The Department of Molecular Microbiology and Immunology (MMI) at the University of Missouri School of Medicine has three primary missions: to foster cutting-edge research on biomedically relevant problems in microbiology, immunology, and virology; to educate strong, independent research scientists; and to provide knowledge-based service to the state, nation and international communities.

Molecular Microbiology and Immunology has a long history of providing graduate and postgraduate education in basic principles of microbiology and immunology, as well as research training opportunities in the laboratories of established scientists with diverse research interests. Faculty expansion has provided new curricular offers with flexibility for personalized scholarly pursuits built in. The breadth of research training includes faculty laboratories in the School of Medicine (http://medicine.missouri.edu), the Bond Life Sciences Center (http://bondlsc.missouri.edu) and the College of Veterinary Medicine (http://vetmed.missouri.edu).

The Department of Molecular Microbiology & Immunology, in partnership with the faculty from the Department of Veterinary Pathobiology (VPB), offers a comprehensive graduate program, Molecular Pathogenesis and Therapeutics Graduate Program (MPT), leading to the Doctor of Philosophy (PhD) degree. Strong scientific interactions among faculty from these and other academic units across campus illustrate the importance of scientific collaborations not only in meeting the research challenges in microbiology and immunology, but also in providing a strong academic environment for the training of the next generation of scientists and educators in these disciplines. The faculty in this training program have achieved international recognition for their scientific contributions and expertise, with their research efforts published in top tier research journals and funded through stringent peer-reviewed federal grants. Many of these investigators serve on scientific review committees for these funding agencies.

This program provides individualized training that is strongly oriented toward basic research in molecular and cellular biology, microbiology, virology, pathogenesis, immunology and host-parasite interactions. MMI offers under the program name of Molecular Pathogenesis and Therapeutics Graduate Program (MPT):

- PhD in Microbiology (Medicine)
- Cooperative Degrees: MD/PhD in Microbiology (Medicine)
- MS in Microbiology (http://catalog.missouri.edu/undergraduategraduate/interdisciplinaryacademicprograms/molecularmicrobiologyandimmunology/ms-microbiology)
- PhD in Microbiology (http://catalog.missouri.edu/undergraduategraduate/interdisciplinaryacademicprograms/molecularmicrobiologyandimmunology/phd-microbiology-med)

Faculty

Molecular Microbiology and Immunology

**Professor** D. Burke, D. Duan, M. A. McIntosh, M. L. Misfeldt, D. J. Pintel, S. Sarafianos, H. Zaghouani

**Associate Professor** J. F. Cannon, M. A. Daniels, M. C. Johnson, E. Teixeiro-Pernas

**Assistant Professor** M. R. Baldwin, H. Guo,

**Professor Emerita/Emeritus** K. L. Bennett, H. Braley-Mullen, R. A. Finkelstein, H. S. Goldberg, D. R. Lee, K. S. Wise

**Assistant Teaching Professor** J. L. Furrer

Veterinary Pathobiology

**Professor** C. R. Brown, B. T. Beernstsen, E. C. Bryda, M. J. Calcutt, C. L. Franklin, C. L. Lorson, B. K. Ray, G. Stewart, R. W. Stich

**Associate Professor** D. M. Anderson, G. Zhang

**Assistant Professor** J. Amos-Landgraf, A. Franz, J. Skyberg

Jointly appointed to Molecular Microbiology and Immunology

**Professor** J. D. Wall

**Associate Professor** U. Atasoy, D. Cornelison, B. Hahm, S. C. McKarns

**Assistant Professor** P. Brown

- Graduate Faculty Member - membership is required to teach graduate-level courses, chair master's thesis committees, and serve on doctoral examination and dissertation committees.

- Doctoral Faculty Member - membership is required to chair doctoral examination or dissertation committees. Graduate faculty membership is a prerequisite for Doctoral faculty membership.

Undergraduate

While the University of Missouri does not offer an undergraduate degree specifically in molecular microbiology and immunology, undergraduates are able to take basic courses offered by Molecular Microbiology and Immunology in the areas of microbiology, immunology and virology. MU does offer baccalaureate opportunities in a number of related areas in the other Schools and Colleges within, including courses offered through Biological Sciences, Biochemistry, Pre-Med, Nursing, and Health Professions. The course catalog provides a complete list of these degree options (http://catalog.missouri.edu/degreesanddegreeprograms).

Graduate

- MS in Microbiology (http://catalog.missouri.edu/undergraduategraduate/interdisciplinaryacademicprograms/molecularmicrobiologyandimmunology/ms-microbiology)
- PhD in Microbiology (http://catalog.missouri.edu/undergraduategraduate/interdisciplinaryacademicprograms/molecularmicrobiologyandimmunology/phd-microbiology-med)

School of Medicine

M616 Medical Sciences Building
(573) 882-8152
http://medicine.missouri.edu/mmi/mpt/

The Departments of Molecular Microbiology & Immunology (MMI), in partnership with the faculty from the Department of Veterinary Pathobiology (VPB), offers a comprehensive graduate program, Molecular Pathogenesis and Therapeutics Graduate Program (MPT), leading to the Doctor of Philosophy (Ph.D.) degree. The Molecular Pathogenesis and Therapeutics Graduate Program is built around scholarly activities with three important missions: cutting-edge research programs to address relevant biomedical problems in microbiology, pathogenesis, and immunology, a graduate training program to educate strong, independent research scientists, and a commitment to provide knowledge-based service to the state, national and international communities that will improve global understanding of the microbial world, infectious diseases and host immunity to infection. Graduate (and postgraduate) education programs offer the basic principles of microbiology, pathogenesis, and immunology as well as research training.
opportunities in the laboratories of established scientists with diverse research interests.

**Faculty Research**

The program is equipped to support a wide range of research activities at the cutting edge of our diverse science. Faculty research activities focus on key problems in pathogenic microbiology, immunology, molecular biology, genetics, therapeutics, and virology.

**Research Facilities and Resources**

The research environment at MU with Colleges of Medicine, Veterinary Medicine, Agriculture, Engineering, and Arts and Sciences on one comprehensive campus fosters the development of interdisciplinary scientific interactions that enhance both research and training opportunities for faculty and students alike. The Bond Life Sciences Center represents such an interdisciplinary research enterprise and houses investigators from multiple colleges and departments, including MMI and VIB. Critical to the Molecular Pathogenesis and Therapeutics Graduate Program interests in infectious diseases, pathogenesis, therapeutics, and immunity research, the recent construction of an NIH-funded Laboratory for Infectious Disease Research provides modern BSL3/ABSL3 containment research space and animal holding facilities for the investigation of highly infectious organisms and human select agents. This resource, and the Molecular Pathogenesis and Therapeutics Graduate Program’s partnership with the Midwest Regional Center for Excellence in Biodefense and Emerging Infectious Disease Research, centered at Washington University in St. Louis, position MU in the national network of infectious disease research and training efforts. Please visit the MMI Web site (http://medicine.missouri.edu/mmi) for additional information on MMI’s access to state of the art facilities.

**Career Opportunities**

Graduates completing this training are prepared to pursue challenging and rewarding professional careers that involve research and teaching at supervisory levels in both the academic and private sectors.

**Research & Teaching Assistantships**

Students in the doctoral program are awarded research assistantships. Research assistants work with faculty members to obtain practical experience in carrying out research proposals through the collection of research data and writing research reports. All students in the graduate program are required to participate as teaching assistants for two semesters during their studies.

If you are interested in a Molecular Pathogenesis Graduate Program, please see the “Degrees, Majors (Degree Programs), Emphasis Areas, Minors and Certificate (http://catalog.missouri.edu/degreesanddegreeprograms)” page for the Ph.D. in Microbiology.

**MICROB 2800: Microbiology for Nursing and Health Professions**

This course will provide basic principles for understanding microbial growth, function, and control. This includes a survey of microbial cellular structure/functions, immunology concepts, epidemiology, specimen handling, and causes of microbial disease (bacterial, viral, and parasitic). Material is presented in lecture and corresponding laboratory exercises that will allow students to explore the microbial world around them.

**Credit Hours:** 4  
**Prerequisites:** The overall content is “restricted to Freshman and sophomore Nursing and Health Related Professional students only”. Other inquiries contact department

**MICROB 3200: Medical Microbiology and Immunology**

Focus on medically important viruses, bacteria, fungi and parasites with emphasis on their disease causing potential and mechanisms. Introduction to cells and molecules of the immune system with emphasis on their role in fighting infectious diseases. Discussion of treatment and prevention strategies. Lecture material will be reinforced with laboratory demonstrations and hands-on exercises. The course is intended for preprofessional students.

**Credit Hours:** 4

**MICROB 3800: Case-Based Microbiology: Assembling Systemic Health Connections**

Detailed infectious diseases across organ systems. The biological characteristics and pathologic mechanisms of infectious diseases caused by bacteria, viruses, fungi and parasites are explored in a case-based learning. Student-driven learning objectives for each case (to include microbiology, anatomy, physiology, pharmacology, technology and clinical LO's each case) help groups connect scientific information across disciplines.

**Credit Hours:** 3  
**Prerequisites:** Instructor's consent  
**Recommended:** MICROB 2800 or MICROB 3200, MPP 3202, and PTH _AS 2201

**MICROB 4300: Bacterial Pathogenesis**

(cross-leveled with MICROB 7404). This team taught course covers the biology and virulence mechanisms of bacterial pathogens, with emphasis on those causing human and zoonotic diseases. Topics covered include bacterial structure, genetics, physiology, and metabolism; antibiotic resistance; host-pathogen interactions; microbiomes and emerging pathogens.

**Credit Hours:** 2  
**Prerequisites:** MICROB 3200 or equivalent. Consent from Course Director is required to insure academic readiness

**MICROB 4303: Fundamental Virology**

Classification of viruses, life cycles, genome organization and expression, host-virus interactions, oncogenes and cellular transformation, viral pathogenesis, viral gene therapy approaches, strategies for anti viral therapy.

**Credit Hours:** 2  
**Prerequisites:** undergraduates require instructor's consent. This course will include evaluation of current literature and require paper presentations

**MICROB 4304: Immunology**

This is a comprehensive team-taught, basic immunology course covering cells and organs of the immune system, lymphocyte development, innate immunity, antibody production, antibody-antigen presentation, CD4+ and CD8+ T lymphocyte responses, cytokines, autoimmunity and immunodeficiency among other immunologically relevant topics. Completion of a biochemistry, genetics, or molecular biology course would be helpful.

**Credit Hours:** 2  
**Recommended:** MICROB 3200 or BIOCHM 4270
MICROB 4305H: Honors Bacterial Pathogenesis
This team taught course covers the biology and virulence mechanisms of bacterial pathogens, with emphasis on those causing human and zoonotic diseases. Topics covered include bacterial structure, genetics, physiology, and metabolism; antibiotic resistance; host-pathogen interactions; microbiomes and emerging pathogens.

Credit Hours: 2  
Prerequisites: MICROB 3200 or equivalent; Honors eligibility required. Consent from Course Director required to insure academic readiness.

MICROB 6291: ABS Microbiology Mechanism of Disease
ABS Microbiology Mechanism of Disease

Credit Hour: 5-10

MICROB 6293: ABS Microbiology Research
ABS Microbiology Research

Credit Hour: 5-10

MICROB 6295: ABS Microbiology Research and Review
ABS Microbiology Research and Review

Credit Hour: 5-10

MICROB 7101: Structure and Synthesis of Macro Molecules
This multiple-instructor course is designed to provide students with a detailed understanding of the structure, function, and biophysical properties of bio-molecules. Principles and techniques of molecular biology related to the study of recombinant DNA and genetic analysis, protein structure, function and basic immunological principles will be covered. Admission is dependent on approval by course director.

Credit Hours: 2  
Prerequisites: consent required

MICROB 7303: Fundamental Virology
Classification of viruses, life cycles, genome organization and expression, host-virus interactions, oncogenes and cellular transformation, viral pathogenesis, viral gene therapy approaches, strategies for anti viral therapy.

Credit Hours: 2  
Prerequisites: Undergraduates require instructor's consent. This course will include evaluation of current literature and require paper presentations.

MICROB 7304: Immunology
Covers innate immunity, antibodies, antigens, MHC, antigen presentation, lymphocyte development, antigen specific receptors, lymphocyte activation and differentiation, immune effector mechanisms, hypersensitivities, tolerance, autoimmunity, immunodeiciencies.

Credit Hours: 2  
Recommended: MICROB 3200 or BIOCHM 4270 or BIOCHM 4272 or instructor's consent

MICROB 7404: Foundations in Bacteriology and Pathogenesis
This team taught course covers the biology and virulence mechanisms of bacterial pathogens, with emphasis on those causing human and zoonotic disease. Topics covered include bacterial structure, genetics, physiology, and metabolism; antibiotic resistance; host-pathogen interactions; microbiomes and emerging pathogens.

Credit Hours: 3

MICROB 8050: Graduate Student Survival Skills
This course is an introduction to inform new graduate students about the Microbiology program and provide them with the knowledge to access resources and information needed for a successful transition into their course work and research. The course will also focus on guidelines in selecting mentors and their relationships, time management, good notebook practices, presentation and posters, comprehensive exams, and computer skills needed. Graded on S/U basis only.

Credit Hour: 1

MICROB 9001: Topics in Microbiology
Current topics, highly specialized topics taught infrequently, or courses taught by visiting professors.

Credit Hour: 1-99  
Prerequisites: instructor's consent

MICROB 9085: Problems in Microbiology
Students assigned individual problems in microbiology for library or lab investigation. Graded on A-F basis only.

Credit Hour: 1-99  
Prerequisites: instructor's consent

MICROB 9087: Seminar in Microbiology
Presentation and critical discussion of student and faculty research, current literature, and guest lectures on subjects in various areas of microbiology. Graded on A-F basis only.

Credit Hour: 1

MICROB 9090: Research in Microbiology
Original investigations in various areas of microbiology related to bacteria, fungi, rickettsia, viruses, and animal parasites, or immunology relating to antigens and antibodies of infectious and noninfectious nature designed for graduate thesis research. Graded on a S/U basis only.

Credit Hour: 1-99  
Prerequisites: instructor's consent

MICROB 9403: Advanced Medical Microbiology
Similar to MICROB 4300 but treats medical microbiology and immunology in a more advanced manner. Methods of preparation and instruction stressed. Graded on A-F basis only.

Credit Hours: 2  
Prerequisites: instructor's consent

MICROB 9404: Advanced Bacterial Pathogenesis
Literature based lectures and discussions covering current issues in bacterial pathogenesis. Focus is on understanding host-pathogen interactions; microbiomes and emerging pathogens.

Credit Hours: 2  
Prerequisites: instructor's consent
interactions that lead to disease. Topics include bacterial toxins and secreted virulence factors, intracellular bacterial growth and survival, host cell death and inflammatory pathways. Course will focus on a few model pathogens and discuss the molecular mechanisms of the pathogen and host that contribute to virulence. Graded on A-F basis only.

**Credit Hours:** 4  
**Prerequisites:** MICROB 7404  
**Recommended:** MICROB 4304 or MICROB 7304

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**MICROB 9407: Advanced Immunology**  
Literature based lectures and discussions covering current issues in molecular and cellular immunology. Topics include innate immunity; lymphocyte development; inflammation; tolerance, infection, and autoimmunity; mucosal immunity; asthma and allergy and tumor immunology.

**Credit Hours:** 4  
**Prerequisites:** MICROB 4304 or MICROB 7304, or instructor's consent

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**MICROB 9411: Responsible Conduct of Research**  
Ethical, legal and sociological ramifications of research including data management, authorship, human and animal use, conflict of interest and misconduct. Round table discussions and interactive forums. Grading based on participation in discussions and assignments. Graded on S/U basis only.

**Credit Hour:** 1

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**MICROB 9430: Molecular Biology I**  
(same as BIOCHM 9430). Detailed examination of current fundamental concepts of molecular genetics of bacteria, bacteriophages and yeast. Experimental approaches to analysis of the physical structures of genomic nucleic acids, the biochemistry and genetics of mutations, replications, gene transfer and gene expression will be examined in depth from reports in the current literature.

**Credit Hours:** 4  
**Prerequisites:** Biochemistry, genetics

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**MICROB 9432: Molecular Biology II**  
(same as BIOCHM 9432 and BIO_SC 9432). Detailed experimental analysis of eukaryotic cellular and molecular biology relevant to cellular and viral gene expression, post-transcriptional and post-translational modifications and genome replication. Models for developmental genetic analysis and genetic determinants controlling developmental processes utilizing the current literature will be examined.

**Credit Hours:** 4  
**Prerequisites:** MICROB 9430

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**MICROB 9449: Infection and Immunity**  
Writing, discussion, literature driven course, covering topics that focus on the interface between infectious diseases, cancer and the immune system. May be repeated for credit. Graded A-F basis only.

**Credit Hours:** 4  
**Prerequisites:** 2nd year Graduate student with bacteriology, virology, microbial pathogenesis and immunology background only. 1st year graduate students require instructor approval