161 Cell and Molecular Biology
Fall, Spring. 3(3-0) Interdepartmental with Biochemistry and Molecular Biology and Biological Science. Administered by Biological Science. P: (CEM 141 or concurrently) or (CEM 151 or concurrently) or (CEM 181H or concurrently) or (LB 171 or concurrently) SA: BS 149H, BS 111 Not open to students with credit in BS 161 or LB 145. Macromolecular synthesis. Energy metabolism. Molecular aspects of development. Molecular genetics.

171 Cell and Molecular Biology Laboratory
Fall, Summer. 2(1-2) Interdepartmental with Biochemistry and Molecular Biology and Biological Science. Administered by Biological Science. P: (BS 161 or concurrently) or (BS 181H or concurrently) SA: BS 111L, BS 159H Not open to students with credit in BS 191H or LB 145. Principles and applications of common techniques used in cell and molecular biology.

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 151 or concurrently) or (CEM 181H or concurrently) or (LB 171 or concurrently) SA: BS 149H, BS 111 Not open to students with credit in BS 161 or 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) 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) or MMG 105 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.

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

408 Advanced Microbiology Laboratory (W)
Fall. 3(1-6) P: (MMG 302 and (MMG 431 or concurrently)) or MMG 431 SA: MMG 408 Microbiological techniques and procedures to study physiology and genetics of bacteria and bacteria-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 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.

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. Macronuclear 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.

435 Geomicrobiology  
Fall. 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. Geomicrobial and microbiological perspectives on microbial activities in diverse environmental settings, including geological change mediated by microorganisms, microbial evolution driven by geologically diverse habitats, including the evolution of life on Earth, the search for life on other planets, the study of life in extreme environments, and industrial applications of geomicrobiology.

440 Food Microbiology Laboratory  
Spring. 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  
Spring. 3(3-0) Interdepartmental with Food Science. Administered by Food Science. P: (FSC 440 or concurrently) and completion of Tier I writing requirement. RB: MMG 302 SA: MGH 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)) R: 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. 3(3-0) P: (MMG 301) RB: MMG 433 SA: MPH 461 Molecular basis of microbial virulence. Nature of determinants and their role in overcoming host defense mechanisms.

463 Medical Microbiology  
Fall. 3(3-0) Interdepartmental with Biomedical Laboratory Diagnostics. Administered by Microbiology and Molecular Genetics. P: MMG 301 or (MMG 201 and BS 161) or (MMG 201 and LB 145) or (MMG 201 and BS 181H) RB: MMG 451 or BLD 434 R: Open to juniors or seniors in the Biomedical Laboratory Diagnostics Program or in the Department of Microbiology and Molecular Genetics or in the Biomedical Laboratory Science Major or in the Lyman Briggs Biomedical Laboratory Science Coordinate Major or in the Lyman Briggs Environmental/Biology/Microbiology Biology Coordinate Major or in the Environmental Biology/Microbiology Major or in the Genomics and Molecular Genetics Major or in the Lyman Briggs Genomics and Molecular Genetics Coordinate Major or in the Lyman Briggs Human Biology Coordinate Major or in the Human Biology Major or in the Lyman Briggs Microbiology Coordinate Major. SA: MIC 463 Properties of pathogenic bacteria and viruses and their mechanisms of pathogenicity and clinical diagnoses.

464 Diagnostic Microbiology Laboratory  
Fall. 2(0-4) Interdepartmental with Biomedical Laboratory Diagnostics. Administered by Microbiology and Molecular Genetics. P: MMG 463 or completion of Tier I writing requirement. R: Open to juniors or seniors in the Biomedical Laboratory Diagnostics Program or in the Department of Microbiology and Molecular Genetics or in the Lyman Briggs Biomedical Laboratory Science Coordinate Major or in the Lyman Briggs Genomics and Molecular Genetics Coordinate Major or in the Lyman Briggs Microbiology Coordinate Major. SA: MIC 464 Clinical laboratory diagnostic procedures for the identification of pathogenic microbes.

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 499R 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 499 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

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

571 Veterinary Pathogenic Microbiology: Parasites
Spring, 3(2-2) R: Open to graduate-professional students in the College of Veterinary Medicine. SA: MMG 569

560 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. SA: MMG 660

564 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. SA: MMG 664

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. SA: MMG 662

681 Advanced Microbial Pathogenesis
Spring of odd years. 3(3-0) R: MMG 461 or MMG 405

680 Special Problems in Microbiology
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to graduating seniors in the Department of Microbiology and Molecular Genetics. SA: MMG 680

689 Master's Thesis Research
Fall, Spring. 1(1-0) A student may earn a maximum of 12 credits in all enrollments for this course. R: Open only to graduate students in the Department of Microbiology and Molecular Genetics. SA: MMG 689

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.

845 Multi-disciplinary Research Methods for the Study of Evolution
Spring, 3(3-0) Interdepartmental with Computer Science and Engineering, Zoology. 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 students in the Colleges of Human Medicine, Veterinary Medicine, Natural Science, and Agriculture and Natural Resources. SA: MPH 851

855 Molecular Evolution: Principles and Techniques
Fall of even years. 3(3-0) R: Open to graduate students in the Colleges of Human Medicine, Osteopathic Medicine, Veterinary Medicine, Osteopathic Medicine, Veterinary Medicine, Osteopathic Medicine, Veterinary Medicine, Natural Science, and Agriculture and Natural Resources. SA: MPH 855
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.