

HUMAN GENETICS, DOCTOR OF PHILOSOPHY (PH.D.) WITH A CONCENTRATION IN MOLECULAR BIOLOGY AND GENETICS

Program goals

The molecular biology and genetics curriculum is an integrated interdisciplinary program of study that builds on the graduate programs of participating departments in the School of Medicine. The doctoral curriculum is designed to be an intensive course of study that will provide students with the skills required to advance to research-oriented careers in biotechnology.

1. The curriculum includes core, specialization and elective courses. Electives drawn from various departments allow individual specialization.
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. The program relates this framework to the development of the ability to design, implement and interpret experimental approaches which address the questions identified.
3. 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.
4. The program centers on a research project conducted under the guidance of a selected faculty mentor and culminates in the presentation and defense of a doctoral dissertation.

Participating faculty are associated not only with programs and departments within the School of Medicine, but also with the VCU Massey Cancer Center, the Philips Institute for Oral and Craniofacial Molecular Biology (School of Dentistry), the Institute of Structural Biology and Drug Discovery (School of Pharmacy) and the VCU Center for the Study of Biological Complexity (VCU Life Sciences).

The interdisciplinary approach to the solution of biological problems provided by this training is designed to develop in students the flexibility and problem-solving skills necessary for success in a variety of scientific career opportunities or further graduate study.

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 **doctoral 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:
Ph.D.	Fall	Applications received prior to Jan 15 given priority consideration	GRE, MCAT or DAT

Special requirements

- MCAT or DAT acceptable in lieu of GRE for combined professional/academic degree programs
- 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.

In addition to the general admission requirements of the VCU Graduate School (<http://bulletin.vcu.edu/graduate/study/admission-graduate-study/admission-requirements>), 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. Current GRE scores (taken within the past five years), with scores at the 75th percentile or greater preferred
3. 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.)
4. 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
5. Three letters of recommendation that speak to the scientific competency and experience of the applicant

6. 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.)

7. Laboratory experience also strongly recommended

Degree requirements

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 86 graduate credit hours.

During the first year, students pursue research rotations, take formal course work and become familiar with current research topics through seminars, discussion groups and lectures by distinguished scientists. By the end of the first year, students choose a faculty adviser and begin dissertation research. Prior to the beginning of the third year of study, students should successfully pass written and oral candidacy examinations. Following completion of the research project and defense of the doctoral dissertation, graduates are equipped to participate in a broad range of current biomedical research areas.

Curriculum requirements

Required courses

Course	Title	Hours
BIOC 503	Biochemistry, Cell and Molecular Biology ¹	5
BIOC 504	Biochemistry, Cell and Molecular Biology	1-5
BIOC 602	Physical Properties of Macromolecules (modules 1 and 2)	2
HGEN 501/BIOL 530	Introduction to Human Genetics	3
HGEN 602	Genetic Models of Disease	3
or HGEN 614	Pathogenesis of Human Genetic Disease	
IBMS 600	Laboratory Safety	1
IBMS 610	Laboratory Opportunities	0.5
IBMS 620	Laboratory/Clinical Rotations (three rotations)	6
Select one of the following (or an equivalent):		1
IBMS 630	Critical Thinking	
BIOC 691	Special Topics in Biochemistry	
HGEN 691	Special Topics in Genetics	
IBMS 680	Proposal Preparation	1
IBMS 690	Basic Health Sciences Research Seminar (first year only)	1
MICR 605	Prokaryotic Molecular Genetics	3
MICR 607	Techniques in Molecular Biology and Genetics	2
Take one credit in the following every semester beginning in the second year:		variable
MICR 690	Microbiology Research Seminar (section 002-MBG)	
Take the following course at least twice:		variable
MICR 693	Topics in Molecular Biology and Genetics	
Select one of the following:		1
OVPR 601	Scientific Integrity	

OVPR 602	Responsible Scientific Conduct
OVPR 603	Responsible Conduct of Research

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Students may complete the five-credit module sequence BIOC 530, BIOC 531, BIOC 532 and BIOC 533 in place of BIOC 503.

Directed research and electives

Course	Title	Hours
Select a variable number of credit hours of the following to amass the required minimum of 86 credit hours.		variable

HGEN 697	Directed Research in Genetics
Electives	

Total graduate credit hours required (minimum) 86

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.

Graduate program director

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Program website: [vcu.edu/mbg](http://www.vcu.edu/mbg) (<http://www.vcu.edu/mbg>)