MICROBIOLOGY AND IMMUNOLOGY, DOCTOR OF PHILOSOPHY (PH.D.)

Program goal
The graduate programs of the Department of Microbiology and Immunology in the School of Medicine include degrees offered at the master's and doctoral levels. These educational programs have as their mission the preparation of individuals for a variety of career objectives in microbiology and immunology. The programs incorporate formal instructional activities and, as appropriate, research training, mentored by the members of the faculty. The M.S. program is distinguished by inclusion of the preparation of the individual to function as a laboratory director or scientific investigator.

The Ph.D. 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. 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. The program relates this framework to the development of the ability to design, implement and interpret experimental approaches that address the questions identified.

The Ph.D. program is also designed to 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. Oral communication skills: The candidate 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.
2. Written communication skills: The candidate 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.
3. Experimental design: The candidate 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.
4. Problem-solving skills: The candidate 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.
5. General knowledge of science: The candidate should demonstrate a general knowledge of the elements of the sciences as related to molecular/cellular bioscience and a detailed knowledge of his or her area of research, including an appropriate familiarity with the research literature.

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.graduateschool.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-reg)

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-reg/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-reg/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://wwwgraduate.admissions.vcu.edu).

Admission requirements

<table>
<thead>
<tr>
<th>Degree</th>
<th>Semester(s) of entry</th>
<th>Deadline dates</th>
<th>Test requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ph.D.</td>
<td>Fall</td>
<td>Applications received prior to Jan 15 given priority consideration</td>
<td>GRE or MCAT</td>
</tr>
</tbody>
</table>

Special requirements

- MCAT 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. GRE scores greater than 153 for quantitative, 156 for verbal (or combined 1250 on previous scale) and 4.0 analytical scores
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.)

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 58 graduate credit hours. At least six credits must come from didactic 600-level courses.

The Department of Microbiology and Immunology has an outstanding faculty with diverse research interests that include cell and molecular biology, molecular genetics, molecular pathogenesis, bacteriology, immunology, immunotoxicology, virology, parasitology, mycology and oncology. The goal of the graduate program is to prepare students to become creative problem-solvers and leaders in scientific research. The Ph.D. degree is offered, as well as an M.D./Ph.D. degree for medical students interested in academic or research careers.

The research experience is complemented with excellent course offerings, seminar programs, teaching opportunities, presentations at scientific meetings, writing of a grant application and writing of scientific papers. Graduate students acquire a wide range of research experience in the first year through exposure to a variety of research laboratories and investigators. The student chooses a research adviser, undergoes a written and oral examination and then carries out an original independent research project under the direction of the adviser. The project falls under the review of an advisory committee, and a written dissertation is defended in a final oral examination.

A cumulative GPA of 3.0 (with no more than six credit hours of a C grade) is required to continue in the program.

Curriculum requirements

Note: First-year Ph.D. students in the Biomedical Sciences Doctoral Portal must earn a minimum of seven credits of didactic courses in the fall semester in order to be eligible to matriculate into the Department of Microbiology and Immunology without being on academic probation. Three of these credits must come from MICR 505 or MICR 515.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>BIOC 503</td>
<td>Biochemistry, Cell and Molecular Biology</td>
<td>5</td>
</tr>
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<td>Biochemistry, Cell and Molecular Biology</td>
<td>5</td>
</tr>
<tr>
<td>MICR 505</td>
<td>Immunobiology</td>
<td>3</td>
</tr>
<tr>
<td>MICR 515</td>
<td>Principles of Molecular Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>IBMS 600</td>
<td>Laboratory Safety</td>
<td>1</td>
</tr>
<tr>
<td>IBMS 620</td>
<td>Laboratory/Clinical Rotations (three rotations)</td>
<td>6</td>
</tr>
<tr>
<td>MICR 690</td>
<td>Microbiology Research Seminar (taken each fall and spring semester; minimum eight credits)</td>
<td>8</td>
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</table>

Advanced microbiology and immunology course

Select at least one of the following (satisfies three credits of six-credit 600-level didactic requirement):

| MICR 605 | Prokaryotic Molecular Genetics |
| MICR 616 | Mechanisms of Viral and Parasite Pathogenesis |
| MICR 618 | Molecular Mechanisms of Bacterial Pathogenesis |
| MICR 686 | Advanced Immunobiology |

Journal club

Select one of the following journal club courses for one semester every year (four credits minimum).

| MICR 692 | Current Topics in Molecular Pathogenesis |
| MICR 693 | Topics in Molecular Biology and Genetics |
| MICR 694 | Current Topics in Immunology |

Responsible research and critical thinking

| OVPR 601 | Scientific Integrity |
| or OVPR 602 | Responsible Scientific Conduct |
| or OVPR 603 | Responsible Conduct of Research |
Electives and directed research
Select credits in directed research and additional elective courses from the following list to amass the required minimum of 58 credit hours from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>MICR 607</td>
<td>Techniques in Molecular Biology and Genetics</td>
</tr>
<tr>
<td>MICR/BNFO 653</td>
<td>Advanced Molecular Genetics: Bioinformatics</td>
</tr>
<tr>
<td>MICR 684</td>
<td>Molecular Biology of Cancer</td>
</tr>
<tr>
<td>MICR 697</td>
<td>Directed Research in Microbiology</td>
</tr>
</tbody>
</table>

Total Hours 58

Offered in alternate years

May be repeated with different content to satisfy the six-credit 600-level didactic requirement.

The minimum total of graduate credit hours required for this degree is 58.

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
Cynthia Nau Cornelissen, Ph.D.
Professor, Department of Microbiology and Immunology
cynthia.cornelissen@vcuhealth.org
(804) 827-1754

Additional contact
Martha L. VanMeter
Office services specialist
martha.vanmeter@vcuhealth.org
(804) 828-9728

Program website: vcu.edu/micro (http://www.vcu.edu/micro)