

Immunology and Microbial Pathogenesis Graduate Program

WEST VIRGINIA UNIVERSITY HEALTH SCIENCES CENTER

Doctor of Philosophy in Immunology and Microbial Pathogenesis

Goals and Objectives

The major objective of graduate education in the Immunology and Microbial Pathogenesis Graduate Program is research training. To achieve this purpose, students are grounded with a strong foundation in basic concepts of microbiology, microbial pathogenesis, and immunology and allowed flexibility in choosing advanced coursework in their specific areas of interest. A major emphasis of the advanced coursework in the graduate program is extensive laboratory research in a specific area of immunology or microbial pathogenesis. Each student will complete an original, in-depth research investigation and document that investigation in the form of a written dissertation. The overall educational objective of the program is to produce doctoral students capable of designing, performing, and directing independent research in Immunology and Microbial Pathogenesis as well as teach at the highest academic levels.

The mission of West Virginia University and the Graduate Program in Immunology and Microbial Pathogenesis is to provide excellence in education, research, and service to the State of West Virginia. The cornerstone to achieving this mission is a sustained research program that is internationally recognized as contributing to state-of-the-art knowledge in each of the sub disciplines of the program. This research expands knowledge necessary to provide new state-of-the-art treatments for our patients, develops in our students the knowledge base and skills necessary to mature to become independent investigators, and allows our faculty to contribute to the overall service mission of the university.

Program Description

Details of the graduate program, with a complete description and the requirements of the program, are below. Briefly, students will enter the program as second year students after successfully completing the common first year core curriculum, which is directed by the Office of Research and Graduate Studies. The first year core courses include Cellular Structure and Function, Fundamentals of Integrated Systems, Statistics for the Biomedical Sciences, Discussions on Scientific Integrity, Molecular Biology, Research Rotations, and at least five additional credits from courses offered by each of the seven graduate programs at the Health Sciences Center in the spring semester. The Doctor of Philosophy program requires at least 30 hours of course work. Six credit hours must be in research (*MICB 797 Doctoral Degree Research and Dissertation*). The student and their advisory committee select the remaining advanced course work that specifically

addresses their research interests. At the end of the first year in the graduate program, students eligible to enter the Graduate Program in Immunology and Microbial Pathogenesis will be required to successfully pass a written Comprehensive Preliminary Examination. In addition, students are required to write an NIH-style grant proposal and must successfully pass an oral Candidacy exam based on the proposal. A dissertation representing original research and a final oral examination is required. A grade-point average of at least 3.0 must be maintained. In general, four to five years are required to complete the Ph.D. program. All full-time students are required to participate in teaching (*MICB 790 Teaching Practicum*).

Grading and Quality Control

Entrance Standards to the Biomedical Sciences Graduate Program

Applicants to the Graduate Program of Immunology and Microbial Pathogenesis must have an earned bachelors or masters' degree from an accredited institution. Applicants should have a strong background in biological sciences, organic chemistry, physics, and mathematics. The Office of Research and Graduate Studies directs the Recruitment Committee and Admission Committee for the recruitment and selection of applicants into the first year core curriculum. All applicants are required to take the general aptitude sections of the Graduate Record Examination. A minimum combined score of 1000 (Verbal + Quantitative) is required for admission. Foreign students must also submit scores on the Test of English as a Foreign Language. Students in the Program will be supported by fellowships, traineeships, teaching assistantships, faculty research grants, and individual fellowships from outside sources. Support will include full tuition, health services and hospitalization insurance to the student, and a monthly stipend.

Entrance Standards to the Immunology and Microbial Pathogenesis Graduate Program

The following are required to be eligible for entrance into the Immunology and Microbial Pathogenesis Graduate Program:

- 1) A minimum of a B average (≥ 3.0 GPA) on the required core curriculum courses taken in the first 2 semesters of residence in the Biomedical Sciences Graduate Program
- 2) An advisor has been selected in consultation with the Immunology and Microbial Pathogenesis program director and the Office of Research and Graduate Studies, and the advisor has agreed to accept the student in their laboratory

Students that do not have the minimum grade point average to enter the program will have one semester to elevate their grade point average to a 3.0 or better and then may apply for entrance into the Immunology and Microbial Pathogenesis

Graduate Program. The courses that will be used to calculate the GPA must be at the 700 level or above. Note: Graduate seminar courses, Special Topics (journal clubs), Research credits, and teaching credits will NOT be used in the calculation of the GPA to determine if a probationary student will return to regular graduate student status and be eligible to apply for entrance into the Immunology and Microbial Pathogenesis Program.

Grades

Students in the Immunology and Microbial Pathogenesis Graduate Program must maintain a minimum of a B (3.0/4.0) average in all attempted coursework numbered 500 or above to remain classified as a *regular graduate student*.

Students who fall below this grade-point average will be reclassified as *probationary*. Probationary students have one semester to elevate their grade point average to 3.0 or better. The Graduate Advisory Committee of the student must approve the courses taken during the probationary semester. The courses must be at the 700 level or above. Note: MICB 796 (Graduate seminar), MICB 793 (Special Topics, journal clubs), Research credits, and teaching credits will NOT be used in the calculation of the GPA to determine if a probationary student will return to regular graduate student status. Students who do not return to regular student status in one semester will be dismissed from the program.

Students may appeal this decision to the Scholarship Committee and the Director of the Immunology and Microbial Pathogenesis Graduate Program who must approve all exceptions to the above.

Advisory Committees

Graduate Advisor

After completion of rotations in the first year of residence in the graduate program, graduate students eligible to enter the Immunology and Microbial Pathogenesis Graduate Program will select an area of research and appropriate graduate advisor in consultation with the Immunology and Microbial Pathogenesis program director and the Office of Research and Graduate Studies.

Graduate Advisory Committee

Graduate students, in consultation with their graduate advisor, select a graduate advisory committee made up of at least 5 members. The majority of the members of the graduate advisory committee (to include the graduate advisor) must be *regular members* of the graduate faculty and no more than one member without WVU graduate faculty status may be included. Three of the members of this committee are required to be members of the faculty of the Graduate Program in Immunology and Microbial Pathogenesis at West Virginia University. In compliance with the WVU Graduate Catalog (page 41) at least one member of the committee must be from a Program other than the one in which the student is seeking a degree. The graduate advisory committee will monitor the student's progress throughout the graduate program, certify admission to candidacy, and

evaluate the final oral examination (defense of dissertation). The Scholarship Committee and the Director of the Graduate Program of Immunology and Microbial Pathogenesis must approve all exceptions to the above.

Scholarship Committee

The departmental director will annually appoint a three-member committee to oversee the progress of all students in the graduate program and administer the written preliminary examination. This committee will represent, as best possible, the disciplines of Microbiology, Immunology, and Microbial Pathogenesis. The Scholarship Committee will formulate and administer the written preliminary examination described below. Results of the preliminary examination will be forwarded to the student, the graduate student's advisor, and the Program director.

Progress Assessment

Progress in the graduate program will be assessed by the Scholarship Committee twice a year and by regular meetings of the graduate advisory committee.

The Scholarship Committee will give a formal report on the progress of all students twice a year. The reports will be done at the regular faculty meeting in December after the fall semester and at the end of the spring semester, usually at the annual faculty retreat. All students will receive a letter from the Scholarship Committee informing them of their status and of any deficiencies in their file.

Regular meetings of the graduate advisory committee will assess progress in the graduate program. The graduate advisory committee will meet regularly and *at least* once every 12 months to review the academic and research progress of each graduate student. The 12-month period will begin when the student has chosen an advisor and officially enters a laboratory. The advisor will send a written report of these meetings to the Scholarship Committee, the Director, and the student. A copy of these reports will be kept in the student's permanent file. Students who fail to have a graduate advisory committee meeting at least once every 12 months will have their tuition waiver withheld until a meeting is held. The Director of the Graduate Program in Immunology and Microbial Pathogenesis, the Scholarship Committee, and the graduate advisory committee must approve exceptions to the 12-month deadline at least one month prior to the 12-month deadline.

Time limit

According to University guidelines (WVU Graduate Catalog, pg. 44) doctoral candidates must complete all degree requirements within five years of achieving candidacy (described below). The student's graduate committee must approve

extensions of the time limit and the student will be required to repeat the candidacy examination.

Career Opportunities in Field

Most previous graduates of this program have gone to post-doctoral fellowships in university, government (NIH, NIOSH) or pharmaceutical companies. After their post-doctoral fellowships they have obtained permanent positions in academics, government, and biotechnology companies. Skills learned in this program are especially versatile because they allow students to work in most fields of cell and molecular biology, as well as more specialized areas of microbiology and immunology.

Typical Curriculum

Course requirements for the degree of Ph.D.

The minimum course requirement for the degree of Doctor of Philosophy is 30 semester hours with no more than 6 semester hours of that total designated as independent research. Required core courses for the graduate program are detailed below.

First year core curriculum

The first year graduate courses are overseen by the Office of Graduate Research and Studies and are listed below.

1st Semester

| <u>Course</u> | <u>Credits</u> |
|--|----------------|
| Cellular Structure and Function | 4 |
| Fundamentals of Integrated Systems | 4 |
| Statistics for the Biomedical Sciences | 1 |
| Discussions on Scientific Integrity | 1, S/U |
| Research Rotation 1 | 1 |

2nd Semester

| <u>Course</u> | <u>Credits</u> |
|--|-----------------------------------|
| Molecular Biology | 3 |
| Modules: | 5 (minimum of 5 from the modules) |
| Bench to Market | 3 |
| Cancer | 2 |
| Cardiovascular Biology | 2 |
| Cell Signaling & Metabolism | 2 |
| Immunology & Micro. Patho. | 3 |
| Muscle, Structure & Func. | 2 |
| Neuroscience II | 2 |
| Research Rotations 2 & 3 with program journal clubs | 1, each |

Summer

| <u>Course</u> | <u>Credits</u> |
|--------------------|----------------|
| Scientific Writing | 1, S/U |
| Research | |

Required core courses for the graduate program in Immunology and Microbial Pathogenesis are detailed below

MICB 793 Special Topics (Journal Club) (*1 credit hour/semester of residence*). Students are required to register for MICB 793 each semester of residence and are required to present at least one research paper in a regularly attended journal club each semester.

Immunology and Microbial Pathogenesis Journal Club
Other Journal Clubs as approved by the Course Coordinator

MICB 796 Graduate Seminar (*1 credit hour/semester of residence*). Students are required to register for MICB 796 each semester of residence and are required to present at least one seminar during each school calendar year (Fall – Spring semesters).

MICB 797 Research or Dissertation (*as needed*). MICB 797 credits are recorded as Satisfactory (S) or Unsatisfactory (U) as determined by the student's research advisor.

MICB 790 Teaching Assistant

Students are required to serve as a laboratory teaching assistant as needed in one of the following service courses taught by the Department of Microbiology, Immunology, and Cell Biology: MICB 701, Immunity, Infection and Disease (Medical Student course), MICB 702, Microbiology (Dental Student course), MICB 327 Parasitology, or MICB Microbiology (Medical Technician course). Laboratory teaching assistants provide basic laboratory instructions and introduction to the laboratory exercises, assist students with the laboratory exercises as needed, and grade laboratory reports.

Remaining coursework: Additional graduate coursework to be included in the Ph.D. program may come from any department of the University and is included at the discretion of the Graduate Advisory Committee. Although the number of graduate courses required will vary for different students, most students will be expected to complete *at least* two additional graduate level courses (numbered 700 or above) beyond the basic required courses taken as part of the common core curriculum in the first year of graduate school and those listed above. The advisory committee can recommend additional coursework to exceed the minimum requirement. Note: MICB 796 (Graduate seminar), MICB 793 (journal clubs), and MICB 790 (teaching assistant) **do not** fulfill this requirement.

Required credit hours. Full time students on a stipend must register for nine or more credit hours in each of the fall and spring semesters and six or more credit hours in the summer session.

Educational Enrichment

Cell and Molecular Biology Seminar Series. The Department of Microbiology, Immunology, and Cell Biology supports a regular series of extramural seminar speakers whose research is relevant to the interests of the Graduate Program in Immunology and Microbial Pathogenesis. Students are expected to attend this seminar series and time will be specifically set aside for the students to meet with each invited speaker for informal discussion.

Work-in-Progress Seminars. The graduate program requires that graduate students participate in the regularly scheduled "Work-in-Progress" Seminar.

Student Teaching Responsibilities

MICB 790 Teaching Assistant

Students are required to serve as a laboratory teaching assistant as needed in one of the following service courses taught by the Department of Microbiology, Immunology, and Cell Biology: MICB 701, Immunity, Infection and Disease (Medical Student course), MICB 702, Microbiology (Dental Student course), MICB 327 Parasitology, or MICB Microbiology (Medical Technician course). Laboratory teaching assistants provide basic laboratory instructions and introduction to the laboratory exercises, assist students with the laboratory exercises as needed, and grade laboratory reports.

Research Expectations

Ability to apply the scientific method to solving a research problem is assessed by the student's committee at regularly scheduled meetings. Written reports are submitted to the scholarship committee and placed in the student's file by their advisor.

Ability to discuss and defend their research is assessed annually at regularly scheduled seminars given by the students on their research progress. Ability to express themselves in writing is assessed by the students writing manuscripts for publication in peer-reviewed journals and the dissertation required by the graduate school.

Candidacy

Comprehensive Preliminary Examination. All students in the Immunology and Microbial Pathogenesis Graduate Program are required to successfully pass a written comprehensive preliminary examination. This will normally be taken at the end of the first academic year in residency in the graduate school. Students must have a cumulative GPA of ≥ 3.0 in their graduate courses to be eligible to take the written preliminary examination. All required graduate courses from the first year common core curriculum must be successfully completed before taking

the examination. In addition, students must have successfully passed the Immunology and Microbial Pathogenesis Module with a grade of B or better. If a student has joined the Program but has not taken the Immunology and Microbial Pathogenesis Module, they must complete the module the next spring with a grade of B or better and will then be eligible to take the examination. The examination will be formulated by the Scholarship Committee from questions submitted by the faculty and will usually be administered in June. The examination will consist of two major areas, Immunology and Microbial Pathogenesis. Students will be expected to select questions and provide detailed discussion type answers. The scored candidacy examination and recommendations (pass/fail) will be forwarded to the Scholarship Committee and the program director for further action. The committee will consider a score of 75% on any section to be a passing performance and will use the average score for all of the questions in a given section of the examination in determining overall performance. If a student fails any section of the written preliminary examination, that section must be taken a second time within four months of the date of the first exam. However, in order for a student to retake any part of a preliminary exam, or an entire exam, an affirmative and supportive vote by the Scholarship Committee must occur. If a student does not receive this affirmative vote after having failed his/her first attempt at the preliminary exam, the student will be dismissed from the program. If a student fails the written examination a second time, he/she will be dismissed from the program. The program director and the Scholarship Committee of the Immunology and Microbial Pathogenesis Graduate Program must approve exceptions to this process. In compliance with the WVU Graduate Catalog (page 43), in no case will this examination be administered more than 3 times.

Candidacy. After successfully passing the comprehensive written preliminary examination, students must complete an NIH style research proposal using the electronic format from the NIH to be considered for candidacy for the degree of Doctor of Philosophy. The Scholarship Committee will provide a set of specific instructions for the sections to be completed for this written portion of the candidacy examination. The proposal should be in the area of the student's proposed research and formulated in consultation with the selected graduate advisor. The written proposal will be presented to the graduate advisory committee for review and the proposal will be defended as the focal point of an oral candidacy exam administered by that committee. This oral examination is not limited to the research proposal and should include general questioning of the candidate to establish scientific competency. Passing performance on the candidacy examination is voted on by the committee and no more than one dissenting vote is allowable. The oral candidacy exam must be taken within 18 months after a student successfully passes the written comprehensive preliminary exam. Students who fail to take the candidacy exam within this time frame will have their tuition waiver withheld until the exam is held. Exceptions to the 18-month deadline must be approved at least one month prior to the 18-month deadline by the program director, the Scholarship Committee, and the

graduate advisory committee. If a student fails the candidacy examination, he/she must repeat the examination within four months. A second failing mark on this examination will normally result in dismissal from the program. The program director, the Scholarship Committee, and the Graduate Advisory Committee must approve exceptions to this process. In compliance with the WVU Graduate Catalog (page 43), in no case will this examination be administered more than 3 times.

Dissertation requirements

Written Dissertation. The form of the dissertation will be decided by the graduate advisory committee and must be consistent with the *WVU Guide to the Preparation of Master's Theses and Doctoral Dissertations* and the guidelines published in the university graduate catalog. All dissertations written in partial fulfillment of the requirements of any doctoral degree conferred by the University must ordinarily be filed electronically with the WVU Libraries system according to University procedures. Exceptions to filing electronically must be approved by the Office of the Provost. The department recognizes that, in many cases, the form will be that of a compilation of published or completed manuscripts with the addition of an appropriate abstract, introduction, literature survey, and conclusion. For the document to be approved, there must be no more than one unfavorable vote among members of the student's committee.

A copy of the dissertation draft should be delivered to the graduate advisory committee and to the Office of Research and Graduate Studies in a timely manner month prior to the defense of dissertation to allow for public notice of the defense of the dissertation.

Defense of dissertation. Each student must present his/her research in an open seminar to the faculty of the University. A public announcement of the Defense of Dissertation Seminar must be published prior to the examination date. Successful completion of this requirement of the program and conferral of the degree of Doctor of Philosophy is determined by a vote of the advisory committee and is subject to guidelines stated in the general graduate catalog of the university.

Conferral of degree. Completion of the final examination requires the conferral of the degree by the Graduate Advisory Committee. The student must also fulfill all of the appropriate deadlines and guidelines for graduation posted by the WVU Health Sciences Center Office of Research and Graduate Studies.

Trainee support

The Office of Graduate and Research Studies will support students for the first two years in residence. For the remainder of their graduate studies the research advisor will be responsible for their support. This will typically be from extramurally funded research grants.

Requirements for requesting a change to the Department of Microbiology, Immunology, and Cell Biology Masters program from the Ph.D. program.

1) A student who is in the Ph.D. program that fails to successfully pass the written preliminary exam at the end of the first year, or the candidacy exam, will be dismissed from the program. Students who fail either exam and would like to enter the Masters program in the Department of Microbiology, Immunology, and Cell Biology must apply to the Admissions Committee in the Office of Research and Graduate Studies for admission into the Masters program.

2) A student in the Ph.D. program that has successfully passed the written preliminary exam, and is in good academic standing in the Program, may request to write a thesis and defend for a Masters degree. The student's graduate advisory committee and the Department of Microbiology, Immunology, and Cell Biology Scholarship Committee must approve the request.

3) A student in the Ph.D. program that has successfully passed the written preliminary exam, the candidacy exam, and is in good academic standing in the Program, may request to write a thesis and defend for a Masters degree. The student's graduate advisory committee and the Department of Microbiology, Immunology, and Cell Biology Scholarship Committee must approve the request.

Requirements for Students Enrolled in the M.D.-Ph.D. Program.

Requirements for students enrolled in the WVU School of Medicine M.D.-Ph.D. program will be exactly the same as for regular graduate students, with the following exceptions: (1) successful completion of the first two years of the medical school basic sciences curriculum will be considered equivalent to the required course component (i.e. the first year curriculum) (2) a passing score on the USMLE Board Examination taken at the end of the second year of the medical school curriculum will be considered equivalent to a passing score on the written preliminary examination of the Ph.D. curriculum; (3) students must serve as a teaching assistant in MICB 701 Medical Microbiology course at least once during their residence in the department.