, molecular imaging, signal and image processing, and MRI methods. These courses will be completed in addition to experiential research, journal clubs, and selective seminars.

Subsequent years in the program will be devoted to experiential learning in biomedical imaging and research, journal clubs, and electives relevant to imaging technologies. Students can complete the program in a minimum of four years and in not more than seven years.

Articulation and Inter-institutional Cooperation

As reported above, MUSC and Clemson University have an active collaborative relationship in bioengineering. Students from Clemson, with the approval of their institution, will be allowed and encouraged to take courses offered in MUSC's Biomedical Imaging program.

Estimate of Costs

This program will be a new program among the College of Graduate Studies' doctoral programs in biomedical sciences. Applicants to the program will be competing for a set number of slots along with applicants to the other existing Ph.D. programs. The total costs of the program will depend on the number of students accepted and are expected to be approximately the same per student as in other programs.

Much of the necessary infrastructure is pre-existing, but there will be some new costs for administration. Faculty for the program (primarily from MUSC's Center for Biomedical Imaging, see <http://academicdepartments.musc.edu/cbi/>), are supported by research grants that will also support projects that the Biomedical Imaging Ph.D. students will engage in as part of their independent research and experiential learning. However, partial salary compensation is needed for faculty, staff, and a program director to implement this program.