181H Honors Cell and Molecular Biology
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.

301 Introductory General 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
Introduction to microbiology, microbial genetics, and the environment.

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
Introduction to basic microbiology. Microscopy, staining, aseptic technique, media, quantification, diagnostics, and laboratory safety.

400 Introduction to Bioinformatics
Spring, 3(2-2) P: (BS 161 or concurrently) or (BS 181H or concurrently) SA: BS 111L, BS 159H Not open to students with credit in BS 181H or LB 145.

161 Cell and Molecular Biology
Fall, Spring, Summer, 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 (LB 171 or concurrently) or (CEM 181H or concurrently) SA: BS 111, BS 149H Not open to students with credit in BS 181H or LB 145.
Integration of the principles of biology, biochemistry, molecular biology, and evolutionary biology. Emphasis on experimental design and hypothesis formulation; biochemistry, molecular biology and genetics.

301 Advanced Microbiology Laboratory (W)
Fall, Spring, 3(1-6) P: (MMG 301 and MMG 431 or concurrently) and completion of Tier I writing requirement. SA: MPH 408
Microbiological techniques and procedures to study physiology and genetics of bacteria and bacteriophages. Emphasis on experimental design and hypothesis formulation; biochemistry, molecular biology and genetics.

401 Microbial Ecology
Fall, Spring, 3(3-0) Interdepartmental with Crop and Soil Sciences. Administered by Microbiology and Molecular Genetics. RB: BS 162 or LB 144 or BS 181H or BS 161 or LB 145 or BS 182H and (CEM 143 or CEM 251) SA: MPH 425
Microbial population and community interactions. Microbial activities in natural systems, including associations with plants or animals.

242 Biotechnology
Spring, 1(1-2) Interdepartmental with Biological Science and Zoology. Administered by Microbiology and Molecular Genetics. RB: (BS 162 or LB 144 or BS 181H or BS 161 or LB 145 or BS 182H) and (CEM 143 or CEM 251) SA: MPH 425
Introduction to the principles of ecology, microbiology, geochemistry, and environmental chemistry. Social and ethical considerations of research in aquatic and terrestrial habitats.

243 Microbial Genomics
Spring, 3(2-3) P: (MMG 431) RB: (MMG 421 or BMB 461) and CSE 101

401 Laboratory in Genomics and Molecular Genetics
Spring, 3(1-6) P: (CEM 143 or concurrently) and completion of Tier I writing requirement and (MMG 431 or MMG 433) R: Open to students in the Genomics and Molecular Genetics.
Genomics and molecular genetic techniques using microbes. Collection and critical assessment of quantitative data and written communication of results.

240 Food Microbiology
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. SA: MPH 440
Major groups of microorganisms of importance to the food industry. Ecological, physiological, and public health aspects.

241 Food Microbiology Laboratory
Spring, 2(0-4) Interdepartmental with Food Science. Administered by Food Science. P: (FSC 440 concurrently) and completion of Tier I writing requirement. RB: MMG 206 or 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.
Microbiology and Molecular Genetics—MMG

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) SA: MPH 451 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.

463 Medical Microbiology Fall. 3(3-0) Interdepartmental with Biomedical Laboratory Diagnostics. Administered by Microbiology and Molecular Genetics. P: MMG 301 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 Lyman Briggs Environmental/Biology/Microbiology Coordinate Major or in the Lyman Briggs Genomics and Molecular Genetics Coordinate Major in the Lyman Briggs Human Biology Coordinate Major or in the Human Biology major or in the Lyman Briggs Medical Technology Coordinate Major or in the Lyman Briggs Microbiology Coordinate Major or in the Environmental Biology/Microbiology major or in the Genomics and Molecular Genetics 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 concurrently R: Open to juniors or seniors in the Department of Microbiology and Molecular Genetics or in the Biomedical Laboratory Diagnostics Program or in the Clinical Laboratory Sciences 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. SA: MPH 490 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.

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 School. 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 -0) R: Open to graduate-professional students in the College of Veterinary Medicine. SA: MMG 567 Basic principles of microbiology (bacteriology, virology, mycology, and parasitology) and immunology and their relationship to disease in humans.

531 Medical Immunology Fall. 2(2-0) R: Open to graduate-professional students in the College of Os teopathic Medicine. C: BMB 515 concurrently and MMG 532 concurrently and PSL 536 concurrently and PSL 537 concurrently and PHM 564 concurrently. 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 Ost eopathic Medicine. C: BMB 515 concurrently and BMB 527 concurrently and MMG 531 concurrently and PSL 536 concurrently and PSL 537 concurrently and PHM 564 concurrently. Basic principles of microbiology including bacteriology, virology, mycology, and parasitology and their relationship to disease in humans.

559 Veterinary Microbiology and Immunology Fall. 4(4-0) R: Open to graduate-professional students in the College of Vet erinary 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, Spring, Summer. 3 credits. A student may earn a maximum of 6 credits in all professional enrollments for this course. 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: Open to graduate-professional students in the College of Veterinary Medicine. SA: MMG 569 Etiology, pathogenesis, 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.

631 Veterinary Medical Genetics Spring. 3(1-1) R: Open to graduate-professional students in the College of Veterinary Medicine. SA: MMG 569 Etiology, pathogenesis, transmission, 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 Veter inary 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 Veter inary 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 Veter inary Medicine. Guided clinical parasitology experience.
MMG—Microbiology and Molecular Genetics

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. Pre: MMG 801 or concurrently.
In-depth study of a particular topic from integrative microbial biology.

810 Theories and Practices in Bioinformatics
Spring. 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 statistic 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.

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.

837 Human Molecular Genetics
Fall of odd years. 3(3-0) RB: MMG 835 or comparable background in genetics.
Discovery and function of genetic factors involved in human diseases and traits. Biological and clinical questions addressed by human genetic analyses and the types of approaches used.

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(3-0) Interdepartmental with Plant Biology and Zoology. Administered by Zoology. RB: ZOL 341 or ZOL 445
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 masters 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 120 credits in all enrollments for this course. R: Open only to graduate students in the Microbiology and Molecular Genetics major. SA: MPH 999
Doctoral dissertation research.