

# MICROBIOLOGY AND MOLECULAR GENETICS

## MMG

### Department of Microbiology and Molecular Genetics College of Natural Science

- 141 Introductory Human Genetics**  
Fall, Spring. 3(3-0) R: Not open to students in the Biochemistry and Molecular Biology major or in the Biological Science Major or in the Biomedical Laboratory Science Major or in the Clinical Laboratory Sciences Major or in the Environmental Biology/Microbiology Major or in the Environmental Biology/Plant Biology Major or in the Environmental Biology/Zoology Major or in the Genomics and Molecular Genetics Major or in the Human Biology Major or in the Microbiology Major or in the Neuroscience Major or in the Physiology Major or in the Plant Biology Major or in the Zoology Major and not open to students in the Lyman Briggs Biochemistry and Molecular Biology Coordinate Major or in the Lyman Briggs Biological Science-Interdepartmental Coordinate Major or in the Lyman Briggs Biomedical Laboratory Science Coordinate Major or in the Lyman Briggs Environmental Biology/Plant Biology Coordinate Major or in the Lyman Briggs Environmental/Biology/Microbiology Coordinate Major or in the Lyman Briggs Environmental Biology/Zoology Coordinate Major or in the Lyman Briggs Genomics and Molecular Genetics Coordinate Major or in the Lyman Briggs Human Biology Coordinate Major or in the Lyman Briggs Neuroscience Major or in the Lyman Briggs Microbiology Coordinate Major. SA: ZOL 141 Not open to students with credit in IBIO 341.  
Inheritance of human traits. Impact of genetic technology on society. Ethical and legal issues. Risks and benefits of genetic technology.
- 201 Fundamentals of Microbiology**  
Spring. 3(3-0) RB: (CEM 141 or ISP 207 or ISP 209 or ISP 217 or LB 171) and (BS 161 or BS 181H or LB 145) SA: MMG 105, MMG 205  
Microbial structure, function, growth, control, and diversity. Role of microbes in health, industry, and the environment.
- 301 Introductory Microbiology**  
Fall, Spring. 3(3-0) P: (BS 161 or LB 145 or BS 181H) and ((CEM 251 or concurrently) or (CEM 351 or concurrently) or (CEM 143 or concurrently)) SA: MIC 301  
Fundamentals of microbiology, including microbial structure and function, nutrition and growth, death and control. Importance and applications of major microbial groups.
- 302 Introductory Laboratory for General and Allied Health Microbiology**  
Spring. 1(0-3) P: (MMG 201 or concurrently) or (MMG 301 or concurrently) SA: MIC 302  
Methodology of microbiology. Microscopy, staining, aseptic technique, media, quantification, diagnostics, and laboratory safety.
- 365 Medical Microbiology**  
Spring. 3(3-0) Interdepartmental with Biomedical Laboratory Diagnostics. Administered by Microbiology and Molecular Genetics. P: (BS 161 and CEM 141) and (MMG 201 or MMG 301) Not open to students with credit in MMG 463.  
Laboratory diagnosis, disease and epidemiology of the most common bacterial, viral, fungal and parasitic pathogens and concepts in infectious disease control, prevention and treatment.
- 365L Medical Microbiology Laboratory**  
Spring. 1(0-2) Interdepartmental with Biomedical Laboratory Diagnostics. Administered by Microbiology and Molecular Genetics. P: (MMG 365 or concurrently) and (MMG 201 or MMG 301) Not open to students with credit in MMG 464.  
Practical experience in safely and accurately performing standard clinical microbiology tests to diagnose disease-causing microbes.
- 400 Introduction to Bioinformatics**  
Fall of even years. 3(2-2) Interdepartmental with Biochemistry and Molecular Biology and Plant Biology. Administered by Plant Biology. P: (STT 200 or STT 201 or STT 231 or STT 421) and (PLB 203 or MMG 201 or BMB 200 or BS 161) RB: An introductory biology course covering basic genetics, macromolecules, evolution, energy metabolism, genetic materials, and signal transduction is recommended for non-biology majors. A statistics course covering random variable, distributions, and basic probability theory is recommended for biology majors.  
Managing and analyzing biological data with bioinformatic tools, basic programming, and statistics.
- 404 Human Genetics**  
Fall. 3(3-0) P: IBIO 341 SA: ZOL 344, ZOL 404  
Inheritance of human traits. Medical, molecular, physiological and forensic applications. Biochemical, clinical, and molecular genetics of human disease. Prenatal, pre-symptomatic, and clinical diagnosis. Ethical, legal and social considerations.
- 408 Advanced Microbiology Laboratory (W)**  
Fall. 3(1-6) P: (MMG 302 and (MMG 431 or concurrently)) and completion of Tier I writing requirement R: Open to students in the Department of Microbiology and Molecular Genetics or in the Genetics Major or in the Environmental Biology/Microbiology Major or in the Microbiology Major. SA: MPH 408  
Microbiological techniques and procedures to study physiology and genetics of bacteria and bacteriophages. Collection and critical assessment of quantitative data and written communication of results.
- 409 Eukaryotic Cell Biology**  
Spring. 3(3-0) P: (BS 161 or LB 145 or BS 181H) and ((BMB 401 or concurrently) or (BMB 462 or concurrently)) SA: MIC 403, MPH 403  
Structure and function of nucleated cells. Emphasis on the molecular mechanisms that underlie cell processes.
- 410 Bioinformatics and Computational Biology**  
Spring. 3(2-2) Interdepartmental with Biochemistry and Molecular Biology and Computational Mathematics, Science, & Engineering and Plant Biology. Administered by Computational Mathematics, Science, & Engineering. P: ((CMSE 201 and LB 144 and LB 145) or (CMSE 201 and BS 161 and BS 162) or (CMSE 201 and BS 181H and BS 182H)) and (STT 200 or STT 201 or STT 231 or STT 421 or STT 351 or ECE 280)  
Computational approaches in modern biology with a focus on applications in genomics, systems biology, evolution, and structural biology.
- 411 Computational Medicine**  
Fall of even years. 3(3-0) Interdepartmental with Biochemistry and Molecular Biology and Computational Mathematics, Science, & Engineering. Administered by Computational Mathematics, Science, & Engineering. P: (CMSE 201 and LB 144 and LB 145) or (CMSE 201 and BS 161 and BS 162) or (CMSE 201 and BS 181H and BS 182H)  
Computational approaches in biology with a focus on medicine.
- 413 Virology**  
Spring. 3(3-0) P: (BMB 462 or concurrently) or BMB 401  
Viruses and modern molecular biology. Viral replication and gene expression of the major classes of viruses. Virus-cell interactions and viral diseases.
- 421 Prokaryotic Cell Physiology**  
Fall. 3(3-0) P: (MMG 301 and (BMB 461 or concurrently)) or (MMG 301 and (BMB 401 or concurrently)) SA: MIC 401, MPH 401  
Prokaryotic cell structure and function. Growth and replication. Macromolecular synthesis and control.
- 425 Microbial Ecology**  
Spring. 3(3-0) Interdepartmental with Crop and Soil Sciences. Administered by Microbiology and Molecular Genetics. RB: MMG 301 SA: MPH 425  
Microbial population and community interactions. Microbial activities in natural systems, including associations with plants or animals.
- 431 Microbial Genetics**  
Fall. 3(3-0) P: (BMB 461 or concurrently) or (BMB 401 or concurrently) RB: MMG 301 or ZOL 341 SA: MIC 401, MPH 401  
Genetics of bacteria, their viruses, plasmids, and transposons. Emphasis on genetic principles.
- 433 Microbial Genomics**  
Spring. 3(3-0) P: (MMG 431) RB: (MMG 421 or BMB 461) and CSE 101  
Structure of microbial genomes and implications for growth and evolution of bacteria and fungi. Computer analysis of genome sequence databases. Applications to gene expression and phylogenetic analysis.
- 434 Laboratory in Genomics and Molecular Genetics (W)**  
Spring. 4(1-8) P: (MMG 301 and (MMG 433 or concurrently)) and completion of Tier I writing requirement R: Open to students in the Genomics and Molecular Genetics Major or in the Lyman Briggs Genomics and Molecular Genetics Coordinate Major.  
Genomics and molecular genetic techniques using microbes. Collection and critical assessment of quantitative data and written communication of results.

## MMG—Microbiology and Molecular Genetics

- 435 Geomicrobiology**  
Spring of odd years. 4(3-2) Interdepartmental with Geological Sciences. Administered by Geological Sciences. RB: GLG 201 or MMG 201 or BS 161 or LB 145 R: Open to juniors or seniors or graduate students in the College of Natural Science or in the Lyman Briggs College.  
Geological and microbiological perspectives on microbial activities in diverse environmental settings, including geological change mediated by microorganisms, microbial evolution driven by geologically diverse habitats.
- 440 Food Microbiology**  
Fall. 3(3-0) Interdepartmental with Food Science. Administered by Food Science. P: (MMG 201 or MMG 301) and completion of Tier I writing requirement. R: Not open to freshmen.  
Major groups of microorganisms of importance to the food industry. Ecological, physiological, and public health aspects.
- 441 Food Microbiology Laboratory**  
Fall. 2(0-4) Interdepartmental with Food Science. Administered by Food Science. P: (FSC 440 or concurrently) and completion of Tier I writing requirement RB: MMG 302 SA: MPH 441  
Methods for studying major groups of microorganisms important to the food industry. Isolation, enumeration, characterization, identification, and use of microorganisms.
- 445 Microbial Biotechnology (W)**  
Fall, Summer. 3(3-0) P: (MMG 301 or BMB 461 or BMB 401) and completion of Tier I writing requirement SA: MIC 445  
Applications of microbial products and processes in areas such as biopharmaceuticals, bioremediation, biocatalysis and other green chemistries.
- 451 Immunology**  
Fall. 3(3-0) P: (BS 161 or LB 145 or BS 181H) and ((BMB 401 or concurrently) or (BMB 461 or concurrently)) Not open to students with credit in BLD 434.  
Structure and function of molecules involved in immune responses. Quantification of immune responses and cellular participants. Immunologic abnormalities. Immunotherapy. Experimental approaches to dissection of immune functions.
- 461 Molecular Pathogenesis**  
Spring of even years. 3(3-0) P: (MMG 301) RB: MMG 431 SA: MPH 461  
Molecular basis of microbial virulence. Nature of determinants and their role in overcoming host defense mechanisms.
- 465 Advanced Medical Microbiology Laboratory**  
Fall. 3(3-0) Interdepartmental with Biomedical Laboratory Diagnostics. Administered by Microbiology and Molecular Genetics. P: MMG 365 Not open to students with credit in MMG 463.  
Advanced laboratory diagnosis, epidemiology, and prevention of infectious diseases using an anatomical system specimen approach to study a comprehensive set of human pathogens and microbiota.
- 465L Advanced Medical Microbiology Laboratory**  
Fall. 2(0-6) Interdepartmental with Biomedical Laboratory Diagnostics. Administered by Microbiology and Molecular Genetics. P: MMG 365L and (MMG 465 or concurrently) Not open to students with credit in MMG 464. C: MMG 465 concurrently.  
Practical experience in safely and accurately performing standard clinical microbiology tests to process clinical specimens, identify pathogens and perform and interpret susceptibility testing.
- 490 Special Problems in Microbiology**  
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of department.  
Library research or tutorial instruction in advanced laboratory techniques.
- 491 Current Topics in Microbiology and Molecular Genetics**  
Spring. 3(4-0) R: Open to seniors in the Lyman Briggs College or in the Department of Microbiology and Molecular Genetics or in the Lyman Briggs Genomics and Molecular Genetics Coordinate Major. SA: MIC 491  
Capstone experience for microbiology majors. Presentation and discussion of journal articles. Writing of position papers. Topics such as microbial physiology, ecology, genetics, molecular biology, virology, immunology, or pathogenesis.
- 492 Undergraduate Research Seminar**  
Spring. 1(2-0) P: MMG 499 or MMG 499H R: Open to students in the Department of Microbiology and Molecular Genetics or in the Lyman Briggs Genomics and Molecular Genetics Coordinate Major. SA: MIC 492  
Presentation and group discussion of undergraduate research results.
- 499 Undergraduate Research**  
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open to students in the Department of Microbiology and Molecular Genetics or in the Lyman Briggs Environmental/Biology/Microbiology Coordinate Major or in the Lyman Briggs Genomics and Molecular Genetics Coordinate Major or in the Lyman Briggs Microbiology Coordinate Major. SA: MIC 499  
Participation in a laboratory research project.
- 499H Honors Research**  
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open to students in the Department of Microbiology and Molecular Genetics or in the Lyman Briggs Environmental/Biology/Microbiology Coordinate Major or in the Lyman Briggs Genomics and Molecular Genetics Coordinate Major or in the Lyman Briggs Microbiology Coordinate Major. SA: MIC 499H  
Research project with thesis and oral report. A portion of Microbiology or Genomics and Molecular Genetics capstone experience.
- 522 Medical Microbiology and Immunology**  
Spring. 5(4-2) R: Open to graduate-professional students in the College of Osteopathic Medicine or in the College of Human Medicine.  
Basic principles of microbiology (bacteriology, virology, mycology and parasitology) and immunology and their relation to disease in humans.
- 531 Medical Immunology**  
Fall. 2(2-0) R: Open to graduate-professional students in the College of Osteopathic Medicine.  
Basic principles of immunology. Overview of concepts and terminology in relation to human disease defenses.
- 532 Medical Microbiology**  
Fall. 2(1-2) R: Open to graduate-professional students in the College of Osteopathic Medicine.  
Basic principles of microbiology including bacteriology, virology, mycology, and parasitology and their relationship to disease in humans.
- 539 Principles of Cell Biology and Pathophysiology**  
Fall. 4(3-2) Interdepartmental with Human Anatomy and Biochemistry and Molecular Biology and Physiology. Administered by Physiology. R: Open to graduate-professional students in the College of Osteopathic Medicine.  
Modern concepts of human cell biology as a basis for understanding integration of structure (histology) and function (physiology) in health and disease (pathology). Introduction to adaptive growth response, cell injury, inflammation, hemodynamic disorders, and tissue repair.
- 559 Veterinary Microbiology and Immunology**  
Fall. 4(4-0) R: Open to graduate-professional students in the College of Veterinary Medicine. SA: MMG 561, MMG 567, MMG 569  
Medically important properties of veterinary pathogens. Principles of positive and negative host response.
- 563 Veterinary Pathogenic Microbiology: Bacteria and Fungi**  
Fall. 3(3-0) RB: Completion of Year 1 of the graduate-professional program in the College of Veterinary Medicine. R: Open to graduate-professional students in the College of Veterinary Medicine. SA: MMG 567  
Etiology, pathogenesis, transmission, pathogenicity, host response, therapy, and control of bacterial and fungal diseases of animals.
- 565 Veterinary Pathogenic Microbiology: Viruses**  
Spring. 2(2-0) RB: Completion of Year 1 of the graduate-professional program in the College of Veterinary Medicine. R: Open to graduate-professional students in the College of Veterinary Medicine. SA: MMG 569  
Etiology, pathogenesis, pathogenicity, transmission, diagnosis, host response, therapy, and control of selected viral diseases of animals.
- 571 Veterinary Pathogenic Microbiology: Parasites**  
Spring. 3(2-2) R: Open to graduate-professional students in the College of Veterinary Medicine. SA: MMG 569  
Etiology, pathogenesis, transmission, pathogenicity, diagnosis, host response, therapy, and control of selected parasitic diseases of animals.
- 660 Veterinary Clinical Bacteriology Clerkship**  
Fall, Spring, Summer. 3 credits. RB: Completion of semester 5 of the graduate-professional program in the College of Veterinary Medicine.  
Guided clinical bacteriology experience.

- 662 Clinical Veterinary Virology Clerkship**  
Fall, Spring, Summer. 3 credits. RB: Completion of semester 5 of the graduate-professional program in the College of Veterinary Medicine.  
Guided clinical virology experience.
- 664 Veterinary Clinical Parasitology Clerkship**  
Fall, Spring, Summer. 3 credits. RB: Completion of semester 5 of the graduate-professional program in the College of Veterinary Medicine.  
Guided clinical parasitology experience.
- 690 Veterinary Microbiology Clerkship**  
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course. RB: Completion of 5 semesters of the graduate-professional program in the College of Veterinary Medicine. SA: MPH 690  
Laboratory-based investigation of microbiological problems pertinent to veterinary medicine.
- 801 Integrative Microbial Biology**  
Fall. 4(4-0) Not open to students with credit in MMG 821 or MMG 829 or MMG 841 or MMG 827.  
Structural, metabolic, phylogenetic, and genomic diversity of microbes and microbial communities. Microbial ecology, evolution, and behavior. Regulation of gene expression. Microbial interactions with other microbes, animals, or plants
- 803 Topics in Integrative Microbial Biology**  
Fall, Spring. 2(2-0) A student may earn a maximum of 10 credits in all enrollments for this course. P: MMG 801 or concurrently  
In-depth study of a particular topic from integrative microbial biology.
- 810 Theories and Practices in Bioinformatics**  
Fall of even years. 3(2-2) Interdepartmental with Biochemistry and Molecular Biology and Plant Biology. Administered by Plant Biology. RB: Basic genetics, macromolecules, evolution, energy metabolism, genetic materials, and signal transduction is recommended for non-biology majors. A statistics course covering random variable, distributions, and basic probability theory is recommended for biology majors.  
Theories and algorithms behind bioinformatics tools. Basic tool development by writing scripts in the Python programming language for data analysis.
- 813 Molecular Virology**  
Spring of even years. 3(3-0) R: Open only to graduate students in the Colleges of Human Medicine, Osteopathic Medicine, Veterinary Medicine, Natural Science, and Agriculture and Natural Resources. SA: MPH 813  
Molecular nature and biochemistry of replication of animal viruses. Current advances, research concepts, and the role of viruses in molecular biology research.
- 825 Cell Structure and Function**  
Spring. 3(3-0) Interdepartmental with Biochemistry and Molecular Biology and Physiology. Administered by Biochemistry and Molecular Biology. RB: BMB 401 or BMB 461. SA: BCH 825  
Molecular basis of structure and function. Cell properties: reproduction, dynamic organization, integration, programmed and integrative information transfer. Original investigations in all five kingdoms.
- 832 Microbiology**  
Fall. 2(1-2) Interdepartmental with PA Medicine. Administered by PA Medicine. R: Open to students in the Department of PA Medicine.  
Basic principles of microbiology and their relationship to disease in humans.
- 833 Microbial Genetics**  
Fall. 3(3-0) R: Open only to graduate students in the Colleges of Human Medicine, Osteopathic Medicine, Veterinary Medicine, Natural Science, and Agriculture and Natural Resources. SA: MPH 833  
Gene structure and function. Genetic regulation at classical and molecular levels in prokaryotes and lower eukaryotes.
- 835 Eukaryotic Molecular Genetics**  
Spring. 3(3-0) Interdepartmental with Genetics. Administered by Microbiology and Molecular Genetics. RB: BMB 462 and ZOL 341 R: Open only to graduate students in the colleges of Agriculture and Natural Resources, Engineering, Human Medicine, Natural Science, Osteopathic Medicine, and Veterinary Medicine.  
Gene structure and function in animals, plants, and fungi. Basic aspects of modern human genetics and the genetic basis for disease. Molecular genetic analyses. Eukaryotic modeling systems.
- 845 Multi-disciplinary Research Methods for the Study of Evolution**  
Spring. 3(3-0) Interdepartmental with Computer Science and Engineering and Integrative Biology. Administered by Computer Science and Engineering.  
Techniques for engaging in multi-disciplinary research collaborations, including biology, computer science, and engineering. Students engage in group projects to answer fundamental questions about the dynamics of actively evolving systems including both natural and computational. Multi-disciplinary teams will learn to overcome discipline-specific language and conceptual issues. Experimental design, statistical analysis, data visualization, and paper and grant writing for multi-disciplinary audiences.
- 847 Advanced Mycology**  
Fall of even years. 4(2-4) Interdepartmental with Plant Biology and Plant Pathology. Administered by Plant Pathology. RB: PLB 402 SA: BOT 847  
Systematics, identification, physiology, genetics, and molecular biology of plant pathogenic fungi.
- 851 Immunology**  
Fall of odd years. 3(3-0) R: Open only to graduate students in the Colleges of Human Medicine, Osteopathic Medicine, Veterinary Medicine, Natural Science, and Agriculture and Natural Resources. SA: MPH 851  
Functional aspects of immune responses; synthesis, structure, and function of effector molecules; cell-cell interactions; current advances and research techniques.
- 855 Molecular Evolution: Principles and Techniques**  
Fall of odd years. 3(2-2) Interdepartmental with Integrative Biology and Plant Biology. Administered by Integrative Biology. RB: IBIO 341 or IBIO 445 SA: ZOL 855  
Current techniques used to characterize and compare genes and genomes. Genetic variation, assays of variation. Data analysis and computer use to conduct a phylogenetic analysis to compare organisms and infer relationships.
- 861 Advanced Microbial Pathogenesis**  
Spring of odd years. 3(3-0) RB: MMG 461 or MMG 409  
Molecular basis of microbial virulence. Virulence factors of microorganisms and the relationship of these factors to disease; host-pathogen interactions.
- 890 Special Problems in Microbiology**  
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 16 credits in all enrollments for this course. R: Open to master's students in the Department of Microbiology and Molecular Genetics. SA: MIC 890  
Individualized laboratory or library research.
- 892 Seminar**  
Fall, Spring. 1(1-0) A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to graduate students in the College of Agriculture and Natural Resources or College of Engineering or College of Human Medicine or College of Natural Science or College of Osteopathic Medicine or College of Veterinary Medicine. SA: MPH 892  
Student review and presentation of selected topics in microbiology and public health.
- 899 Master's Thesis Research**  
Fall, Spring, Summer. 1 to 12 credits. A student may earn a maximum of 36 credits in all enrollments for this course. R: Open only to graduate students in the Department of Microbiology and Molecular Genetics. SA: MPH 899  
Master's thesis research.
- 991 Topics in Microbiology**  
Fall, Spring. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. SA: MPH 991  
Topics are selected from traditional subdisciplines such as bacteriology, virology, cell biology, and immunology or from transecting subdisciplines such as microbial genetics, physiology, molecular biology and ecology.
- 999 Doctoral Dissertation Research**  
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 36 credits in all enrollments for this course. R: Open to graduate students in the Genetics Major or in the Microbiology and Molecular Genetics Major.  
Doctoral dissertation research.