

**BIOMEDICAL  
LABORATORY  
DIAGNOSTICS**      **BLD**

**Biomedical Laboratory  
Diagnostics Program  
College of Natural Science**

**120 Learning in the Biomedical Sciences**  
Fall. 1 credit. R: Open to freshmen or sophomores. SA: MT 120 Not open to students with credit in NSC 201 or NSC 202.

Learning strategies appropriate for science. Development of critical thinking and problem solving. Group processes. Adapting study to personal learning styles and college instruction.

**150 Preview of Biomedical Research**  
Spring. 1(1-0) Interdepartmental with Natural Science. Administered by Biomedical Laboratory Diagnostics. R: Open to freshmen or sophomores. SA: MT 150

Exploration of biomedical research careers. Biomedical research in the United States: funding, safety, regulatory agencies, ethics, experimental design, trouble-shooting, and data interpretation.

**204 Mechanisms of Disease**  
Spring. 3(3-0) P: BS 161 or LB 145 or BS 181H SA: MT 204

Pathophysiological mechanisms of diseases. Selected applications to organ system pathology.

**213 Application of Clinical Laboratory Principles**  
Fall, Summer. 2(1-3) P: (CEM 141 and CEM 161) or (LB 171 and LB 171L) RB: BS 171 R: Open to students in the Biomedical Laboratory Science major or in the Lyman Briggs Biomedical Laboratory Science Coordinate major or in the Clinical Laboratory Sciences major or in the Diagnostic Molecular Science major or in the Lyman Briggs Diagnostic Molecular Science Coordinate Major or in the Human Biology major. SA: MT 213

Lab safety and standards of good laboratory practice including specimen handling and processing. Application of technologies and techniques to the performance of clinical diagnostic testing.

**220 Preparing for a Health Professions Career**  
Spring. 1(1-0) R: Open to sophomores or juniors. SA: MT 220

Development of skills needed for success in a health professions career. Historical, economic, sociological and ethical perspectives on the U.S. health professions with focus on medical laboratory careers.

**324 Fundamentals of Hematology, Hemostasis, and Urinalysis**  
Fall. 3(3-0) P: (BS 161 or concurrently) or (LB 145 or concurrently) or (BS 181H or concurrently) SA: MT 324

Physiology and biochemistry of normal hematologic, hemostatic, and urinary systems. Principles of diagnostic assays to detect diseases affecting those systems.

**324L Introductory Laboratory in Hematology, Hemostasis and Urinalysis**  
Fall. 1(0-3) P: BLD 324 or concurrently R: Open to students in the Clinical Laboratory Sciences major. SA: MT 423, MT 324L

Routine laboratory assays used to assess the health of the hematological, hemostatic, and urinary systems.

**413 Advanced Biomedical Laboratory Diagnostics Laboratory**

Spring. 1(0-3) P: BLD 213 and BLD 324 and BLD 434 and BLD 435 and MMG 463 RB: BLD 424 and BLD 430 R: Open to students in the Diagnostic Molecular Science major or in the Biomedical Laboratory Science major or in the Lyman Briggs Diagnostic Molecular Science Coordinate Major or in the Lyman Briggs Biomedical Science Coordinate major.

Diagnostic assays across various disciplines within the clinical laboratory (microbiology, immunohematology, hematology and molecular diagnostics) as well as data interpretation and problem solving skills.

**414 Clinical Chemistry Analysis and Practice**  
Spring. 3(3-0) P: (STT 200 or concurrently) or (STT 201 or concurrently) or (STT 231 or concurrently) or (STT 351 or concurrently) or (STT 421 or concurrently) RB: BLD 213 and PHY 231 R: Open to students in the Biomedical Laboratory Science major or in the Lyman Briggs Biomedical Science Coordinate major. SA: MT 417 Not open to students with credit in BLD 417.

Concepts and principles of analytic methods commonly used in the clinical laboratory. Qualitative and quantitative features of instrumental analysis. Issues of quality control and quality assurance, method evaluation and standards of laboratory practice.

**416 Clinical Chemistry**  
Fall. 4(4-0) P: BLD 213 and (BMB 401 or BMB 461) and (PSL 250 or PSL 310 or PSL 431) RB: BLD 414 or (BLD 417 and CEM 333) SA: MT 416

Correlation of laboratory test results with normal physiology and biochemistry and with disease states. Metabolic and endocrine systems. Acquired and inherited diseases. Therapeutic drug monitoring, and toxicology.

**417 Quality Processes in Diagnostic Laboratory Testing**

Spring. 2(2-0) P: (STT 200 or concurrently) or (STT 201 or concurrently) or (STT 421 or concurrently) or (STT 351 or concurrently) or (STT 231 or concurrently) RB: BLD 213 and PHY 231 R: Open to students or students in the Clinical Laboratory Sciences major or in the Diagnostic Molecular Science major or in the Lyman Briggs Diagnostic Molecular Science Coordinate Major. SA: MT 414, MT 417 Not open to students with credit in BLD 414.

Statistical methods for validating diagnostic laboratory tests including quality control processes, proficiency testing, method evaluation, related regulatory requirements, laboratory information systems, and laboratory mathematics.

**424 Advanced Hematology, Hemostasis and Urinalysis**  
Spring. 2(2-0) P: BLD 324 SA: MT 422, MT 424

Etiology and pathogenesis of diseases of the hematologic, hemostatic and urinary systems including anemias, leukemias, and hemophilias. Diagnostic testing for such diseases.

**424L Advanced Laboratory in Hematology, Hemostasis, and Urinalysis**  
Spring. 1(0-3) P: BLD 324L and (BLD 424 or concurrently) SA: MT 423, MT 424L

Specialized and advanced assays used in the diagnosis of diseases of the hematological, hemostatic, and urinary systems.

**430 Molecular Laboratory Diagnostics**  
Spring. 2(2-0) P: BS 161 or LB 145 or BS 181H SA: MT 430

Concepts and principles of molecular analysis applied to medical diagnostics and related applications.

**433 Clinical Immunology and Immunoematology Laboratory**  
Spring. 1(0-3) P: BLD 213 and (BLD 435 or concurrently) R: Open to students in the Clinical Laboratory Sciences major. SA: MT 433

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

**434 Clinical Immunology**  
Fall, Spring, Summer. 3(3-0) Summer: Grand Rapids. P: BS 161 or LB 145 or BS 181H RB: BLD 204 and BLD 213 SA: MT 432, MT 434 Not open to students with credit in MMG 451.

Concepts of innate, cellular, and humoral immunity. Immunodeficiency and autoimmunity. Principles and applications of immunoassays in medical laboratories.

**435 Transfusion and Transplantation Medicine**  
Spring. 3(3-0) P: BLD 434 or MMG 451 SA: MT 432, MT 435

Principles and practice of transfusion medicine including blood typing. Principles and practices of transplantation medicine. Transplantation immunology, organ procurement, and rejection detection.

**436 Principles of Diagnostic Molecular Science**  
Spring. 2(2-0) P: BMB 461 and (BS 161 or LB 145 or BS 181H) and ZOL 341 SA: MT 436 Not open to students with credit in BLD 830. C: BMB 462 concurrently.

Principles and techniques of molecular diagnostic assays including applicable regulations.

**437 Clinical Applications of Diagnostic Molecular Science**  
Spring. 2(2-0) P: BLD 436 SA: MT 437 Not open to students with credit in BLD 831.

Application of molecular diagnostic methods in clinical and other types of laboratory disciplines.

**438 Molecular Diagnostic Laboratory**  
Fall. 2(0-6) P: BLD 436 SA: MT 438 Not open to students with credit in BLD 832.

Laboratory in molecular techniques with emphasis on clinical and diagnostic applications.

## Biomedical Laboratory Diagnostics—BLD

- 450 Eukaryotic Pathogens**  
Spring. 3(3-0) P: BS 161 or LB 145 or BS 181H RB: MMG 201 or MMG 301 SA: MT 450  
Medically important fungi and parasites. Host-parasite relationships, life cycles, culture, identification, and associated diseases.
- 455 Integrating Clinical Laboratory Science Discipline (W)**  
Fall, Spring. 2(2-0) P: ((BLD 324 or concurrently) or (BLD 417 or concurrently) or (BLD 416 or concurrently) or (MMG 463 or concurrently) or (BLD 435 or concurrently) or (CEM 332 or concurrently) or (BLD 436 or concurrently)) and completion of Tier I writing requirement R: Open to undergraduate students in the Clinical Laboratory Sciences major or in the Biomedical Laboratory Science major or in the Diagnostic Molecular Science major. SA: MT 455  
Problem oriented approach integrating topics from biomedical laboratory diagnostics courses with emphasis on writing experience in the major and on critical thinking skills.
- 463 Medical Microbiology**  
Fall. 3(3-0) Interdepartmental with Microbiology and Molecular Genetics. 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 or 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 Microbiology and Molecular Genetics. 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.
- 471 Advanced Clinical Chemistry Laboratory**  
Fall, Spring, Summer. 3 credits. P: CEM 333 R: Open to students in the Clinical Laboratory Sciences major. SA: MT 471  
Application and integration of theory and technical skills in clinical chemistry and biochemistry.
- 472 Advanced Clinical Chemistry**  
Fall, Spring, Summer. 1 credit. P: BLD 416 and BLD 417 R: Open to seniors in the Clinical Laboratory Sciences major. SA: MT 472 C: BLD 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. 3 credits. P: BLD 424L R: Open to seniors in the Clinical Laboratory Sciences major. SA: MT 473  
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. P: BLD 424 R: Open to seniors in the Clinical Laboratory Sciences major. SA: MT 474 C: BLD 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 Immunohematology Laboratory**  
Fall, Spring, Summer. 2 credits. P: BLD 433 R: Open to seniors in the Clinical Laboratory Sciences major. SA: MT 475  
Application and integration of theory and technical skills in immunology and immunohematology.
- 476 Advanced Clinical Immunology and Immunohematology**  
Fall, Spring, Summer. 1 credit. P: BLD 435 and BLD 434 R: Open to seniors in the Clinical Laboratory Sciences major. SA: MT 476 C: BLD 475 concurrently.  
Theoretical aspects of immunology and immunohematology. Integration of cognitive material with clinical laboratory test results.
- 477 Advanced Clinical Microbiology Laboratory**  
Fall, Spring, Summer. 3 credits. P: MMG 464 and BLD 450 R: Open to seniors in the Clinical Laboratory Sciences major. SA: MT 477  
Application and integration of theory and technical skills in clinical microbiology and infectious disease.
- 478 Advanced Clinical Microbiology**  
Fall, Spring, Summer. 1 credit. P: MMG 463 or BLD 450 or BLD 498 R: Open to seniors in the Clinical Laboratory Sciences major. SA: MT 478 C: BLD 477 concurrently.  
Theoretical aspects of clinical microbiology and infectious disease. Integration of cognitive material with clinical laboratory test results.
- 479 Professional Behavior in Clinical Laboratory Science**  
Fall, Spring, Summer. 1(0-2) P: (BLD 220 and BLD 442) and ((BLD 471 or concurrently) or (BLD 473 or concurrently) or (BLD 475 or concurrently) or (BLD 477 or concurrently)) R: Open to students in the Clinical Laboratory Sciences major. SA: MT 479  
Application of professional behavior principles to practical experiences in clinical laboratory science.
- 482 Advanced Diagnostic Molecular Science**  
Spring. 2 credits. R: Open to students in the Diagnostic Molecular Science major. SA: MT 482 C: BLD 483 concurrently or BLD 484 concurrently or BLD 485 concurrently or BLD 486 concurrently.  
Integration of principles and concepts in diagnostic molecular science with diagnostic laboratory test results.
- 483 Molecular Diagnostic Experience in Hematopathology and Oncology**  
Spring. 2 credits. P: BLD 438 R: Open to students in the Diagnostic Molecular Science major. SA: MT 483 C: BLD 482 concurrently.  
Clinical experience in molecular diagnostic laboratories with applications in hematopathology and oncology.
- 484 Molecular Diagnostic Experience in Infectious Disease**  
Spring. 2 credits. P: BLD 438 R: Open to students in the Diagnostic Molecular Science major. SA: MT 484 C: BLD 437 concurrently.  
Clinical experience in molecular diagnostic laboratories with applications to infectious disease diagnosis.
- 485 Molecular Diagnostic Experience in Inherited and Predictive Genetics**  
Spring. 2 credits. P: BLD 438 R: Open to students in the Diagnostic Molecular Science major. SA: MT 485 C: BLD 482 concurrently.  
Clinical experience in molecular diagnostic laboratories with applications in inherited and predictive genetics.
- 486 Molecular Diagnostic Experience in Genotyping and Individual Identification**  
Spring. 2 credits. P: BLD 438 R: Open to students in the Diagnostic Molecular Science major. SA: MT 486 C: BLD 482 concurrently.  
Clinical experience in molecular diagnostic laboratories with applications to genotyping and identification of individuals.
- 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 to students in the Clinical Laboratory Sciences major or in the Diagnostic Molecular Science major or in the Lyman Briggs School-Medical Technology Coordinate Major or in the Medical Technology major. SA: MT 495  
Faculty directed study including assigned readings, reviews of appropriate scientific periodicals, research, and laboratory experience.
- 498 Focused Problems in Clinical Laboratory Science**  
Spring. 2(1-2) P: (MMG 463 or concurrently) and (MMG 464 or concurrently) R: Open to students in the Clinical Laboratory Sciences major. SA: MT 454, MT 498  
Case study problems of medical microbiology, hematology, and clinical chemistry.
- 498L Infectious Disease Diagnostic Laboratory**  
Spring. 1(0-3) P: MMG 463 and MMG 464 and BLD 434 and (BLD 450 or concurrently) RB: BLD 430 R: Open to undergraduate students in the Clinical Laboratory Sciences major.  
Applying pre-analytical, analytical, and post-analytical principles to the identification of infectious agents in unknown samples.
- 801 Biomedical Laboratory Diagnostics Seminar**  
Fall, Spring. 1(1-0) A student may earn a maximum of 2 credits in all enrollments for this course. SA: MT 801  
Current research topics in clinical laboratory sciences.

- 811 Fundamentals of Scientific Research**  
Spring of even years. 1(1-0) R: Open to masters students in the Biomedical Laboratory Diagnostics Program. SA: MT 810 Not open to students with credit in NSC 830.  
Best practices for the research enterprise. Ethical conduct of research. Critical evaluation of scientific literature.
- 815 Cell Biology in Health and Disease I**  
Spring. 2(2-0) RB: Undergraduate course in Biochemistry and Physiology.  
Experience in a clinical laboratory  
Principles and theories of cell biology and biochemistry are presented with a focus on applications to clinical pathology.
- 816 Cell Biology in Health and Disease II**  
Summer. 2(2-0) P: BLD 815 RB: Undergraduate course in biochemistry and physiology. Experience in a clinical laboratory  
Continuation of BLD 815.
- 820 Advanced Human Hematology**  
Fall of odd years. 2(2-0) Interdepartmental with Pathobiology and Diagnostic Investigation. Administered by Biomedical Laboratory Diagnostics. RB: BLD 424  
Pathogenesis, mechanisms, and morphological pictures. Laboratory tests and interpretation of results.
- 821 Advanced Clinical Laboratory Practice**  
Spring. 1(1-0) P: PHM 830 or approval of department RB: Experience in a clinical laboratory  
Establishment and review of good clinical laboratory practice through the appropriate use of statistical functions.
- 830 Concepts in Molecular Biology**  
Fall, Spring. 2(2-0) Interdepartmental with Pathobiology and Diagnostic Investigation. Administered by Biomedical Laboratory Diagnostics. RB: One course in biochemistry or concurrently. SA: MT 830  
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**  
Spring, Summer. 2(2-0) P: BLD 830 RB: Basic biochemistry, medical or research laboratory experience SA: MT 831  
Molecular diagnostic principles. Diagnostic outcomes in traditional and non-traditional laboratory disciplines.
- 832 Molecular Pathology Laboratory**  
Summer. 2(0-4) P: BLD 831 or concurrently SA: MT 831L, MT 832  
Equipment operation, DNA extraction and measurement, electrophoresis, hybridization and transfers, amplification and detection including techniques and automated sequencing. Clinical applications.
- 835 Hemostasis, Thrombosis and Effective Resource Management**  
Fall. 3(3-0) RB: Background in hemostasis, thrombosis and blood product management. R: Open to lifelong graduate students in the College of Natural Science or in the Biomedical Laboratory Diagnostics Program or in the Clinical Laboratory Sciences major or approval of department.  
Theories of coagulation, thrombosis and effective blood product management. Needs and particular stresses during an active bleeding crisis.
- 836 Adverse Transfusion Outcomes: Detection, Monitoring and Prevention**  
Spring, Summer. 2(2-0) RB: Medical technology and clinical laboratory sciences laboratory professionals. R: Open to lifelong graduate students and open to graduate students in the Biomedical Laboratory Operations major or in the Clinical Laboratory Sciences major.  
Adverse transfusion outcomes (ATO) covering cause, methods of detection, monitoring paradigms and prevention.
- 837 Transfusion Service Operations and Management**  
Fall, Spring. 1(1-0) RB: Clinical transfusion service practical experience.  
Management and operational practices needed to meet both the fiscal and regulatory oversight of a transfusion service.
- 842 Managing Biomedical Laboratory Operations**  
Fall, Spring. 2(2-0) R: Open to graduate students or lifelong graduate students or approval of department. SA: MT 842  
Integration of the roles of legislative, regulatory, technological and economic factors that influence the practice and management of biomedical laboratory operations.
- 844 Topics in Biomedical Laboratory Operations**  
Spring. 1(1-0) P: BLD 842 R: Open to graduate students or lifelong graduate students or approval of department. SA: MT 844  
Current issues relevant to biomedical laboratory operations from an interdisciplinary perspective with an emphasis on efficient laboratory operations.
- 846 Decision Processes for Biomedical Laboratory Operations**  
Fall. 2(2-0) P: BLD 842 R: Open to master's students or lifelong graduate students or approval of department. SA: MT 846  
Integrative case studies presented in a problem-based learning format. Strategies for decision-making in the operations of a biomedical laboratory. Cases integrate scientific principles, management principles and regulatory factors.
- 850 Concepts in Immunodiagnosics**  
Fall, Spring. 2(2-0) RB: An undergraduate course in biochemistry or cell biology. SA: MT 850  
Immunology principles and theory applied to diagnostic evaluation of the host immune response during health and disease.
- 851 Clinical Application of Immunodiagnostic Principles**  
Spring, Summer. 2(2-0) P: BLD 850 SA: MT 851  
Immunodiagnostic theories and principles applied to clinical assay development and method evaluation.
- 852 Immunodiagnosics Laboratory**  
Summer. 2(2-0) P: BLD 850 SA: MT 851L, MT 852  
Performance of immunopurifications, in vitro diagnostic assays and basic flow cytometry. Data analysis and quality control evaluation.
- 860 Clinical Laboratory Diagnosis of Infectious Diseases**  
Fall of odd years. 2(2-0) Interdepartmental with Pathobiology and Diagnostic Investigation. Administered by Biomedical Laboratory Diagnostics. RB: MMG 451 and MMG 464 and BLD 434 SA: MT 860  
Laboratory techniques for diagnosing infectious diseases in humans. Emphasis on differential diagnosis and correlation of microbiological results with serology, hematology, and clinical chemistry.
- 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 to graduate students in the Clinical Laboratory Sciences major. SA: MT 890  
Non-thesis research for Plan B master's students.
- 895 Projects in Biomedical Laboratory Operations**  
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open to masters students in the Biomedical Laboratory Operations major or approval of department. SA: MT 895  
Completion of a significant on-site project in cooperation with an industrial/clinical partner.
- 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 to graduate students in the Clinical Laboratory Sciences major. SA: MT 899  
Master's thesis research.