

PHYSIOLOGY AND BIOPHYSICS, MASTER OF SCIENCE (M.S.)

Program goal

The master's program in physiology and biophysics is designed to provide students with the skills required to advance to positions as physiology and bioscience researchers and trainers in a broad spectrum of positions. The structure of the program provides a framework for the progressive development of a mastery of the current state of the subject matter of physiology and bioscience, as well as an ability to synthesize this information and apply this foundation to the identification of key areas of investigation and experimentation in bioscience. The program relates the above framework to the development of the ability to design, implement and interpret experimental approaches which address the questions identified. In addition, students will develop skills in the various means of communicating both the core of bioscience knowledge and the expression of experimental design, results and interpretation to a variety of potential audiences.

Student learning outcomes

1. Problem-solving skills: Degree candidates will demonstrate an appropriate level of skill in the identification and selection of meaningful problems to be addressed in bioscience research, including the ability to defend said identifications and to design and develop appropriate methods to solve said problems as measured by rubric.
2. General knowledge of sciences: Degree candidates will demonstrate an appropriate level of knowledge of the current elements of the biosciences as related to disciplinary specialization and a more detailed understanding of the individual area of scholarship, including an appropriate familiarity with the research literature and the ability to evaluate and critique publications, as measured by rubric.
3. Communication skills: Degree candidates will demonstrate that an appropriate level of oral, written and visual communication skills have been acquired.
 - a. Oral communication skills: Degree candidates will demonstrate the achievement of an appropriate level of oral communication skills with respect to the content, organization, logical flow, presentation and appropriate use of language incorporating the use of visual aids, as measured by rubric.
 - b. Written communication skills: Degree candidates will demonstrate the achievement of an appropriate level of written communication skill with respect to grammar, syntax, spelling and use of vocabulary to effectively present information including the use of figures, tables and citations as measured by rubric.
4. Experimental design: Degree candidates will demonstrate the achievement of an appropriate level of competence in the ability to appraise, modify and/or create, and implement experimental protocols and to design and develop experiments as measured by rubric.

VCU Graduate Bulletin, VCU Graduate School and general academic policies and regulations for all graduate students in all graduate programs

The VCU Graduate Bulletin website documents the official admission and academic rules and regulations that govern graduate education for all graduate programs at the university. These policies are established by the graduate faculty of the university through their elected representatives to the University Graduate Council.

It is the responsibility of all graduate students, both on- and off-campus, to be familiar with the VCU Graduate Bulletin as well as the Graduate School website (<http://www.graduate.vcu.edu>) and academic regulations in individual school and department publications and on program websites. However, in all cases, the official policies and procedures of the University Graduate Council, as published on the VCU Graduate Bulletin and Graduate School websites, take precedence over individual program policies and guidelines.

Visit the academic regulations section for additional information on academic regulations for graduate students. (<http://bulletin.vcu.edu/academic-regs>)

Degree candidacy requirements

A graduate student admitted to a program or concentration requiring a final research project, work of art, thesis or dissertation, must qualify for continuing master's or doctoral status according to the degree candidacy requirements of the student's graduate program. Admission to degree candidacy, if applicable, is a formal statement by the graduate student's faculty regarding the student's academic achievements and the student's readiness to proceed to the final research phase of the degree program.

Graduate students and program directors should refer to the following degree candidacy policy as published in the VCU Graduate Bulletin for complete information and instructions.

Visit the academic regulations section for additional information on degree candidacy requirements. (<http://bulletin.vcu.edu/academic-regs/grad/candidacy>)

Graduation requirements

As graduate students approach the end of their academic programs and the final semester of matriculation, they must make formal application to graduate. No degrees will be conferred until the application to graduate has been finalized.

Graduate students and program directors should refer to the following graduation requirements as published in the Graduate Bulletin for a complete list of instructions and a graduation checklist.

Visit the academic regulations section for additional information on graduation requirements. (<http://bulletin.vcu.edu/academic-regs/grad/graduation-info>)

Other information

School of Medicine graduate program policies

The School of Medicine provides policies applicable to all programs administratively housed in the school. Information on **master's programs** is available elsewhere in this chapter of the Graduate Bulletin.

Apply online at graduate.admissions.vcu.edu (<http://www.graduate.admissions.vcu.edu>).

Admission requirements

Degree:	Semester(s) of entry:	Deadline dates:	Test requirements:
M.S.	Fall preferred	Apr 15	GRE, MCAT or DAT

Special requirements

- Students admitted through the Certificate in Pre-medical Graduate Health Sciences program only.

In addition to the general admission requirements of the VCU Graduate School (<http://bulletin.vcu.edu/graduate/study/admission-graduate-study/admission-requirements>), applicants generally meet the following minimum requirements: baccalaureate degree or its equivalent at the time of enrollment and successful completion of the Certificate in Pre-medical Graduate Health Sciences.

Basic science, research-intensive, non-thesis curriculum for medical students

Individuals who are participants in medical training (the Doctor of Medicine program) at VCU may be eligible for enrollment in a research-intensive, non-thesis graduate curriculum. This basic science option builds on the core of disciplinary material embedded in the first two years of training in the medical school curriculum. Additional exposure is provided to specialized areas in basic science disciplines in concert with an intensive research experience leading to the preparation of a report in the form of a manuscript suitable for publication. The program is designed to be completed within 12 to 15 months. Subject matter related to the core material and/or suitable elective courses taken in the didactic phase of medical training correspond to a minimum of the equivalent of 24 graduate credit hours. The equivalent of 12 credit hours may be applied to the M.S. degree program in which the student is enrolled in accordance with Graduate School policy. Medical students interested in the basic science option should contact the M.S. graduate program director for additional information.

Degree requirements

The Department of Physiology and Biophysics offers courses of study leading to the Master of Science and the Doctor of Philosophy. A combined M.D./Ph.D. degree program is also available through this department and the School of Medicine. It is generally recommended that students intending to pursue careers as professional physiologists should attempt to earn the Ph.D. Work done in partial or complete fulfillment of the requirements for the master's degree may be applied toward the Ph.D. provided that it is of adequate quality.

Graduate education in physiology and biophysics is a highly individualized enterprise, of which the formal course requirements comprise only a portion. The degree program described here provides an opportunity for apprenticeship in research and, through this, the development of a capacity for scholarship. The essence of this type of education lies in the development of a close relationship between the student and the faculty adviser. The adviser and the student, jointly and with the approval of the department chair and the associate dean of medicine for graduate education, select the student's graduate advisory committee.

The M.S. degree program includes a year of didactic course work (completed as part of the Certificate in Pre-medical Graduate Health Sciences program) and a second year largely devoted to the completion of an independent research project, writing a thesis based on this work and a successful oral defense of this thesis and completed course work.

In addition to the general VCU Graduate School graduation requirements (<http://bulletin.vcu.edu/academic-regs/grad/graduation-info>), students must complete a minimum of 30 graduate credit hours for the M.S. in Physiology and Biophysics.

Teaching experience

M.S. students also have the opportunity to acquire teaching experience and financial support by serving as teaching assistants for PHIZ 206 Human Physiology Laboratory for one semester. Teaching assistants must complete PHIS 691 (PHIS 501) for two credit hours prior to or concurrent with the assistantship.

Curriculum requirements

Course	Title	Hours
Select one of the following:		1
OVPR 601	Scientific Integrity	
OVPR 602	Responsible Scientific Conduct (online)	
OVPR 603	Responsible Conduct of Research (hybrid)	
PHIS 604	Cell Physiology: Cardiovascular and Respiratory	3
PHIS 606	Molecular Basis for Disease (001)	3
Take two credits in the following course:		2
PHIS 690	Physiology Research Seminar (901)	
PHIS 692	Special Topics (606)	1
Take 20 credits in the following course:		20
PHIS 697	Directed Research in Physiology (801)	
Total Hours		30

Total graduate credit hours required (minimum) 30

Advanced optional elective courses available in the second year include:

Course	Title	Hours
PHIS 612	Cardiovascular Physiology	3
PHIS 615	Signal Detection in Sensory Systems	3
PHIS 619	Mitochondrial Pathophysiology and Human Diseases	3
PHIS/PHTX 620	Ion Channels in Membranes	3
PHIS 630	Methods in Molecular Biophysics: A Practical Approach	2
PHIS 631	Electrophysiology and Photonic Methods	2
PHIS 691	Special Topics in Physiology ((003))	3

Typical plan of study

Many students often end up taking more than the minimum number of hours required for a degree program. The total number of hours may vary depending upon the program, nature of research being conducted by a study or in the enrollment or funding status of the student. Students should refer to their program websites and talk with their graduate

program directors or advisers for information about typical plans of study and registration requirements.

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Program website: physiology.vcu.edu (<http://www.physiology.vcu.edu>)