and benefits of genetic technology. 

Inheritance of human traits. Impact of genetic technology on society. Ethical and legal issues. Risks and control. Importance and applications of major microorganisms. Microbial population and community interactions. Microbial activities in natural systems, including associations with plants or animals.


Microbial population and community interactions. Microbial activities in natural systems, including associations with plants or animals. Structure and function of nucleated cells. Emphasis on the molecular mechanisms that underlie cell processes.

Computational approaches in modern biology with a focus on applications in genomics, systems biology, evolution, and structural biology.


Prokaryotic cell structure and function. Growth and replication. Macromolecular synthesis and control.

Microbial population and community interactions. Microbial activities in natural systems, including associations with plants or animals. Structure and function of nucleated cells. Emphasis on the molecular mechanisms that underlie cell processes.

Computational approaches in modern biology with a focus on applications in genomics, systems biology, evolution, and structural biology.
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
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 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—Viruses
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/Veterinary 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, MMG 569 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 567, 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 Agricultural 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. R: Open only to graduate students in the Department of Microbiology and Molecular Genetics. 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.