Microbiology

School of Medicine
M604 Medical Sciences Building
https://medicine.missouri.edu/departments/molecular-microbiology-immunology/graduate-program (https://medicine.missouri.edu/departments/molecular-microbiology-immunology/graduate-program/)

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 (https://medicine.missouri.edu/), the Bond Life Sciences Center (https://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. The last class for the MPT program was accepted in Fall of 2021 and new students are now admitted under the Translational Biosciences PhD Program (TBS (https://medicine.missouri.edu/offices-programs/translational-biosciences-graduate-program/)) through the Infection and Immunity Emphasis Area.

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 Translational Biosciences PhD Program (TBS) Infection & Immunity Emphasis Area:

- PhD in Translational Biosciences with emphasis in Infection & Immunity
- Cooperative Degrees: MD/PhD in Translational Biosciences with emphasis in Infection & Immunity

Faculty

Molecular Microbiology and Immunology

Professor D.H. Burke, P. de Figueiredo, D. Duan, M.C. Johnson, X. Wan, H. Zaghouani
Associate Professor M.R. Baldwin, J.F. Cannon, M.A. Daniels, A.G. Schrum, E. Teixeiro-Pernas
Assistant Professor M J. Lange
Professor Emerita/Emeritus K.L. Bennett, H. Braley-Mullen, D.R. Lee, M.A. McIntosh, M.L. Misfeldt, D.J. Pintel, K.S. Wise
Research Assistant Professor D. Chance
Associate Teaching Professor J.L. Furrer

Veterinary Pathobiology

Professor D.M. Anderson, J.J. Adamovicz, B.T. Beerntsen, C.R. Brown, M.J. Calcutt, C.L. Franklin, C.L. Lorson, W. Ma, R.W. Stich
Associate Professor J. Amos-Landgraf, A. Franz, J. Skyberg
Adjunct Professor G.C. Stewart

Jointly appointed to Molecular Microbiology and Immunology

Professor C.R. Brown, M.J. Calcutt, D. Cornelison, C.L. Franklin, W. Ma, H. Shirwan, E. Yolcu
Associate Professor P.B. Brown, D. Gil Pagés, B. Hahm

* 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

For information on the undergraduate degree in Microbiology offered through the university's College of Arts and Science, refer to the BS in Microbiology (https://catalog.missouri.edu/collegeofartsandscience/microbiology/bs-microbiology/). The catalog provides a complete list of degree program options (https://catalog.missouri.edu/degreesanddegreeprograms/).

Graduate

- MS in Microbiology (https://catalog.missouri.edu/schoolofmedicine/microbiology/ms-microbiology/)
- PhD in Microbiology (https://catalog.missouri.edu/schoolofmedicine/microbiology/phd-microbiology-med/)

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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. The last class for the MPT program was accepted in Fall of 2021 and new students are now admitted under the Translational Biosciences PhD Program (TBS (https://medicine.missouri.edu/offices-programs/translational-biosciences-graduate-program/)) through the Infection and Immunity Emphasis Area.

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 VPB. 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 (https://medicine.missouri.edu/departments/molecular-microbiology-immunology/graduate-program/) 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 and Teaching Assistantships

Students in the doctoral program are awarded research assistantships. Research assistants work with faculty members to obtain practical experience in carrying out a research project 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 the Molecular Pathogenesis Graduate Program, please see the "Degrees, Majors (Degree Programs), Emphasis Areas, Minors and Certificate (https://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 inquires contact department

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MICROB 2800H: Microbiology for Nursing and Health Professions - Honors
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: Honors eligibility required; The overall content is "restricted to Freshman and sophomore Nursing and Health Related Professional students only". Other inquires contact department

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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 4304: Immunology for Health Professions
This is a 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. Graded on A-F basis only.

Credit Hours: 3
Recommended: MICROB 3200 or BIOCHM 4270 or MICROB 2800

MICROB 4307: Clinical Immunology
Introduces the principles of immune system function and their application to human health and disease. Students will explore the mechanisms of innate and adaptive immunity, immune regulation, and the immunologic basis of disorders such as autoimmunity, immunodeficiency, allergy, infection, and cancer. Emphasis is placed on clinical correlations, diagnostic immunology, modern immunotherapies, and clinical case studies. Designed for pre-professional students preparing for careers in medicine, nursing, biomedical research, and health-related fields. Graded on A-F basis only.

Credit Hours: 4
Prerequisites: MICROB 2800, MICROB 3200, MICROB 4304 or MICRO 3551

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 A-F basis only.

Credit Hour: 1

MICROB 8070: Professional Communication Development
(same as BIOCHM 8070, BIO_SC 8070). The purpose of this course is to develop professional communication skills in students that are planning to attend graduate school or are in their first year of graduate training. Graded on A-F basis.

Credit Hour: 1-2
Prerequisites: Graduate standing is required. Graduate students must be be enrolled in one of the PhD programs in the life sciences at MU and have completed less than 30 credit hours of graduate study at MU. Graduate students who participate in the IMSD T32 training program are required to take this class. IMSD T32 trainees are students who are enrolled in one of four PhD programs (Biochemistry, Biology, Translational Biosciences, or BBCE) and meet the T32 eligibility criteria in the biomedical sciences. Other graduate students in their first year of graduate school will be allowed to take this class, with permission of the instructor

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MICROB 8303: 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. Graded on A-F basis only.

Credit Hours: 2
Prerequisites: Undergraduates require instructor's consent. This course will include evaluation of current literature and require paper presentations
Recommended: All students in the PhD programs in the Translational Biosciences PhD program will be required to take one course outside of their research/ program interest. This would be an option to them

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MICROB 8304: Immunology
Covers innate immunity, antibodies, antigens, MHC, antigen presentation, lymphocyte development, antigen specific receptors, lymphocyte activation and differentiation, immune effector mechanisms, hypersensitivities, tolerance, autoimmunity, immunodeciencies. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: Undergraduates require instructor's consent. This course will include evaluation of current literature and require paper presentations
Recommended: All students in the PhD programs in the Translational Biosciences PhD program will be required to take one course outside of their research/ program interest. This would be an option to them

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MICROB 8404: Foundations in Bacterial 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. Graded on A-F basis only.

Credit Hours: 2

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 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 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 8404
Recommended: MICROB 4304 or MICROB 8304

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 9432: Molecular Biology II
(same as BIOCHM 9432, 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

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