

# Immunology and Microbial Pathogenesis

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## Degrees Offered

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

## Educational Objectives

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. 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, i.e. 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.

Faculty members and students explore diverse areas of inquiry related to the medical implications of microbes and the human body's response to them.

## Current Research Areas

- Immunology
- Effects of man-made pesticides and herbicides on the immune system
- Effects of heavy metals on the immune system
- Biochemistry of inflammatory cytokines
- Immune response in bacterial and viral diseases
- Regulation of signal transduction in immune responses
- Molecular aspects of cell signaling as it relates to cancer chemotherapy and cell growth
- Peptide and DNA vaccines for contraception
- Microbiology
- Physiology of pathogenic microbes
- Microbial genetics
- Mechanisms of bacterial pathogenesis
- Chemotaxis and motility
- Interactions between microbes and their hosts
- Molecular mimicry and structure-function relationship of bacterial virulence factors
- Microbial biofilms

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## FACULTY

### GRADUATE PROGRAM DIRECTOR

- John Barnett - Ph.D. (University of Louisville)

### PROFESSORS

- Nyles Charon - Ph.D. (University of Minnesota)
- Christopher Cuff - Ph.D. (Temple University)

- Laura F. Gibson - Ph.D. (West Virginia University)
- Vazhaikkurichi Rajendran - Ph.D. (University of Madras)

## ASSOCIATE PROFESSORS

- Tim Eubank - Ph.D. (The Ohio State University)
- Slawomir Lukomski - Ph.D. (University of Lodz, Poland)
- Karen Martin - Ph.D. (Duke University)
- Edmidio Pistilli - Ph.D. (West Virginia University)
- Cory Robinson - Ph.D. (Miami University of Ohio)
- Lisa Robinson - Ph.D. (Cornell University)
- Rosana Schafer - Ph.D. (Temple University)
- James M. Sheil (Emeritus) - Ph.D. (University of Kentucky)

## ASSISTANT PROFESSORS

- Amanda Ammer - Ph.D. (West Virginia University)
- Mariette Barbier - Ph.D. (Universitat de les Illes Balears)
- Candace Brown - Ph.D. (Duke University)
- Kathy Brundage - Ph.D. (University of Pennsylvania)
- Duaa Dakhallah - Ph.D. (The Ohio State University)
- F. Heath Damron - Ph.D. (Marshall University)
- Meenal Elliott - Ph.D. (University of Alabama)
- Jennifer Franko - Ph.D. (Case Western Reserve University)
- Ivan Martinez - Ph.D. (University of Pittsburgh)
- Gordon Meares - Ph.D. (University of Alabama)
- Xuefang "Sophie" Ren - M.D., MSc (Ullm University, Germany)
- Edwin Wan - Ph.D. (City University of Hong Kong)
- Valerie Watson - M.S. (West Virginia University)

## ADJUNCT PROFESSORS

- Don Beezhold - Ph.D. (University of Illinois Medical Center)
- John Noti - Ph.D. (Purdue University)
- David Weissman - M.D. (Northwestern University)

## ADJUNCT ASSISTANT PROFESSORS

- Stacey Anderson - Ph.D. (West Virginia University)
- Alexandra Elliott - Ph.D.
- Brett J. Green - Ph.D. (University of Sydney)
- David Klinke - Ph.D. (Northwestern University)
- Yong Qian - Ph.D. (West Virginia University)
- Jenny Roberts - Ph.D. (West Virginia University)

## Doctor of Philosophy

## MAJOR REQUIREMENTS

Scientific Integrity		2
BMS 700	Scientific Integrity	
BMS 702	Biomedical Lab Experience	2
BMS 706	Cellular 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
MICB 781	Advanced Immunology	3
MICB 791	Advanced Topics (Advanced Microbiology)	2
Journal Club		7
MICB 785	Immunology and Microbiology Journal Club	
MICB 790	Teaching Practicum	2
Graduate Seminar		7
MICB 796	Graduate Seminar	
Research		45
MICB 797	Research	
Advanced Course		3
Qualifying Exam		
Dissertation Proposal		
Dissertation Defense		
Total Hours		86

### 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 700	1 MICB 797	3
BMS 706	1 MICB 781	3 Qualifying Examination	
BMS 702	2 MICB 785	1	
BMS 747	4 MICB 796	1	
BMS 777	4 MICB 797	3	
	12	9	3

### Second Year

Fall	Hours Spring	Hours Summer	Hours
MICB 785	1 Advanced Course	3 BMS 720	2
MICB 790	1 MICB 785	1 MICB 797	1
MICB 791 (Advanced Microbiology)	2 MICB 790	1	
MICB 796	1 MICB 796	1	

MICB 797	3 MICB 797	3	
	8	9	3
<b>Third Year</b>			
<b>Fall</b>	<b>Hours Spring</b>	<b>Hours Summer</b>	<b>Hours</b>
MICB 785	1 MICB 785	1 MICB 797	1
MICB 796	1 MICB 796	1 BMS 707	2
MICB 797	7 MICB 797	7	
	Dissertation Proposal		
	9	9	3
<b>Fourth Year</b>			
<b>Fall</b>	<b>Hours Spring</b>	<b>Hours Summer</b>	<b>Hours</b>
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: 86

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:

- Demonstrate a general knowledge of basic concepts of microbiology, microbial pathogenesis, and immunology, and a detailed knowledge of his or her area of research
- Be familiar with the research literature in microbiology and immunology and in their specific field of study and should have the ability to keep abreast of major developments and to acquire a working background in any area
- Demonstrate skill in the recognition of meaningful problems and questions for research in Microbiology and Immunology
- Possess technical skill in laboratory manipulation
- Demonstrate that oral, written, and visual communication skills have been acquired
- Demonstrate skill in designing experimental protocols and in conducting productive self-directed research