MICROBIOLOGY AND IMMUNOLOGY, MASTER OF SCIENCE (M.S.)

Program goals
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.

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/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.

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 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://wwwgraduate.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 master’s programs is available elsewhere in this chapter of the Graduate Bulletin.
Apply online at graduate.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>M.S.</td>
<td>Fall</td>
<td>Applications received prior to Jan 15 given priority consideration</td>
<td>GRE, DAT or MCAT</td>
</tr>
</tbody>
</table>

Special requirements

1. Successful domestic applicants typically have GRE scores of at least 156 for verbal reasoning and 153 for quantitative reasoning, 4.0 for analytical reasoning; DAT score of 18 or greater; or MCAT score of 26 or greater. International applicants should display English language proficiency by achieving a TOEFL score of 100 (IBT) or higher.

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 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 Master of Science degree is offered, as well as a Ph.D. and 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 and writing 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 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.

M.S. students will select their permanent advisers after three rotations completed during the first year of study. Research projects will be based on ongoing research in laboratories of the selected permanent adviser. A graduate advisory committee will be developed by the student and adviser. The M.S. student and the GAC will formulate a suitable curriculum of study based on the student's area of research interest.

In addition to the general VCU Graduate School graduation requirements, students in the M.S. degree program must complete a minimum of 41 credit hours (25 credit hours in didactic formal graduate courses, a minimum of four elective credit hours and a minimum of 12 directed research hours). Additional hours may be completed for successful outcome of the M.S. degree. A cumulative GPA of 3.0 (with no more than six credit hours of a C grade) is required to continue in the program.

An oral defense, consisting of a public presentation of the thesis and a committee meeting to discuss the results, under the direction of the GAC but open to all faculty members, students and staff, shall be scheduled to examine the student's underlying fundamental knowledge of the disciplines encompassed by the student's research. Announcement of the oral defense, including the candidate's name, project title, and the day, place and time of the defense, shall be made at least seven working days in advance of the defense.

Curriculum requirements

Core didactic courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOC 503</td>
<td>Biochemistry, Cell and Molecular Biology</td>
<td>5</td>
</tr>
<tr>
<td>BIOC 504</td>
<td>Biochemistry, Cell and Molecular Biology</td>
<td>5</td>
</tr>
<tr>
<td>IBMS 600</td>
<td>Laboratory Safety</td>
<td>1</td>
</tr>
<tr>
<td>MICR 505</td>
<td>Immunobiology</td>
<td>3</td>
</tr>
<tr>
<td>or MICR 515</td>
<td>Principles of Molecular Microbiology</td>
<td></td>
</tr>
<tr>
<td>MICR 608</td>
<td>Introduction to Microbiology and Immunology Research</td>
<td>3</td>
</tr>
<tr>
<td>MICR 609</td>
<td>Introduction to Microbiology and Immunology Research</td>
<td>3</td>
</tr>
<tr>
<td>MICR 690</td>
<td>Microbiology Research Seminar</td>
<td>1</td>
</tr>
<tr>
<td>OVPR 601</td>
<td>Scientific Integrity</td>
<td>1</td>
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</table>
or OVPR 602
or OVPR 603

| Total Hours | 22 |

**Electives**

Select seven credits from the following:

- **MICR 505** Immunobiology (if not taken previously)
- **MICR 515** Principles of Molecular Microbiology (if not taken previously)
- **MICR 605** Prokaryotic Molecular Genetics
- **MICR 607** Techniques in Molecular Biology and Genetics
- **MICR 608** Introduction to Molecular Microbiology and Immunology Research
- **MICR 616** Mechanisms of Viral and Parasite Pathogenesis
- **MICR 618** Molecular Mechanisms of Bacterial Pathogenesis
- **MICR/BNFO 653** Advanced Molecular Genetics: Bioinformatics
- **MICR 684** Molecular Biology of Cancer
- **MICR 686** Advanced Immunobiology

Take one of the following journal club courses for one semester every year:

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

**Total Hours**

| Total Hours | 7 |

1. MICR 616 and MICR 618 are offered in alternate years.

**Directed research**

**MICR 697** Directed Research in Microbiology (minimum 12 credits)

**Total graduate credit hours required (minimum) 41**

**Graduate program director**

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