

Medical Biophysics, PhD

Program Description

Students and faculty associated with Clemson University's Medical Biophysics Graduate Program (MBGP) use the language and tools of physics, medicine, genetics, biochemistry, mathematics, physical chemistry, and molecular and cellular biology to understand fundamental physical principles underlying complex biological and medical phenomena, and the application of these principles in solving biomedical problems.

Students in the MBGP perform collaborative, highly interdisciplinary research in multiple Clemson departments and colleges and through partnerships with the Health Sciences Center at PRISMA Health, the Clemson Center for Human Genetics Clemson Genomic Institute, the Eukaryotic Pathogen Innovations Center, and the Center of South Carolina Translational Research Improving Musculoskeletal Health. The graduate training provided by the MBGP prepares students for careers bridging fundamental science and medicine. The MBGP is an independent graduate program. MBGP students work with an interdisciplinary group of researchers and have access to resources of all participating departments, colleges, and research centers associated with Clemson University.

The Doctor of Philosophy degree in Medical Biophysics is designed for individuals seeking employment in academia, NIH, national labs, and the biomedical industry. Upon graduation, and sequential postdoctoral training, students are very competitive for tenure-track positions in R-1 institutions and high-level positions in government and commercial institutions.

Successful students in the MBGP at Clemson University are expected to come from many different scientific backgrounds and the curriculum is designed with the flexibility to meet student-specific goals. Students take four required courses during their first year and choose from a large and growing range of elective courses in subsequent years so their training is tailored specifically to desired research interests. The MBGP is designed so students spend the maximum amount of time in research training rather than in the classroom.

Summary of Degree Requirements

The Doctor of Philosophy in Medical Biophysics requires a minimum of 60 credits of coursework, completion of core courses with average grade "B" or higher and the successful submission presentation and defense of a doctoral thesis.

Coursework

During their first year, students take the following courses:

- MBIO 8100 - Molecular and Cellular Medical Biophysics 3 Credits

- MBIO 8110 - Medical Biophysics at Larger Scale: Tissues and Organs 3 Credits
- MBIO 8210 - Medical Biophysics and Human Health 3 Credits
- MBIO 8220 - Medical Biophysics Seminar Series 3 Credits

Upon successful completion of the core courses, the student and the advisory committee select a minimum of total four elective courses that must be completed in the second and third year from courses in fields such as bioengineering, biology, chemical and biomolecular engineering, chemistry, computer science, genetics and biochemistry, materials sciences, mathematical sciences, physics, or plant and environmental sciences, or various lectures and seminars offered by PRISMA Health. The student may select, or the advisory committee may require, more elective courses if necessary. List of available elective courses is provided here.

The student's advisory committee is formed by three members of participating faculty who are experts in the field chosen by the student. In addition, to ensure student has broad view in Medical Biophysics, it is required that two additional members be selected from participating faculty who are not experts in the research area of the student's doctoral thesis.

Outcomes, Learning Objectives, and Graduation Requirements

Outcomes: Graduated students are expected to be fully prepared to successfully practice Medical Biophysics in academia, government institutions, industry and other related fields. They will support the growth of and be employed by the medical biophysics industry and related fields within South Carolina and USA. The program will maintain a total enrollment sufficient to ensure program viability and program quality.

Learning Objectives:

- (1) An ability to identify, formulate, and solve complex problems in the field of Medical Biophysics.
- (2) An ability to develop and conduct appropriate computational and/or experimental investigations, analyze and interpret data, and use scientific judgment to draw conclusions.
- (3) An ability to apply Medical Biophysics knowledge in Computational and Experimental Biophysics to produce solutions that meet specified needs of Medicine.
- (4) An ability to carry independent research and to lead a team of researchers.
- (5) An ability to apply Medical Biophysics knowledge to problems and discoveries that are of interest of South Carolina and US industry, academic and medical institutions. This will be targeted via the MBIO 9910 course with topics aligned with particular needs.

Graduation Requirements:

- (1) Successful completion of core courses with average grade "B" or higher.
- (2) The first-year students take core courses. It is required that students have at minimum 30 credit hours in coursework. At the end of the program, the students accumulate 60 credit hours, which includes 30 research credits via MBIO 9910 course.
- (3) Several peer reviewed papers, which demonstrate the ability to address a complex problem in the field as determined by an internally developed rubric.

- (4) Completion of dissertation thesis that demonstrates the student's ability to develop and conduct experimental and/or computational investigations, analyze data and draw conclusions.
- (5) Assessment of student's performance in core coursework and final exams on topics related to Biophysics (Biophysics component) and genetical origin of human diseases and Personalized Medicine (Medical component).
- (6) Several talks/posters as a first author at regional/national meetings, which demonstrate the ability to address a complex problem in the field as determined by an internally developed rubric.