

## MICROBIOLOGY AND MOLECULAR GENETICS

### OVERVIEW

<https://www.med.uvm.edu/mmg/home> (<https://www.med.uvm.edu/mmg/home/>)

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The goal of the Microbiology and Molecular Genetics Master's Programs is to prepare students for careers in science. The program provides an increased knowledge base in both microbiology and molecular genetics as well as the ability to think critically, communicate scientific knowledge clearly and perform independent scientific research. In addition to the Microbiology and Molecular Genetics M.S. and Accelerated Master's Program (AMP), the MMG faculty participate in the interdisciplinary doctoral program in Cellular, Molecular, and Biomedical Sciences.

### DEGREES

- Microbiology and Molecular Genetics AMP (<http://catalogue.uvm.edu/graduate/microbiologymoleculargenetics/microbiologymoleculargeneticsamp/>)
- Microbiology and Molecular Genetics M.S. (<http://catalogue.uvm.edu/graduate/microbiologymoleculargenetics/microbiologymoleculargeneticsms/>)

### FACULTY

**Bruce, Emily;** Assistant Professor, Department of Microbiology and Molecular Genetics; PHD, Cambridge University

**Chatterjee, Nimrat;** Assistant Professor, Department of Microbiology and Molecular Genetics; PHD, Baylor College of Medicine

**Colgate, Ross;** Assistant Professor, Department of Microbiology and Molecular Genetics; PHD, University of Vermont

**Diehl, Sean;** Associate Professor, Department of Microbiology and Molecular Genetics; PHD, University of Vermont

**Doublié, Sylvie;** Professor, Department of Microbiology and Molecular Genetics; PHD, University of North Carolina Chapel Hill

**Dragon, Julie;** Associate Professor, Microbiology and Molecular Genetics; PHD, University of Vermont

**Kirkpatrick, Beth Diane;** Professor, Department of Microbiology and Molecular Genetics; MD, Albany Medical College

**Lee, Andrea J.;** Assistant Professor, Department of Microbiology and Molecular Genetics; PHD, University of Wisconsin-Madison

**Martorelli Di Genova, Bruno;** Assistant Professor, Department of Microbiology and Molecular Genetics; PHD, Federal University of Sao Paulo

**Mintz, Keith Peter;** Associate Professor, Department of Microbiology and Molecular Genetics; PHD, University of Vermont

**Thali, Markus Josef;** Professor, Department of Microbiology and Molecular Genetics; PHD, University of Zurich

**Ward, Gary E.;** Professor, Department of Microbiology and Molecular Genetics; PHD, University of California San Diego

**Wargo, Matthew;** Associate Professor, Department of Microbiology and Molecular Genetics; PHD, Dartmouth College

### Courses

#### MMG 201. Molecular Cloning Lab. 4 Credits.

Intensive advanced laboratory course in the fundamentals of recombinant DNA technology through the isolation and characterization of a unique gene. Prerequisite: MMG 104 or BIOC 207 or Instructor permission. Fall.

#### MMG 205. Biochemistry I. 3 Credits.

Introduction to chemistry and structure of biological macromolecules; examination of mechanisms of chemical processes in biological systems, including enzyme catalysis, biosynthesis, regulation, and information transfer. Prerequisite: CHEM 048 or CHEM 142 or CHEM 144. Cross-listed with: BIOC 205, CHEM 205. Fall.

#### MMG 206. Biochemistry II. 3 Credits.

Continuation of Biochemistry I. Biochemistry of nucleic acids; nucleic acid based processes, such as replication and transcription; cellular information transfer, genomics, and proteomics. Prerequisite: MMG 205. Cross-listed with: BIOC 206, CHEM 206. Spring.

#### MMG 207. Biochemistry Lab. 3 Credits.

Introduction to biochemical tools, including spectrometry, chromatography, and electrophoresis; natural and recombinant enzyme isolation; assays of DNA-modifying enzymes; computer-based structure/function exercises. Prerequisite: BIOC 205 or CHEM 205 or MMG 205. Cross-listed with: BIOC 207, CHEM 207.

#### MMG 211. Prokaryotic Molecular Genetics. 3 Credits.

The organization, replication, and expression of genes in prokaryotes, focusing on the genetics of *Escherichia coli* and its viruses. Prerequisite: Introductory microbiology, biochemistry, genetics, and/or cell biology courses. Fall.

#### MMG 220. Environmental Microbiology. 3 Credits.

The activities of microorganisms, primarily bacteria, in air, soil, and water. Prerequisites: MMG 101 and Organic Chemistry Alternate years.

#### MMG 222. Advanced Medical Microbiology. 4 Credits.

Comprehensive study of human pathogenic bacteria and their disease states in humans. Laboratory sessions provide practical experience in handling and identifying these pathogens. Alternate years. Spring. Prerequisites: MMG 065 or MMG 101 or equivalent or Instructor permission.

#### MMG 223. Immunology. 3 Credits.

Analysis of the immune response with respect to structure and function of immunoglobulins and the T-cell receptor, tolerance, innate and adaptive immunity, the Major Histocompatibility Complex, hypersensitivity states, transplantation, cancer, and AIDS. Prerequisite: Instructor permission. Alternate years, Spring.

**MMG 225. Eukaryotic Virology. 3 Credits.**

An in-depth analysis of eukaryotic virus-mammalian cell interactions emphasizing mechanisms by which viruses modulate gene expression in infected cells. Prerequisite: MMG 101 or MMG 104 or equivalent. Alternate years. Fall.

**MMG 231. Bioinformatics&Data Anlysis. 3 Credits.**

Methodological survey of bioinformatics in the -omics era, focusing on genomics data of medically relevant microbes. Topics include data mining, metagenomics, phylogenetics, and comparative genomics. Mix of lecture and hands-on interaction utilizing analysis tools on the Vermont Advanced Computing Core. Prerequisite: Instructor permission.

**MMG 232. QR: Advanced Bioinformatics. 3 Credits.**

Advanced data processing and genome assembly analysis, data integration, and machine learning. Python, R, and Linux-scripting are used to assemble genomes, integrate large data sets, and build complex biological models. Topics include genomics, meta-data management, and multi-omics analyses at systems biology levels. Alternate Years. Spring. Prerequisites: MMG 104 or BCOR 101; MMG 231, or Instructor permission.

**MMG 233. Genetics and Genomics. 3 Credits.**

Integrated entry into both genome science and modern genetic analysis. Students will develop skills needed to access, organize and interpret emerging genomic information. Fall. Prerequisite: Junior/Senior/Graduate standing in biological or computational sciences.

**MMG 320. Cellular Microbiology. 4 Credits.**

Utilizes primary literature to explore the cellular and molecular basis of microbial pathogenesis caused by viruses, pathogenic bacteria and protozoan parasites. Alternate years. Spring.

**MMG 391. Master's Thesis Research. 1-18 Credits.****MMG 393. Graduate Teaching Practicum. 3 Credits.**

Required practicum for all Microbiology and Molecular Genetics Masters Students. Students will be exposed to and mentored in the fundamentals of undergraduate teaching and learning in the laboratory setting.

**MMG 394. Independent Graduate Research. 1-18 Credits.**

Graduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

**MMG 395. Internship. 1-18 Credits.**

On-site supervised work experience combined with a structured academic learning plan directed by a faculty member or a faculty-staff team in which a faculty member is the instructor of record, for which academic credit is awarded. Offered at department discretion.

**MMG 396. Advanced Special Topics. 1-18 Credits.**

See Schedule of Courses for specific titles.

**MMG 490. Internship. 1-18 Credits.**

On-site supervised work experience combined with a structured academic learning plan directed by a faculty member or a faculty-staff team in which a faculty member is the instructor of record, for which academic credit is awarded. Offered at department discretion.

**MMG 491. Doctoral Dissertation Research. 1-18 Credits.****MMG 494. Independent Graduate Research. 1-18 Credits.**

Graduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

**MMG 496. Advanced Special Topics. 1-18 Credits.**

See Schedule of Courses for specific titles.