

Immunology and Microbial Pathogenesis, Ph.D.

Degrees Offered

- Doctor of Philosophy
- Joint Doctor of Medicine and Doctor of Philosophy

Nature of the Program

The **Doctor of Philosophy degree in Immunology and Microbial Pathogenesis** will prepare students from diverse backgrounds to serve as professionals that are knowledgeable about the immune system of humans and other mammals, how the immune system functions, and the consequences of its malfunction on the health of the host. Knowledge of the immune system will be fully integrated with an excellent understanding of the diversity of microorganisms that cause disease in humans and other mammals and mechanisms of disease pathogenesis. Students in the program will apply this knowledge to broad areas of research including the understanding of pathogen-host interactions and development of immunotherapies and vaccines. Graduates will possess the laboratory skills and knowledge needed to assess the functional status of the immune system and to assess the mechanism used by microbial agents to cause disease in mammals. Graduates will be qualified to pursue several professional career paths in private industry, state and federal government, and academic institutions.

The doctoral program in Immunology and Microbial Pathogenesis emphasizes extensive laboratory research in microbiology, immunology, microbial pathogenesis, and/or cell biology in the context of health and disease. The major purpose of graduate education in the program is research training. The basic philosophy of the program is that students acquire a strong foundation in the basic concepts of immunology and microbial pathogenesis and have flexibility in choosing advanced coursework in their specific areas of interest. Each student will complete an original, in-depth research investigation. Its learner-centered curriculum integrates both classroom and hands-on research experiences to produce students capable of designing and doing independent research and teaching.

Completion of the Ph.D. degree is realized when the student successfully presents the research results to faculty of the graduate dissertation committee and program/department. Typically, four to five years are required to realize this goal.

Current Research Areas

IMMUNOLOGY

- Vaccines and immunotherapies against bacterial pathogens
- Autoimmune diseases and neuroimmunology
- Effects of stroke on the immune system
- Influence of sex chromosomes on immunity
- Cytokine biology
- Immune response in bacterial and viral diseases
- Antibody function and use as therapeutics
- Regulation of signal transduction in immune responses
- Molecular aspects of the tumor microenvironment during chemotherapy and cancer cell growth
- Genomics studies of the immune system
- Influence of steroids and hormones on immunity to infection and cancer
- The effects of toxic agents on the immune system

MICROBIOLOGY

- Physiology of pathogenic microbes
 - Microbial genetics
 - Mechanisms of bacterial pathogenesis
 - Chemotaxis and motility
 - Interactions between microbes and their hosts
 - Vaccines and immunotherapies against bacterial and viral pathogens
 - Molecular mimicry and structure-function relationship of bacterial virulence factors
 - Microbial biofilms
-

ADMINISTRATION

CHAIR

- Mariette Barbier - PhD (Universitat de les Illes Balears)
Associate Professor

VICE CHAIR FOR RESEARCH AND GRADUATE EDUCATION

- Cory Robinson - PhD (Miami University of Ohio)
Professor

DIRECTORS

- Kathy Brundage - PhD (University of Pennsylvania)
Director, Flow Cytometry & Single Cell Core Facility
- F. Heath Damron - PhD (Marshall University)
Associate Professor and Director, Vaccine Development Center
- Michael Hu - Ph.D. (Peking University)
Director, Bioinformatics Core
- Karen Martin - PhD (Duke University Medical Center)
Director of Core Resources

FACULTY

CHAIR

- Mariette Barbier - PhD (Universitat de les Illes Balears)

PROFESSORS

- Tim Eubank - PhD (The Ohio State University)
- Ming Lei - PhD (Cornell University)
Sr. Associate Vice President, Office of Research and Graduate Education and Vice Dean of Research, School of Medicine
- Slawomir Lukomski - Ph.D. (University of Lodz, Poland)
- Cory Robinson - PhD (Miami University of Ohio)
Vice Chair for Research and Graduate Education, Microbiology, Immunology, and Cell Biology

ASSOCIATE PROFESSORS

- F. Heath Damron - Ph.D. (Marshall University)
Director, Vaccine Development Center
- Meenal Elliott - Ph.D. (University of Alabama)
- Ivan Martinez - Ph.D. (University of Pittsburgh)
- Edwin Wan - PhD (City University of Hong Kong)

TEACHING ASSOCIATE PROFESSORS

- Kelly Collins - Ph.D. (University of Cincinnati)
Vice Chair of Undergraduate Education, Microbiology, Immunology, and Cell Biology

ASSISTANT PROFESSORS

- Jonathan Busada - Ph.D. (East Carolina University)
- Michael Hu - Ph.D. (Peking University)
- Tracy Liu - Ph.D. (University of Toronto)

RESEARCH ASSISTANT SERVICE PROFESSORS

- Kathy Brundage - PhD (University of Pennsylvania)
- Karen Martin - PhD (Duke University Medical Center)

TEACHING ASSISTANT PROFESSORS

- Chad Sethman - Ph.D. (Miami University)
- Valerie Watson - M.S. (West Virginia University)

TEACHING INSTRUCTOR

- Michelle Witt - M.S. (Virginia Tech)

ADJUNCT PROFESSORS

- Lisa Holland - PhD (University of North Carolina at Chapel Hill)
- Qiang Ma - PhD (Rutgers University)
- John Noti - Ph.D. (Purdue University)
- Vazhaikkurichi Rajendran - PhD (University of Madras)
- Rita Rio - PhD (Yale University)
- Robert Taylor - PhD (Mississippi State University)
- David Weissman - M.D. (Northwestern University)

ADJUNCT ASSOCIATE PROFESSORS

- Candice Brown - Ph.D. (Duke University)
- Matthew Dietz - MD (Temple University School of Medicine)
- Salik Hussain - PhD (Université Paris Cité)
- Emidio Pistilli - PhD (West Virginia University)

ADJUNCT ASSISTANT PROFESSORS

- Stacey Anderson - PhD (West Virginia University)
- Margaret Bennewitz - PhD (Yale University)
- Brian Boone - MD (University of South Florida College of Medicine)
- Tara Cotroneo - DVM (Western University of Health Sciences)
- Jennifer Franko - PhD (Case Western Reserve University)
- Brett Green - PhD (University of Sydney)
- Ida Holaskova - PhD (West Virginia University)
- Sreekumar Othumpangat - PhD (University of Mysore)
- Yong Qian - PhD (West Virginia University)
- Jenny Roberts - PhD (West Virginia University)

ADJUNCT RESEARCH INSTRUCTOR

- Jamie McCall - PhD (University of Nebraska Medical Center)

ADJUNCT ASSOCIATE SERVICE FELLOW

- Tara Croston - Ph.D. (West Virginia University)

PROFESSOR EMERITI

- John B. Barnett - PhD (University of Louisville)
- Nyles Charon - PhD (University of Minnesota)
- Christopher Cuff - PhD (Temple University)
- Laura Gibson - PhD (West Virginia University)
- Kenneth Landreth - PhD University of Washington

ASSOCIATE PROFESSORS EMERITI

- Rosana Schafer - PhD (Temple University)

Doctor of Philosophy

MAJOR REQUIREMENTS - STANDARD TRACK

Code	Title	Hours
BMS 700	Scientific Integrity	1
BMS 701	Scientific Rigor and Ethics	1
BMS 702	Biomedical Lab Experience	2
BMS 706	Biomedical Research Methods	1
BMS 707	Experiential Learning for Biomedical Trainees	2

BMS 720	Scientific Writing	2
BMS 747	Foundations for Contemporary Biomedical Research I	4
BMS 777	Foundations for Contemporary Biomedical Research 2	4
Advanced MICB Courses - 2 from the following:		5-7
MICB 781	Advanced Immunology	
MICB 782	Advanced Microbiology	
MICB 793	Special Topics (Vaccinology)	
MICB 785	Immunology and Microbiology Journal Club (Minimum of 7; Every semester until graduation)	7
MICB 790	Teaching Practicum	2
MICB 796	Graduate Seminar (Minimum of 7; Every semester until graduation)	7
MICB 797	Research (1-15 per semester)	45
Qualifying Exam		
Dissertation Proposal		
Dissertation Defense		
Total Hours		83-85

MAJOR REQUIREMENTS - FAST TRACK

Code	Title	Hours
BMS 700	Scientific Integrity	1
BMS 701	Scientific Rigor and Ethics	1
BMS 707	Experiential Learning for Biomedical Trainees	2
BMS 720	Scientific Writing	2
Advanced MICB Courses - 2 from the following:		5-7
MICB 781	Advanced Immunology	
MICB 782	Advanced Microbiology	
MICB 793	Special Topics (Vaccinology)	
MICB 785	Immunology and Microbiology Journal Club (Minimum of 7; Every semester until graduation)	7
MICB 790	Teaching Practicum	2
MICB 796	Graduate Seminar (Minimum of 7; Every semester until graduation)	7
MICB 797	Research (1-15 per semester)	45
Qualifying Exam		
Dissertation Proposal		
Dissertation Defense		
Total Hours		72-74

Seminars and Research Forum

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).

Journal Club

Students are required to enroll in Journal Club each semester. The course involves the presentation and discussion of current research papers and will help acquaint students with the variety of methods used in scientific research.

Doctoral Research

Students will conduct research with a dissertation mentor during time in the program. Students register for research credits each semester, and their performance is graded by their dissertation mentor.

Qualifying and Dissertation Proposal/Ph.D. Candidacy

The written qualifying exam is given at the end of the first year of study. The dissertation proposal is completed in the third year of study. Admission to Ph.D. candidacy occurs following the successful defense of the dissertation proposal.

Dissertation Defense and First-Author Paper Requirement

Students are allowed to defend their dissertation when a minimum of one manuscript with the student as first author, based on dissertation research, is accepted in a peer-reviewed journal. The final examination for the Ph.D. degree consists of orally defending a written dissertation in a public seminar and then in private to the dissertation committee. Satisfactory performance in the oral defense will result in recommendation for granting of the PhD.

Suggested Plan of Study*

First Year

Fall	Hours	Spring	Hours	Summer	Hours
BMS 700		1 BMS 701		1 MICB 797	3
BMS 706		1 MICB 785		1 Qualifying Examination	
BMS 702		2 MICB 796		1	
BMS 747		4 MICB 797		3	
BMS 777		4			
		12		6	3

Second Year

Fall	Hours	Spring	Hours	Summer	Hours
MICB 785		1 MICB 781		3 BMS 720	2
MICB 790		1 MICB 785		1 MICB 797	1
MICB 782 or 793		2 to 4 MICB 790		1	
MICB 796		1 MICB 796		1	
MICB 797		3 MICB 797		3	
		Dissertation Proposal			
		8-10		9	3

Third Year

Fall	Hours	Spring	Hours	Summer	Hours
MICB 785		1 MICB 785		1 MICB 797	1
MICB 796		1 MICB 796		1 BMS 707	2
MICB 797		7 MICB 797		7	
		9		9	3

Fourth Year

Fall	Hours	Spring	Hours	Summer	Hours
MICB 785		1 MICB 785		1 MICB 797	3
MICB 796		1 MICB 796		1	
MICB 797		7 MICB 797		7	
		9		9	3

Total credit hours: 83-85

NOTE: The graduate curriculum is finalized with a plan of study once the mentor and laboratory have been selected in the first year. The plan of study is developed by the graduate committee in consultation with the student. The courses listed above include the required and elective coursework necessary for the student to finalize his/her plan of study. When the student enters the laboratory of his/her doctoral dissertation mentor repetitive enrollments in research, seminars, and colloquia are typical and will determine total hours necessary for degree completion.

*This is a suggested plan of study. Course sequences and length of time in program may vary depending on student and altered total credit hours.

Major Learning Outcomes

IMMUNOLOGY AND MICROBIAL PATHOGENESIS

Students will:

- Identify and summarize the basic concepts of microbiology, microbial pathogenesis, and immunology.
- Integrate detailed knowledge in microbiology, microbial pathogenesis, and immunology with the knowledge of student's area of research.
- Discuss, critique, and interpret primary research literature in microbiology, microbial pathogenesis, immunology, and in the student's area of research.
- Identify meaningful problems and questions for research in microbiology, microbial pathogenesis, and immunology.
- Acquire expertise and use laboratory techniques required to perform experiments in the student's area of research.
- Design experimental protocols and conduct self-directed research that results in presentations at scientific meeting and publications.

- Demonstrate oral, written, and visual communication skills that result in clear and organized dissemination of material at a level appropriate for the audience.