

# MOLECULAR MICROBIOLOGY AND IMMUNOLOGY (MMI)

## Molecular Microbiology and Immunology (MMI) Courses

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

Prerequisite: BIO 3513 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. Differential Tuition: \$150. Course Fees: GS01 \$90; IUB2 \$10.

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

Prerequisite: BIO 3513 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. Differential Tuition: \$150. Course Fees: GS01 \$90; IUB2 \$10.

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

Prerequisite: BIO 3513 and BIO 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. Differential Tuition: \$150. Course Fees: 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 6951, MMI 6952, and MMI 6953 (Independent Study), will apply to the Master's degree. Differential Tuition: \$50. Course Fees: 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 6951, MMI 6952, and MMI 6953 (Independent Study), will apply to the Master's degree. Differential Tuition: \$100. 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 6951, MMI 6952, and MMI 6953 (Independent Study), will apply to the Master's degree. Differential Tuition: \$150. 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. Differential Tuition: \$150. Course Fees: 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. Differential Tuition: \$150. Course Fees: 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. Differential Tuition: \$150. Course Fees: 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. Differential Tuition: \$150. Course Fees: GS01 \$90; IUB2 \$10.

### 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. Differential Tuition: \$150. Course Fees: GS01 \$90; IUB2 \$10.

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

Prerequisite: MMI 3013 or MMI 6613. Advanced concepts of human disease, diagnosis, and underlying pathology. This course is available to Master and Doctoral students. Generally offered: Spring. Differential Tuition: \$150. Course Fees: GS01 \$90; IUB2 \$10.

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

Prerequisite: BIO 3522 and BIO 3722 or equivalents. 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.) Differential Tuition: \$150. Course Fees: 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. Differential Tuition: \$150. Course Fees: GS01 \$90; IUB2 \$10.

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

Prerequisite: BIO 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.) Differential Tuition: \$150. Course Fees: GS01 \$90; IUB2 \$10.

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

Prerequisite: BIO 3713 and BIO 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.) Differential Tuition: \$150. Course Fees: 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. Differential Tuition: \$150. Course Fees: 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. Differential Tuition: \$150. Course Fees: 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. Differential Tuition: \$50. Course Fees: 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. Differential Tuition: \$100. Course Fees: 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. Differential Tuition: \$150. Course Fees: 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. Differential Tuition: \$150. Course Fees: 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. Differential Tuition: \$50. Course Fees: 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. Differential Tuition: \$100. Course Fees: 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. Differential Tuition: \$150. Course Fees: 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. Differential Tuition: \$50. Course Fees: 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. May be repeated for credit. Differential Tuition: \$50. Course Fees: 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. May be repeated for credit if topic varies. Differential Tuition: \$50. Course Fees: 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. May be repeated for credit. Differential Tuition: \$50. Course Fees: 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. Differential Tuition: \$150. Course Fees: 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. Differential Tuition: \$150. Course Fees: 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. Differential Tuition: \$50. 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. Differential Tuition: \$100. 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. Differential Tuition: \$150. 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. Differential Tuition: \$200. 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. Differential Tuition: \$250. Course Fees: GS01 \$150; IUB2 \$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. Differential Tuition: \$300. 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. Differential Tuition: \$50. Course Fees: 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. Differential Tuition: \$100. Course Fees: 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. Differential Tuition: \$150. Course Fees: 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. Differential Tuition: \$200. Course Fees: 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. Differential Tuition: \$250. Course Fees: 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. Differential Tuition: \$300. Course Fees: GS01 \$180; IUB2 \$10.

**MMI 7571. Doctoral Rotation. (0-0) 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. Differential Tuition: \$50. Course Fees: GS01 \$30; IUB2 \$10.

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

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. Differential Tuition: \$100. Course Fees: GS01 \$60; IUB2 \$10.