

**433. Clinical Immunology and Immunoematology Laboratory**  
*Spring. 1(0-3) P: (MT 213 and MT 432 or concurrently) R: Open only to students in the Clinical Laboratory Sciences major.*

Immunologic methods for disease detection. Methods of blood typing and pre-transfusion testing.

**442. Education and Management in the Clinical Laboratory**

*Fall. 3(3-0) P: (MTH 116) or (MTH 103 and MTH 104) or (LBS 117) (STT 200 or STT 201 or STT 231 or STT 351 or STT 421) R: Open only to students in the Clinical Laboratory Sciences major.*

Basic principles and concepts in education and management in clinical laboratories. Systematic approach to instructional design, delivery and evaluation. Principles of leadership, personnel management, fiscal management, and regulatory compliance.

**454. Problem Solving Across Clinical Laboratory Disciplines (W)**

*Spring. 4(4-0) P: (MT 414 and MT 416 and MT 422 and MT 432 and MIC 463) RB: (MT 442) R: Open only to seniors in the Clinical Laboratory Sciences major.*

Problem-oriented approach integrating topics from previous courses in clinical laboratory sciences. Emphasis on published primary research literature and its critical appraisal.

**455. Integrating Clinical Laboratory Science Discipline (W)**

*Fall, Spring. 2(2-0) P: (MT 422 and MT 432 and MT 414 and MT 416 or concurrently and MIC 463 or concurrently) and completion of Tier 1 writing requirement. R: Open only to seniors in the Medical Technology major or LBS Medical Technology coordinate major.*

Problem oriented approach integrating topics from Medical Technology courses with emphasis on writing experience in the major and on critical thinking skills.

**471. Advanced Clinical Chemistry Laboratory**

*Fall, Spring, Summer. 3 credits. P: (MT 454)*

Application and integration of theory and technical skills in clinical chemistry and biochemistry.

**472. Advanced Clinical Chemistry**

*Fall, Spring, Summer. 1 credit. R: Open only to seniors in the Clinical Laboratory Sciences major. C: MT 471 concurrently.*

Theoretical aspects of clinical chemistry, chemical and biochemical reactions, statistical analysis, and pathophysiologic relationships. Integration of cognitive material with clinical laboratory test results.

**473. Advanced Clinical Hematology and Body Fluids Laboratory**

*Fall, Spring, Summer. 4 credits. P: (MT 454)*

Application and integration of theory and technical skills in hematology, hemostasis, and body fluid analysis.

**474. Advanced Clinical Hematology and Body Fluids**

*Fall, Spring, Summer. 1 credit. R: Open only to seniors in the Clinical Laboratory Sciences major. C: MT 473 concurrently.*

Theoretical aspects of advanced hematology, hemostasis and body fluid analysis. Integration of cognitive material with clinical laboratory test results.

**475. Advanced Clinical Immunology and Immunoematology Laboratory**

*Fall, Spring, Summer. 2 credits. P: (MT 454)*

Application and integration of theory and technical skills in immunology and immunoematology.

**476. Advanced Clinical Immunology and Immunoematology**

*Fall, Spring, Summer. 1 credit. R: Open only to seniors in the Clinical Laboratory Sciences major. C: MT 475 concurrently.*

Theoretical aspects of immunology and immunoematology. Integration of cognitive material with clinical laboratory test results.

**477. Advanced Clinical Microbiology Laboratory**

*Fall, Spring, Summer. 3 credits. P: (MT 454)*

Application and integration of theory and technical skills in clinical microbiology and infectious disease.

**478. Advanced Clinical Microbiology**

*Fall, Spring, Summer. 1 credit. R: Open only to seniors in the Clinical Laboratory Sciences major. C: MT 477 concurrently.*

Theoretical aspects of clinical microbiology and infectious disease. Integration of cognitive material with clinical laboratory test results.

**495. Directed Study**

*Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to students in the Clinical Laboratory Sciences or Medical Technology major or LBS Medical Technology coordinate major.*

Faculty directed study including assigned readings, reviews of appropriate scientific periodicals, research and laboratory experience.

**801. Medical Technology Seminar**

*Spring. 1(1-0) A student may earn a maximum of 2 credits in all enrollments for this course. R: Open only to graduate students in Clinical Laboratory Sciences.*

Current research topics in clinical laboratory sciences.

**810. Research Planning in the Clinical Laboratory Sciences**

*Fall of odd years. 2(2-0) R: Open only to graduate students in Clinical Laboratory Sciences.*

Directed reading and discussions on research methodology and research funding. Written and oral proposal presentations.

**812. Advanced Clinical Chemistry**

*Spring of even years. 2(2-0) Interdepartmental with Pathology. P: BCH 462, MT 414, MT 416.*

Biochemical basis of selected pathologic conditions including inborn errors of metabolism, endocrine and other genetic disorders. Emphasis on current diagnostic techniques.

**820. Advanced Human Hematology**

*Fall of even years. 2(2-0) Interdepartmental with Pathology. P: MT 422.*

Selected topics in hematology including pathogenesis, mechanisms and morphological pictures. Emphasis on laboratory tests and interpretation of results.

**830. Concepts in Molecular Biology**

*Spring of odd years. 2(2-0) Interdepartmental with Pathology. P: One course in Biochemistry or concurrently.*

Techniques and theories of molecular biology, nucleic acid synthesis and isolation, enzymatic digestion and modification, electrophoresis, hybridization, amplification, library construction, and cloning.

**831. Clinical Application of Molecular Biology**

*Summer. 1(2-0) P: (MT 830)*

The utilization of molecular biology principles and techniques as a tool to improving diagnostic outcomes within specific clinical laboratory science disciplines.

**831L. Molecular Pathology Laboratory**

*Summer. 2(0-4) P: (MT 831 or concurrently)*

Equipment operation, DNA extraction and measurement, electrophoresis, hybridization and transfers, amplification and detection including SSOP, ARMS, RFLP and SCP as well as automated sequencing will be covered with specific emphasis on clinical applications.

**840. Advanced Hemostasis**

*Fall of odd years. 2(2-0) Interdepartmental with Pathology. P: BCH 462, MT 422.*

Physiology, pathophysiology, and laboratory evaluation of hemostatic disorders.

**890. Selected Problems in Clinical Laboratory Science**

*Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 12 credits in all enrollments for this course. R: Open only to graduate students in Clinical Laboratory Sciences.*

Non-thesis research for Plan B master's students.

**899. Master's Thesis Research**

*Fall, Spring, Summer. 1 to 10 credits. A student may earn a maximum of 24 credits in all enrollments for this course. R: Open only to graduate students in Clinical Laboratory Sciences.*

## 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. P: 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.

## Descriptions—Medicine of Courses

### 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. P: 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. P: 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. P: 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. P: 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. P: 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. P: 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. P: 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. P: 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.

### 617. Neurology Clerkship

Fall, Spring, Summer. 2 to 12 credits. A student may earn a maximum of 12 credits in all enrollments for this course. P: MED 608. R: Open only to graduate-professional students in College of Human Medicine.

Office and inpatient experience. Evaluation and management of neurological disease.

### 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. P: 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 Family Practice. P: 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. P: MED 608. R: Open only to graduate-professional students in College of Human Medicine.

Clinical and/or clinical-research clerkship: endocrine diseases, electrolyte abnormalities, endocrine hypertension, or diabetes mellitus.

SA: MED 620

### 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. P: (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. P: 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. P: 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. P: 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. P: 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. P: 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: (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; and Pediatrics and Human Development. Administered by Human Medicine. P: 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; and Family Practice. Administered by Human Medicine. P: 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.

**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; and Surgery. Administered by Human Medicine. P: 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. 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**  
Fall. 3(3-0) Interdepartmental with Epidemiology. Administered by Epidemiology. P: (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                      MIC**

**Department of Microbiology  
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.  
Overview of modern microbiology, emphasizing impact on society.  
SA: MPH 101

**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; Botany and Plant Pathology; and Zoology. Administered by Biological Science. P: BS 111 or concurrently  
Principles and applications of common techniques used in cell and molecular biology.

**205. Allied Health Microbiology**  
Spring. 3(3-0) P: (BS 111 or concurrently or LBS 145 or concurrently or LBS 149H or concurrently)  
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.  
SA: MPH 205

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

**301. Introductory Microbiology**  
Fall, Spring. 3(3-0) P: (BS 111 or LBS 145 or LBS 149H) and (CEM 251 or concurrently)  
Fundamentals of microbiology, including microbial structure and function, nutrition and growth, death and control. Importance and applications of major microbial groups.  
SA: MPH 301

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

**408. Advanced Microbiology Laboratory (W)**  
Fall. 3(1-6) P: (MIC 302 and MIC 431 or concurrently) and completion of Tier I writing requirement. R: Open only to students in the Department of Microbiology or LBS Environmental Biology/Microbiology or Microbiology coordinate major.  
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.  
SA: MPH 408

**409. Eukaryotic Cell Biology**  
Spring. 3(3-0) P: (BS 111 or LBS 145 or LBS 149H) and (BCH 401 or concurrently or BCH 462 or concurrently)  
Structure and function of nucleated cells. Emphasis on the molecular mechanisms that underlie cell processes.  
SA: MIC 403, MPH 403

**413. Virology**  
Spring. 3(3-0) Interdepartmental with Botany and Plant Pathology. P: (BCH 462 or concurrently) RB: (MIC 409)  
Viruses and modern molecular biology. Viral replication and gene expression of the major classes of viruses. Virus-cell interactions and viral diseases.  
SA: MPH 403

**421. Prokaryotic Cell Physiology**  
Fall. 3(3-0) P: (MIC 301 and BCH 461 or concurrently)  
Prokaryotic cell structure and function. Growth and replication. Macromolecular synthesis and control.  
SA: MIC 401, MPH 401

**425. Microbial Ecology**  
Spring. 3(3-0) Interdepartmental with Crop and Soil Sciences. P: (MIC 301)  
Microbial population and community interactions. Microbial activities in natural systems, including associations with plants or animals.  
SA: MPH 425

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

**431. Microbial Genetics**  
Fall. 3(3-0) P: (MIC 301 or concurrently)  
Genetics of bacteria, their viruses, plasmids, and transposons. Emphasis on genetic principles.  
SA: MIC 401, MPH 401

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

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

**441. Food Microbiology Laboratory**  
Spring. 1(0-3) Interdepartmental with Food Science and Human Nutrition. Administered by Food Science and Human Nutrition. P: (FSC 440 or concurrently) and completion of Tier I writing requirement. (MIC 206 or MIC 302)  
Methods for studying major groups of microorganisms important to the food industry. Isolation, enumeration, characterization, identification, and use of microorganisms.  
SA: MIC 441, MPH 441