

899 Master's Thesis Research
 Fall, Spring, Summer. 1 to 10 credits. A student may earn a maximum of 36 credits in all enrollments for this course. R: Open only to graduate students in Clinical Laboratory Sciences.
 Master's thesis research.

MEDICINE

MED

**Department of Medicine
 College of Human Medicine**

608 Internal Medicine Clerkship
 Fall, Spring, Summer. 2 to 18 credits. A student may earn a maximum of 42 credits in all enrollments for this course. RB: (FMP 602) R: Open only to graduate-professional students in College of Human Medicine.
 Community hospital clerkship. Interviewing skills, history, physical examination. Problem solving and therapy. Care of the whole patient leading to independence in patient management.

609 Hematology Clerkship
 Fall, Spring, Summer. 2 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: (MED 608) R: Open only to graduate-professional students in College of Human Medicine.
 Data collection, problem solving, and management related to common hematologic disorders of children and adults.

610 Oncology Clerkship
 Fall, Spring, Summer. 2 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: (MED 608) R: Open only to graduate-professional students in College of Human Medicine.
 Data collection, problem solving and management of prevalent cancers in children and adults.

611 Cardiology Clerkship
 Fall, Spring, Summer. 2 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: (MED 608) R: Open only to graduate-professional students in College of Human Medicine.
 Evaluation of patients with cardiac diseases. Special diagnostic procedures including cardiac cuticularization, phonocardiography, echocardiography, and electrocardiography.

612 Nephrology Clerkship
 Fall, Spring, Summer. 2 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: (MED 608) R: Open only to graduate-professional students in College of Human Medicine.
 Integrated concepts of renal physiology and pathophysiology of renal disease. Clinical experience.

613 Dermatology Clerkship
 Fall, Spring, Summer. 2 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: (MED 608) R: Open only to graduate-professional students in College of Human Medicine.
 Experience in a dermatologist's office to develop clinical, observational, and diagnostic skills in dermatology.

614 Pulmonary Clerkship
 Fall, Spring, Summer. 2 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: (MED 608) R: Open only to graduate-professional students in College of Human Medicine.
 Pulmonary physiology. Evaluation of pulmonary function. Diagnosis and treatment of common pulmonary diseases.

615 Gastroenterology Clerkship
 Fall, Spring, Summer. 2 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: (MED 608) R: Open only to graduate-professional students in College of Human Medicine.
 Experience with gastrointestinal problems in ambulatory and hospital settings. Emphasis on continuity and comprehensive care.

616 Allergy Clerkship
 Fall, Spring, Summer. 2 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: (MED 608) R: Open only to graduate-professional students in College of Human Medicine.
 Ambulatory and hospital based experience to develop diagnostic skills in allergy. Review of basic therapeutics related to allergic diseases.

618 Infectious Diseases Clerkship
 Fall, Spring, Summer. 2 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: (MED 608) R: Open only to graduate-professional students in College of Human Medicine.
 Clinical problems in infectious and immunologic diseases. Integrated basic science input is provided in seminars.

619 Ambulatory Care Clerkship
 Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 15 credits in all enrollments for this course. Interdepartmental with Family Practice; Pediatrics. Administered by Department of Family Practice. RB: (FMP 602) R: Open only to graduate-professional students in College of Human Medicine.
 Continuous and comprehensive patient care under supervision of appropriate physicians.

622 Endocrinology and Metabolism Clerkship
 Fall, Spring, Summer. 2 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: (MED 608) R: Open only to graduate-professional students in College of Human Medicine. SA: MED 620
 Clinical and/or clinical-research clerkship: endocrine diseases, electrolyte abnormalities, endocrine hypertension, or diabetes mellitus.

623 Advanced Medicine
 Fall, Spring, Summer. 6 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: (MED 608) R: Open only to graduate-professional students in the College of Human Medicine.
 Hospital-based clinical experience in diagnosing and managing acutely ill patients with non-surgical problems.

626 Physical Medicine and Rehabilitation Clerkship
 Fall, Spring, Summer. 2 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: (MED 608) R: Open only to graduate-professional students in College of Human Medicine.
 Developing regimens for physical medicine procedures, occupational therapy and rehabilitation skills.

627 Rheumatology Clerkship
 Fall, Spring, Summer. 2 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: (MED 608) R: Open only to graduate-professional students in College of Human Medicine.
 Combined ambulatory and hospital consultative clerkship for diagnostic skills in areas of rheumatic diseases.

628 Advanced Internal Medicine
 Fall, Spring, Summer. 2 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: (MED 608) R: Open only to graduate-professional students in College of Human Medicine.
 Clinical experiences to refine diagnostic and management skills in general internal medicine.

630 Emergency Medicine Clerkship
 Fall, Spring, Summer. 2 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: (MED 608) R: Open only to graduate-professional students in College of Human Medicine.
 Clinical diagnosis and treatment of emergencies seen in community emergency departments.

632 Occupational Medicine Clerkship
 Fall, Spring, Summer. 2 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: (MED 608) R: Open only to graduate-professional students in College of Human Medicine.
 Health problems of chemical and mineral dust, radiation, and repetitive trauma.

633 Extended Clinical Experience
 Fall, Spring, Summer. 6(6-0) P:M: (MED 608)
 Based in community hospitals and ambulatory sites, this is a 4 week clinical experience emphasizing interviewing skills, history, physical exam, problem solving and therapy.

635 Core Competencies I
 Fall. 2 credits. A student may earn a maximum of 6 credits in all enrollments for this course. Interdepartmental with Human Medicine; Family Practice; Pediatrics and Human Development. Administered by Human Medicine. RB: (FMP 602) R: Open only to graduate-professional students in College of Human Medicine.
 A weekly seminar addressing core knowledge and skills from an interdisciplinary perspective.

636 Core Competencies II
 Spring. 2 credits. A student may earn a maximum of 6 credits in all enrollments for this course. Interdepartmental with Human Medicine; Family Practice. Administered by Human Medicine. RB: (FMP 602) R: Open only to graduate-professional students in College of Human Medicine.
 A weekly seminar addressing core knowledge and skills from an interdisciplinary perspective.

Medicine—MED

- 637 Core Competencies III**
Spring, Summer. 2 credits. A student may earn a maximum of 6 credits in all enrollments for this course. Interdepartmental with Human Medicine; Family Practice; Obstetrics, Gynecology and Reproductive Biology; Pediatrics and Human Development; Surgery. Administered by Human Medicine. RB: (FMP 602) R: Open only to graduate-professional students in College of Human Medicine.

A weekly seminar addressing core knowledge and skills from an interdisciplinary perspective.

- 645 Primary Health Care in Ecuador**
Summer. 6 credits. Given at the University of Guayaquil, Ecuador. R: Open only to graduate-professional students in the colleges of Human and Osteopathic Medicine and to graduate students in the College of Nursing.

Special problems and challenges to delivery of primary health care in a developing country. Culture and related health care issues in cities and rural areas.

- 820 Evidence-Based Medicine**
Spring of even years. 3(3-0)
Interdepartmental with Epidemiology. Administered by Department of Epidemiology. P:M: (EPI 810 or concurrently and STT 421 or concurrently)

Methodology of clinical epidemiology and health services outcomes research. Linkage of epidemiology with daily clinical problems.

MICROBIOLOGY AND MOLECULAR GENETICS

MMG

Department of Microbiology
and Molecular Genetics
College of Human Medicine
College of Natural Science
College of Osteopathic Medicine
College of Veterinary Medicine

- 101 Preview of Microbiology**
Fall. 1(1-0) R: Open only to freshmen or sophomores. SA: MPH 101
- Overview of modern microbiology, emphasizing impact on society.
- 103 Frontiers of Microbiology**
Spring. 1(2-0) R: Open only to freshmen and sophomores.
- Current microbiology research: significance to modern biological science and impact on society.
- 105 Microbes in Everyday Life**
Fall. 3(3-0)

Role of microbes in agriculture, industry, and medicine. Impact on society of infectious diseases of plants and animals, soil fertility, water quality, biotechnology, genetic engineering, and bioremediation. Public health and environmental concerns.

- 111L Cell and Molecular Biology Laboratory**
Fall, Spring, Summer. 2(1-3)
Interdepartmental with Biological Science; Plant Biology; Zoology. Administered by Natural Science. P:M: (BS111 or concurrently) Not open to students with credit in LBS 159H.

Principles and applications of common techniques used in cell and molecular biology.

- 205 Allied Health Microbiology**
Spring. 3(3-0) SA: MPH 205
- Microbial structure, function, growth, death, and control related to medical and public health concerns. Host-parasite relationships, immunology, action of major pathogenic groups. Commercial applications of microbiology.

- 206 Allied Health Microbiology Laboratory**
Spring. 1(0-2) P:M: (MMG 105 or MMG 205 or concurrently) SA: MPH 206
- Fundamentals of microbiological techniques including microscopy, staining, aseptic technique, culture media, identification, control with disinfectants and antibiotics, and safety in the microbiological laboratory.

- 301 Introductory Microbiology**
Fall, Spring. 3(3-0) P:M: (BS 111 or LBS 145 or LBS 149H) and (CEM 251 or concurrently or CEM 351 or concurrently or CEM 143) SA: MPH 301

Fundamentals of microbiology, including microbial structure and function, nutrition and growth, death and control. Importance and applications of major microbial groups.

- 302 Introductory Microbiology Laboratory**
Spring. 1(0-3) P:M: (MMG 105 or concurrently or MMG 205 or concurrently or MMG 301 or concurrently) SA: MPH 302
- Methodology of microbiology: microscopy, staining, aseptic technique, culture media, quantification, and laboratory safety.

- 408 Advanced Microbiology Laboratory (W)**
Fall. 3(1-6) P:M: (MMG 302 and MMG 431 or concurrently) and completion of Tier I writing requirement. R: Open only to students in the Department of Microbiology and Molecular Genetics or LBS Environmental Biology/Microbiology or Microbiology coordinate 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:M: (BS 111 or LBS 145 or LBS 149H) 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:M: (BMB 462 or concurrently) RB: (MMG 409) SA: MPH 403
- 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:M: (MMG 301 and BMB 461 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. RB: (MMG 301) SA: MPH 425
- Microbial population and community interactions. Microbial activities in natural systems, including associations with plants or animals.

- 426 Biogeochemistry**
Summer. 3 credits. Given only at W.K. Kellogg Biological Station. Interdepartmental with Crop and Soil Sciences; Geological Sciences; Zoology. RB: (BS 110 or LBS 144 or LBS 148H or BS 111 or LBS 145 or LBS 149H) and (CEM 143 or CEM 251) SA: MPH 426
- Integration of the principles of ecology, microbiology, geochemistry, and environmental chemistry. Societal applications of research in aquatic and terrestrial habitats.

- 431 Microbial Genetics**
Fall. 3(3-0) P:M: (BMB 461 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(2-3) P:M: (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.

- 440 Food Microbiology**
Spring. 3(3-0) Interdepartmental with Food Science. Administered by Department of Food Science and Human Nutrition. P:M: (MMG 205 or MMG 301) and completion of Tier I writing requirement. R: Not open to freshmen or sophomores. SA: MPH 440
- Major groups of microorganisms of importance to the food industry. Emphasis on ecological, physiological, and public health aspects.

- 441 Food Microbiology Laboratory**
Spring. 2(0-4) Interdepartmental with Food Science. Administered by Department of Food Science and Human Nutrition. P:M: (FSC 440 or 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.

- 445 Basic Biotechnology**
Fall. 3(3-0) P:M: (MMG 205 or MMG 301) SA: MPH 445
- Growth and genetic improvement of industrial microorganisms. Fermentation fundamentals. Specific classical and recombinant-based bioprocesses and bioconversions of commercial importance.