181H Honors Cell and Molecular Biology
Spring. 3(3-0) Interdepartmental with Biochemistry and Molecular Biology and Biological Science and Lyman Briggs. Administered by Biological Science. P: (CEM 141 or concurrently) or (CEM 181H or concurrently) or (CEM 181H or concurrently) or (LB 171 or concurrently) or (LB 171 or concurrently) SA: BS 149H, BS 111 Not open to students with credit in LB 145.
Physicochemical and molecular organization of cells as the unifying framework for genetics, evolution, and the social relevance of biology.

191H Honors Cell and Molecular Biology Laboratory
Spring. 2(1-3) Interdepartmental with Biochemistry and Molecular Biology and Biological Science and Lyman Briggs. Administered by Biological Science. P: BS 181H or concurrently SA: BS 159H Not open to students with credit in LB 145.
Basic techniques of cellular and molecular biology including experimental design and hypothesis formulation, biochemistry, molecular biology and genetics.

201 Fundamentals of Microbiology
Spring. 3(3-0) P: (LB 161 or BS 145 or BS 181H and (CEM 251 or concurrently) or (CEM 351 or concurrently) or (CEM 143 or concurrently)) or (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: (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
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. 2(1-0) 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 241 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

408 Advanced Microbiology Laboratory (W)
Fall. 1(1-3) P: (MMG 302 and (MMG 431 or concurrently)) and completion of Tier I writing requirement. 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: MIC 408
Microbiological techniques and procedures to study physiology and genetics of bacteria and bacterio- phages. Collection and critical assessment of quantitative data and written communication of results.

409 Eukaryotic Cell Biology
Spring. 3(3-0) P: (BS 161 or BS 145 or BS 181H) and (CEM 351 or concurrently) or (CEM 143 or concurrently)) and completion of Tier I writing requirement. Structure and function of nucleated cells. Focus on the molecular mechanisms that underlie cell processes.

411 Computational Medicine
Fall of odd years. 3(1-6) 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 162H)
Computational approaches in biology with a focus on medicine.

413 Virology
Spring. 3(3-0) P: (BMB 462 or concurrently) or BMB 401

421 Prokaryotic Cell Physiology
Fall. 3(3-0) P: (MMG 301 or BMB 461 or concurrently) or (MMG 301 and (BMB 401 or concurrently)) SA: MIC 401, MHP 401
Prokaryotic cell structure and function. Growth and replication. Macromolecular synthesis and control.
Microbial Genomics
Genetics of bacteria, their viruses, plasmids, and transposons. Emphasis on genetic principles.

Microbial Genomics

Laboratory in Genomics and Molecular Genetics (W)
Genomics and molecular genetic techniques using microbes. Collection and critical assessment of quantitative data and written communication of results.

Geomicrobiology
Geological and microbological perspectives on microbial activities in diverse environmental settings, including geological change mediated by microorganisms, microbial evolution driven by geologically diverse habitats.

Food Microbiology Laboratory
Methods for studying major groups of microorganisms important to the food industry. Isolation, enumeration, characterization, identification, and use of microorganisms.

Microbial Biotechnology (W)
Applications of microbial products and processes in areas such as biopharmaceuticals, bioremediation, biocatalysis and other green chemistries.

Immunology

Molecular Pathogenesis
Molecular basis of microbial virulence. Nature of determinants and their role in overcoming host defense mechanisms.

Advanced Medical Microbiology Laboratory
Practical experience in safely and accurately performing standard clinical microbiology tests to process clinical specimens, identify pathogens and perform and interpret susceptibility testing.

Special Problems in Microbiology
A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of department.

Current Topics in Microbiology and Molecular Genetics
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.

Undergraduate Research Seminar
Undergraduate Research Seminar
Preparation and group discussion of undergraduate research results.

Undergraduate Research
Participation in a laboratory research project.

Honors Research
Research project with thesis and oral report. A portion of Microbiology or Genetics and Molecular Genetics capstone experience.

Medical Microbiology and Immunology
Microbiology and Immunology
Basic principles of microbiology (bacteriology, virology, mycology and parasitology) and immunology and their relationship to disease in humans.

Medical Immunology
Basic principles of immunology. Overview of concepts and terminology in relation to human disease defenses.

Medical Microbiology
Basic principles of microbiology including bacteriology, virology, mycology, and parasitology and their relationship to disease in humans.

Principles of Cell Biology and Pathophysiology
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) R: 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) R: 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
Guided clinical bacteriology experience.

660 Veterinary Clinical Bacteriology Clerkship
Fall, Spring, Summer. 3 credits. R: 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. R: 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. R: 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. R: Completion of 5 semesters of the graduate-professional program in the College of Veterinary Medicine.
Laboratory-based investigation of microbiological problems pertinent to veterinary medicine.

801 Integrative Microbial Biotechnology
Fall. 4(4-0) Not open to students with credit in MMG 621 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) R: 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. R: 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
Fall. 3(3-0) R: Open to graduate students in the Colleges of Human Medicine, Osteopathic Medicine, Veterinary Medicine, 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. R: BMB 401 or BMB 461. SA: BCH 825
Molecular basis of structure and function. Cell properties: reproduction, dynamic organization, integration, programmed and integrated information transfer. Original investigations in all five kingdoms.

833 Microbial Genetics
Fall. 3(3-0) R: Open only to graduate students in the Colleges of Human Medicine, Osteopathic Medicine, Veterinary Medicine, 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.

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, 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. 2(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.
Microbiology and Molecular Genetics—MMG

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. SA: MPH 999
Doctoral dissertation research.