

MOLECULAR MICROBIOLOGY AND IMMUNOLOGY (MMI)

Molecular Microbiology and Immunology (MMI) Courses

MMI 5013. Fundamentals of Biotechnology. (3-0) 3 Credit Hours.

Prerequisite: MMI 3353 or equivalent. The course will provide students with the foundational principles and techniques used in the manipulation of biological systems for practical applications. Key concepts include genetic engineering, recombinant DNA technology, cell culture, bioinformatics, and bioprocessing. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10; LRS1 \$46.20; STSI \$21.60; LRC1 \$12.

MMI 5033. Biotechnology Laboratory I: Foundations and Techniques. (0-9) 3 Credit Hours.

Prerequisite: Good academic standing. This course provides students with hands-on experience in foundational biotechnology laboratory techniques, with a focus on novel approaches used in research and industry. Emphasizing integration approaches like flow cytometry and genomics, students will learn to operate advanced laboratory equipment, analyze data, and interpret results. Critical thinking exercises and case studies will guide students in designing experiments and troubleshooting protocols. Additionally, students will develop oral presentation skills through regular research presentations, enhancing their ability to communicate complex scientific concepts effectively. This course aims to prepare students for more advanced laboratory applications and the challenges of professional internships. This course has Differential Tuition. Course Fee: DL01 \$25; IUB2 \$10; L001 \$30.

MMI 5133. Biotechnology Laboratory II: Advanced Applications. (0-9) 3 Credit Hours.

Prerequisite: MMI 5033. This course advances students' expertise in cutting-edge biotechnological applications. Students will engage in the use of selected advanced techniques focusing on real-world scenarios encountered in the biotechnology industry. Emphasis will be placed on data analysis, experimental design, and critical evaluation of current biotechnological research. Through collaborative projects, students will enhance their oral presentation skills by presenting findings to peers and industry professionals, simulating a professional work environment. The course also includes modules on career readiness, preparing students for successful transitions into internships and careers in the biotechnology sector. This course has Differential Tuition. Course Fee: L001 \$30; GS01 \$30; IUB2 \$10.

MMI 5513. Genes, Microbes and Disease. (3-0) 3 Credit Hours.

Prerequisite: BCH 3303 or equivalent. Primer course that bridges molecular and cell biology, molecular structure and function of genes and nucleic acids, in the focused area of host-pathogen interactions. Genome projects, functional genomics, and the genetic control of development will also be covered. May be repeated for credit. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 5553. Principles of Immunology. (3-0) 3 Credit Hours.

Prerequisite: BCH 3303 or equivalent. A study of cellular and molecular interaction between cells and molecules of the immune system and principles of immune system function. Topics include immune system development, humoral and cell-mediated immunity, disease and treatments, immunization, immunodeficiency, and autoimmunity. May be repeated for credit. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 5573. Principles of Microbiology. (3-0) 3 Credit Hours.

Prerequisite: BCH 3303 and MMI 3713, or equivalents. A study of the cellular and molecular mechanisms by which bacterial, eukaryotic, parasitic and viral pathogens cause disease and the host immune responses against these pathogens. (Credit cannot be earned for both MMI 5573 and BIO 6573.) This course is available to Master and Doctoral students. May be repeated for credit. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 5971. Directed Research. (0-0) 1 Credit Hour.

The directed research course may involve either a laboratory or a theoretical problem. May be repeated for credit, but not more than 6 hours, regardless of discipline, in combination with MMI 5972 and MMI 5973 (Directed Research), and MMI 6951, MMI 6952, and MMI 6953 (Independent Study), will apply to the Master's degree. This course has Differential Tuition. Course Fee: GS01 \$30; IUB2 \$10.

MMI 5972. Directed Research. (0-0) 2 Credit Hours.

The directed research course may involve either a laboratory or a theoretical problem. May be repeated for credit, but not more than 6 hours, regardless of discipline, in combination with MMI 5971 and MMI 5973 (Directed Research), and MMI 6951, MMI 6952, and MMI 6953 (Independent Study), will apply to the Master's degree. This course has Differential Tuition. Course Fees: GS01 \$60; IUB2 \$10.

MMI 5973. Directed Research. (0-0) 3 Credit Hours.

The directed research course may involve either a laboratory or a theoretical problem. May be repeated for credit, but not more than 6 hours, regardless of discipline, in combination with MMI 5971 and MMI 5972 (Directed Research), and MMI 6951, MMI 6952, and MMI 6953 (Independent Study), will apply to the Master's degree. This course has Differential Tuition. Course Fees: GS01 \$90; IUB2 \$10.

MMI 6323. Biostatistics. (3-0) 3 Credit Hours.

This course involves basic, intermediate, and advanced statistical vocabulary, concepts, and methods commonly used in the biomedical research. Concepts and appropriate selections of test/study design using power analyses and estimations of sample sizes; also for clinical trials. Analytical calibration curves, frequency distributions, descriptive statistics, measures of central tendency and dispersion/error, probability, paired and unpaired, one-tailed and two-tailed t-tests, correlations, regression, one-way and two-way analysis of variance with repeated measures, parametric and nonparametric tests, post hoc tests for significance, reporting and interpretations of statistical results, validations of clinical tests for specificity, sensitivity, predictive values, likelihood ratios, and receiver operating characteristic curves. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 6513. Drug Development. (3-0) 3 Credit Hours.

This course will provide students with an overview of the early drug discovery process, including target identification, validation, assay development, and high throughput screening up to pre-clinical trials. (Same as BIO 6513. Credit cannot be earned for both MMI 6513 and BIO 6513.) This course is available to Master and Doctoral students. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 6543. Vaccine Development. (3-0) 3 Credit Hours.

This course will provide students with an overview of issues about the roles of vaccines in the control of infectious diseases, vaccine development, clinical trials, and implementation of vaccine programs. (Same as BIO 6543. Credit cannot be earned for both MMI 6543 and BIO 6543.) This course is available to Master and Doctoral students. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 6613. Introduction to Clinical Medicine and Pathology. (3-0) 3 Credit Hours.

Prerequisite: Graduate standing. Introduction to concepts of human disease, diagnosis, and underlying pathology. This course is available to Master and Doctoral students. Generally offered: Fall. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 6623. Internship in Biotechnology. (0-0) 3 Credit Hours.

Prerequisite: Enrollment in Master's in Biotechnology program and at least 18 credit hours including satisfactory completion of MMI 5013. An internship or a practicum in a Biotechnology company or approved research facility. Must have approval of Biotechnology Graduate Studies Committee. May be repeated for credit. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10; LRS1 \$46.20.

MMI 6643. Introduction to Bioinformatics. (3-0) 3 Credit Hours.

The ability to sequence and analyze genomes has transformed biology. The genomic revolution has been made possible by the development of bioinformatics tools that combine computation with principles of molecular biology. In this course, students will learn how to use some of the major bioinformatics tools and will examine a few genomes to understand the vast amount of information present in them. This course is available to Master and Doctoral students. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 6713. Advanced Clinical Medicine and Pathology. (3-0) 3 Credit Hours.

Prerequisite: MMI 6613. Advanced concepts of human disease, diagnosis, and underlying pathology. This course is available to Master and Doctoral students. Generally offered: Spring. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 6733. Advanced Medical Mycology. (3-0) 3 Credit Hours.

Prerequisite: MMI 3722 or equivalent. A comprehensive study of the etiological agents and host factors that lead to fungal disease in humans. This course is available to Master and Doctoral students. (Same as BIO 5733. Credit cannot be earned for both MMI 6733 and BIO 5733.) This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 6743. Advanced Virology. (3-0) 3 Credit Hours.

Prerequisite: Graduate standing. A study of the diversity of animal viruses with emphasis on the molecular details of genome replication, gene expression, and pathogenesis. (Same as BIO 5743. Credit cannot be earned for both MMI 5743 and BIO 5743.) This course is available to Master and Doctoral students. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 6801. Comprehensive Examination. (0-0) 1 Credit Hour.

Prerequisite: Approval of the program's Graduate Advisor of Record. Enrollment is required each term in which the Comprehensive Examination is taken if no other courses are being taken that term. For students who are not writing theses, this exam aims to assess their capabilities to synthesize and explain knowledge acquired in their field of study in both written and oral formats. The exam includes material from a variety of external sources as well as those covered in regular courses. The grade report for the course is either "CR" (satisfactory performance on the Comprehensive Examination) or "NC" (unsatisfactory performance on the Comprehensive Examination). This course has Differential Tuition. Course Fee: GS01 \$30; LRS1 \$15.40; STSI \$7.20.

MMI 6803. Advanced Immunology. (3-0) 3 Credit Hours.

Prerequisite: MMI 4743 or consent of instructor. Advanced applications of current molecular and cellular concepts of humoral and cell-mediated immunity, with emphasis on host-pathogen interactions, experimental design, and immunological technologies. This course is available to Master and Doctoral students. (Same as BIO 6803. Credit cannot be earned for both MMI 6803 and BIO 6803.) This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 6883. Bacterial Pathogenesis. (3-0) 3 Credit Hours.

Prerequisite: MMI 3713 and MMI 4743, or consent of instructor. This course will present a selection of topics in the field of bacterial pathogenesis. Lectures will cover regulation of virulence, colonization and host tissue damage, vaccines, antibiotics, and novel antimicrobials, evasion of the immune system, intracellular pathogens, pathogenic mechanisms of Gram-negative and Gram-positive bacteria, pathogenic mycobacteriology, and experimental tools in bacterial pathogenesis. (Same as BIO 6883. Credit cannot be earned for both MMI 6883 and BIO 6883.) This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 6923. Advanced Microbial Bioinformatics. (3-0) 3 Credit Hours.

Prerequisite: BIO 2313 or equivalent; MMI 6643, enrollment in Molecular Microbiology and Immunology Ph.D. program required, or permission of the Molecular Microbiology and Immunology Department or instructor. With the advent of next generation sequencing (NGS), genomes and transcriptomes are being added at ever growing rates to the public sequence repositories, which poses challenges for comprehensive data analyses and mining. In this course, students will learn and apply bioinformatics tools and strategies - from the profiling of individual genomes to large-scale multi-isolate comparisons - to harvest the rich information content that can be found in big sequence data. This course focuses on microbial genomics/transcriptomics/evolution with focus on pathogens. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 6933. Data Analysis and Visualization for Biologists. (3-0) 3 Credit Hours.

An introduction to modern techniques used by data scientists; including data organization, manipulation, analysis, visualization, and in silico experimentation. Students will be taught how to use an open-source data science platform (KNIME) to design a workflow specific to their research project. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 6951. Independent Study. (0-0) 1 Credit Hour.

This course involves independent reading, research, discussion, and/or writing under the direction of a faculty member. This course is for students needing specialized work not normally or not often available as part of the regular course offerings. May be repeated for credit, but not more than 6 hours, regardless of discipline, in combination with MMI 5971, MMI 5972, and MMI 5973 (Independent Study), will apply to the Master's degree. This course has Differential Tuition. Course Fee: GS01 \$30; IUB2 \$10.

MMI 6952. Independent Study. (0-0) 2 Credit Hours.

This course involves independent reading, research, discussion, and/or writing under the direction of a faculty member. This course is for students needing specialized work not normally or not often available as part of the regular course offerings. May be repeated for credit, but not more than 6 hours, regardless of discipline, in combination with MMI 5971, MMI 5972, and MMI 5973 (Independent Study), will apply to the Master's degree. This course has Differential Tuition. Course Fee: GS01 \$60; IUB2 \$10.

MMI 6953. Independent Study. (0-0) 3 Credit Hours.

This course involves independent reading, research, discussion, and/or writing under the direction of a faculty member. This course is for students needing specialized work not normally or not often available as part of the regular course offerings. May be repeated for credit, but not more than 6 hours, regardless of discipline, in combination with MMI 5971, MMI 5972, and MMI 5973 (Independent Study), will apply to the Master's degree. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 6973. Special Topics. (3-0) 3 Credit Hours.

Prerequisite: Consent of instructor. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Topics courses may be repeated for credit if the topics vary. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 6981. Master's Thesis. (0-0) 1 Credit Hour.

Corequisites: Enrollment in MMI 6981, MMI 6982, or MMI 6983 is required each term in which the thesis is in progress. Thesis research and preparation. May be repeated for credit, but not more than 6 hours will apply to the Master's degree. Credit will be awarded upon completion of the thesis. This course has Differential Tuition. Course Fee: GS01 \$30; IUB2 \$10.

MMI 6982. Master's Thesis. (0-0) 2 Credit Hours.

Corequisites: Enrollment in MMI 6981, MMI 6982, or MMI 6983 is required each term in which the thesis is in progress. Thesis research and preparation. May be repeated for credit, but not more than 6 hours will apply to the Master's degree. Credit will be awarded upon completion of the thesis. This course has Differential Tuition. Course Fee: GS01 \$60; IUB2 \$10.

MMI 6983. Master's Thesis. (0-0) 3 Credit Hours.

Corequisites: Enrollment in MMI 6981, MMI 6982, or MMI 6983 is required each term in which the thesis is in progress. Thesis research and preparation. May be repeated for credit, but not more than 6 hours will apply to the Master's degree. Credit will be awarded upon completion of the thesis. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 7001. Professional and Leadership Development. (1-0) 1 Credit Hour.

This course focuses on building individual development plans and integration of professional and leadership skills. This course has Differential Tuition. Course Fee: GS01 \$30; IUB2 \$10.

MMI 7031. Graduate Student Seminar: Acquiring Presentation Skills. (1-0) 1 Credit Hour.

This course includes oral presentations, discussions, critical evaluation of students' research in progress, or support preparation of manuscripts/reviews by students to publish their data sets. The grade report for the course is either "CR" (satisfactory performance) or "NC" (unsatisfactory performance). May be repeated for credit. This course has Differential Tuition. Course Fee: GS01 \$30; IUB2 \$10.

MMI 7041. Molecular Microbiology and Immunology Colloquium. (1-0) 1 Credit Hour.

Prerequisite: Graduate standing. This course includes oral presentations, discussions, critical evaluation of students' research in progress, or discussions of current journal articles or reviews of recent scientific advances. The grade report for the course is either "CR" (satisfactory performance) or "NC" (unsatisfactory performance). May be repeated for credit if topic varies. This course has Differential Tuition. Course Fee: GS01 \$30; IUB2 \$10.

MMI 7051. Molecular Microbiology and Immunology Seminar. (1-0) 1 Credit Hour.

Prerequisite: Graduate standing. This course includes formal presentations of research by outside authorities in the biological sciences. The grade report for the course is either "CR" (satisfactory performance) or "NC" (unsatisfactory performance). May be repeated for credit. This course has Differential Tuition. Course Fee: GS01 \$30; IUB2 \$10.

MMI 7113. Teaching in Life Sciences. (3-0) 3 Credit Hours.

Prerequisite: Admission to candidacy for the Doctoral degree. Required course for Molecular Microbiology and Immunology doctoral students. The student will be responsible for all aspects of leading a discussion section or laboratory course. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 7143. Principles of Scientific Writing. (3-0) 3 Credit Hours.

Prerequisite: Admission to candidacy for the Molecular Microbiology and Immunology Doctoral degree. This course will provide an overview of scientific grant and manuscript preparation. The class will be directed toward producing a Ph.D. dissertation proposal and a predoctoral fellowship application. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 7211. Doctoral Research. (0-0) 1 Credit Hour.

Prerequisite: Admission to Molecular Microbiology and Immunology Doctoral program. May be repeated for credit, but no more than 27 hours may be applied to the Doctoral degree. This course has Differential Tuition. Course Fees: GS01 \$30; IUB2 \$10.

MMI 7212. Doctoral Research. (0-0) 2 Credit Hours.

Prerequisite: Admission to Molecular Microbiology and Immunology Doctoral program. May be repeated for credit, but no more than 27 hours may be applied to the Doctoral degree. This course has Differential Tuition. Course Fees: GS01 \$60; IUB2 \$10.

MMI 7213. Doctoral Research. (0-0) 3 Credit Hours.

Prerequisite: Admission to Molecular Microbiology and Immunology Doctoral program. May be repeated for credit, but no more than 27 hours may be applied to the Doctoral degree. This course has Differential Tuition. Course Fees: GS01 \$90; IUB2 \$10.

MMI 7214. Doctoral Research. (0-0) 4 Credit Hours.

Prerequisite: Admission to either the Molecular Microbiology and Immunology, Neuroscience, or Cell and Molecular Biology Doctoral program. May be repeated for credit, but no more than 27 hours may be applied to the Doctoral degree. This course has Differential Tuition. Course Fees: GS01 \$120; IUB2 \$10.

MMI 7215. Doctoral Research. (0-0) 5 Credit Hours.

Prerequisite: Admission to either the Molecular Microbiology and Immunology, Neuroscience, or Cell and Molecular Biology Doctoral program. May be repeated for credit, but no more than 27 hours may be applied to the Doctoral degree. This course has Differential Tuition. Course Fees: GS01 \$150; IUB2 \$10; STSF \$10.

MMI 7216. Doctoral Research. (0-0) 6 Credit Hours.

Prerequisite: Admission to Molecular Microbiology and Immunology Doctoral program. May be repeated for credit, but no more than 27 hours may be applied to the Doctoral degree. This course has Differential Tuition. Course Fees: GS01 \$180; IUB2 \$10.

MMI 7311. Doctoral Dissertation. (0-0) 1 Credit Hour.

Prerequisite: Admission to candidacy for the Molecular Microbiology and Immunology Doctoral degree and completion of at least 1-6 semester credit hours of MMI 7211, MMI 7212, MMI 7213, MMI 7214, MMI 7215, or MMI 7216. May be repeated for credit, but no more than 45 hours may be applied to the Doctoral degree. This course has Differential Tuition. Course Fee: GS01 \$30; IUB2 \$10.

MMI 7312. Doctoral Dissertation. (0-0) 2 Credit Hours.

Prerequisite: Admission to candidacy for the Molecular Microbiology and Immunology Doctoral degree and completion of at least 1-6 semester credit hours of MMI 7211, MMI 7212, MMI 7213, MMI 7214, MMI 7215, or MMI 7216. May be repeated for credit, but no more than 45 hours may be applied to the Doctoral degree. This course has Differential Tuition. Course Fee: GS01 \$60; IUB2 \$10.

MMI 7313. Doctoral Dissertation. (0-0) 3 Credit Hours.

Prerequisite: Admission to candidacy for the Molecular Microbiology and Immunology Doctoral degree and completion of at least 1-6 semester credit hours of MMI 7211, MMI 7212, MMI 7213, MMI 7214, MMI 7215, or MMI 7216. May be repeated for credit, but no more than 45 hours may be applied to the Doctoral degree. This course has Differential Tuition. Course Fee: GS01 \$90; IUB2 \$10.

MMI 7314. Doctoral Dissertation. (0-0) 4 Credit Hours.

Prerequisite: Admission to candidacy for the Molecular Microbiology and Immunology Doctoral degree and completion of at least 1-6 semester credit hours of MMI 7211, MMI 7212, MMI 7213, MMI 7214, MMI 7215, or MMI 7216. May be repeated for credit, but no more than 45 hours may be applied to the Doctoral degree. This course has Differential Tuition. Course Fee: GS01 \$120; IUB2 \$10.

MMI 7315. Doctoral Dissertation. (0-0) 5 Credit Hours.

Prerequisite: Admission to candidacy for the Molecular Microbiology and Immunology Doctoral degree and completion of at least 1-6 semester credit hours of MMI 7211, MMI 7212, MMI 7213, MMI 7214, MMI 7215, or MMI 7216. May be repeated for credit, but no more than 45 hours may be applied to the Doctoral degree. This course has Differential Tuition. Course Fee: GS01 \$150; IUB2 \$10.

MMI 7316. Doctoral Dissertation. (0-0) 6 Credit Hours.

Prerequisite: Admission to candidacy for the Molecular Microbiology and Immunology Doctoral degree and completion of at least 1-6 semester credit hours of MMI 7211, MMI 7212, MMI 7213, MMI 7214, MMI 7215, or MMI 7216. May be repeated for credit, but no more than 45 hours may be applied to the Doctoral degree. This course has Differential Tuition. Course Fee: GS01 \$180; IUB2 \$10.

MMI 7571. Doctoral Rotation. (0-3) 1 Credit Hour.

Prerequisite: Admission to the Molecular Microbiology and Immunology Ph.D. program. This course allows students to perform laboratory-based research under the direction of a Molecular Microbiology and Immunology faculty member. Students will receive mentoring and training in the areas of experimental design, experimentation, data acquisition, data analysis, and presentation (oral/written). May be repeated for credit, but no more than 6 hours may be applied to the Doctoral degree. This course has Differential Tuition. Course Fee: GS01 \$30; IUB2 \$10.

MMI 7572. Doctoral Rotation. (0-6) 2 Credit Hours.

Prerequisite: Admission to the Molecular Microbiology and Immunology Ph.D. program. This courses allows students to perform laboratory-based research under the direction of a Molecular Microbiology and Immunology faculty member. Students will receive mentoring and training in the areas of experimental design, experimentation, data acquisition, data analysis, and presentation (oral/written). May be repeated for credit, but no more than 6 hours may be applied to the Doctoral degree. This course has Differential Tuition. Course Fees: GS01 \$60; IUB2 \$10.