

# PHYSIOLOGY AND BIOPHYSICS, DOCTOR OF PHILOSOPHY (PH.D.)

## Program goals

1. The program is designed to provide students with the skills required to advance to positions as bioscience researchers and trainers in a broad spectrum of positions.
2. The structure of the program provides a framework for the progressive development of a mastery of the current state of the subject matter of bioscience, an ability to synthesize this information and apply this foundation to the identification of key areas of investigation and experimentation in bioscience.
3. The program relates the above framework to the development of the ability to design, implement and interpret experimental approaches which address the questions identified.
4. In addition, the program 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.

## Program goals

### Training in physiology and biophysics

1. Students in the doctoral program in physiology and biophysics will acquire the skills to become independent research scientists, educators and administrators in a broad spectrum of positions.
2. Students will gain a progressive mastery of concepts in physiology and biophysics and related disciplines; an understanding of the current state of research investigations in the field; an ability to synthesize information and apply foundational concepts to identify key areas for innovative investigation and experimentation; and the knowledge to design, execute and interpret experiments and publish studies that address the questions identified.
3. Students will develop skills in various means of communicating core knowledge in the field and the details of experimental design, results and interpretation to a variety of potential audiences.

## Student learning outcomes

1. Problem-solving and analytical skills: Degree candidates will demonstrate an appropriate level of skill to identify and address scientific questions and utilize appropriate analytical methods and tools.
  - a. Problem-solving skills include the ability to: (1) effectively identify and select meaningful problems to be addressed in research studies; (2) define and state the hypotheses to be tested and their significance; (3) develop, justify and execute experimental and analytical methods to address the research questions identified; and (4) appropriately maintain complete records of experimental protocols, experimental data and working results of data analysis in order to document the accuracy and reproducibility of the studies and scientific publications.
  - b. Analytical skills include the ability to: (1) interpret information and quantitative data relevant to studies in physiology and biophysics, including by effectively using software and other analytical tools and by applying appropriate statistical tests to ensure data are robust; (2) connect rationales to experimental approaches; (3) draw reasonable conclusions from the evidence

obtained and consider alternative interpretations; and (4) identify limitations in the experimental design and interpretation.

2. General knowledge of sciences and integration skills: Students will demonstrate an appropriate level of knowledge in related 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.
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 include selection of content, organization and logical flow of ideas, and development of clear and professional presentations using appropriate language and incorporating appropriate visual aids.
  - b. Written communication skills include an appropriate use of grammar, syntax, spelling and vocabulary to effectively present written information in scientific style including the use of figures, tables and citations.

## 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. (<https://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. (<https://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.** (<https://bulletin.vcu.edu/academic-regs/grad/graduation-info/>)

## Other information

Additional information is summarized under the Education tab on the departmental website (<https://physiology.vcu.edu/education/>). Feel free to contact the graduate program coordinator with any questions.

### School of Medicine graduate program policies

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

Apply online today. (<https://www.vcu.edu/admissions/apply/graduate/>)

## Admission requirements

Degree:	Semester(s) of entry:	Deadline dates:	Test requirements:
Ph.D.	Fall	Dec 1 of year before matriculation	TOEFL if international

## Special requirements

- Applications for the program must be submitted to the Biomedical Sciences Doctoral Portal – School of Medicine – Ph.D. selected from the drop-down menu of programs on the VCU online application form.
- Applications to the BSDP should be completed (i.e. receipt of all forms, letters, transcripts, etc.) by Dec. 1 of the year before matriculation. Applications completed after this date will be reviewed only as remaining spaces permit.

In addition to the general admission requirements of the VCU Graduate School (<https://www.vcu.edu/admissions/apply/graduate/>), successful applicants will typically have the following credentials:

1. A baccalaureate degree or its equivalent at the time of enrollment, with an undergraduate GPA of 3.5
2. TOEFL scores of 600 (pBT), 250 (cBT) or 100 (iBT) for individuals for whom English is a second language; or 6.5 on the IELTS (To report GRE or TOEFL score, use VCU Code 5570.)
3. Personal statements, which should include: long-term career goals to assess reasons behind the candidate's application; how a Ph.D. in biomedical science helps achieve those goals; the factors motivating a career in research; research experience, including dates, places and duration
4. Three letters of recommendation that speak to the scientific competency and experience of the applicant

5. The equivalent of two semesters of general chemistry, two semesters of organic chemistry and two semesters of upper-level biology courses (e.g. cell biology, molecular biology, biochemistry, genetics, neuroscience, physiology, biophysics, etc.)

## Degree requirements

Graduate study in the Department of Physiology and Biophysics in the School of Medicine is a highly individualized undertaking and required course work represents only one component. Each student's program is tailored to meet their particular interests, with the primary emphasis on developing research skills and the capacity for independent scholarship.

Opportunities for research experience begin in the first year, when students spend time working in several faculty laboratories of their choice. These lab rotations enable students to examine faculty research projects, experimental approaches and laboratory environment and to select an area of specialization. In the second and subsequent years, increasingly more time is devoted to independent research under the guidance of a faculty adviser. Department-sponsored seminars and other activities give students opportunities to discuss their research interests with visiting scientists and to present their research both internally and at national professional meetings.

**The Ph.D. program in physiology and biophysics normally takes at least four years to complete.** The first two years are devoted mainly to course work. The first year consists primarily of required courses, while the second is geared toward electives and research. On satisfactory completion of two years of course work, students must pass written and oral comprehensive examinations to qualify for degree candidacy. Following admission to candidacy, each student must conduct a substantial original research project, prepare a written dissertation, present their work in a seminar and defend it successfully in an oral examination.

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 66 credit hours for the Ph.D., including directed research.

To gain teaching experience, Ph.D. students are expected to serve as teaching assistants for PHIZ 206 for one semester.

## Course requirements

Course	Title	Hours
<b>Required core courses</b>		
BIOC 503	Biochemistry, Cell and Molecular Biology	5
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IBMS 600	Laboratory Safety	1
IBMS 621	Laboratory Rotation I	2
IBMS 622	Laboratory Rotation II	2
IBMS 623	Laboratory Rotation III	2
PHIS 501	Mammalian Physiology	5
PHIS 650	Critical Thinking in Physiology	1
PHIS 689	Physiology Preseminar Highlights (one-credit course, required each Fall and Spring semester)	4

PHIS 690	Physiology Research Seminar (one-credit course, required each Fall and Spring semester)	4	Graduate program assistant director cescalante@vcu.edu (804) 628-1202
PHIS 695	Research in Progress (0.5-credit course, required each Fall and Spring semester)	2	Christina Kyrus Graduate program coordinator cikyrus@vcu.edu (804) 628-5506
<b>Required additional courses</b>			
OVPR 601	Scientific Integrity	1	
or OVPR 602	Responsible Scientific Conduct		
or OVPR 603	Responsible Conduct of Research		
<b>Elective courses</b>			
Select six credits from the following or as recommended by the graduate advisory committee and approved by the graduate program director:		6	
IBMS 635	Cellular Signalling		
PHIS 604	Cell Physiology: Cardiovascular and Respiratory		
PHIS 606	Molecular Basis for Disease		
PHIS 607	Cell Physiology: GI and Endocrine		
PHIS 612	Cardiovascular Physiology		
PHIS 615	Signal Detection in Sensory Systems		
PHIS 620	Ion Channels in Membranes		
PHIS 630	Methods in Molecular Biophysics: A Practical Approach		
<b>Dissertation research</b>			
PHIS 697	Directed Research in Physiology (variable credit course, required each semester)	26	
<b>Total Hours</b>		<b>66</b>	

The minimum total of graduate credit hours required for this degree is 66.

Students who complete the requirements for this degree will receive a Doctor of Philosophy in Physiology and Biophysics.

## 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.

## M.D.-Ph.D. opportunity

The M.D.-Ph.D. program allows students to pursue both the M.D. and Ph.D. degrees using a coordinated program of study and apply a limited number of M.D. requirements toward fulfillment of requirements for the Ph.D. See the dual degree program page (<https://bulletin.vcu.edu/graduate/dual-degree-ops/md-physbio-phd/>) for additional details.

### Contact

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### Additional contacts

Carlos Escalante, Ph.D.