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. 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 Sciences major or in the Diagnostic Molecular Science major or in the Lyman Briggs Diagnostic Molecular Science 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 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 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 Immunohematology 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 immunosassays 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 438 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
Fall, Spring. 3 credits. P: BS 181 or LB 145 or BS 181H. RB: MMG 201 or MMG 301. SA: MT 450
Medically important fungi and parasites. Host-parasite relationships, 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 (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 diagnoses 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 471 concurrently

Integration of principles and concepts in diagnostic molecular science with diagnostic laboratory test results.

483 Molecular Diagnostic Experience in Hemopathology 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 hemopathology 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 of 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.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
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<tbody>
<tr>
<td>811</td>
<td>Fundamentals of Scientific Research</td>
<td>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.</td>
</tr>
<tr>
<td>815</td>
<td>Cell Biology in Health and Disease I</td>
<td>Spring. 2(2-0) R: 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.</td>
</tr>
<tr>
<td>816</td>
<td>Cell Biology in Health and Disease II</td>
<td>Summer. 2(2-0) P: BLD 815 R: Undergraduate course in biochemistry and physiology. Experience in a clinical laboratory. Continuation of BLD 815.</td>
</tr>
<tr>
<td>820</td>
<td>Advanced Human Hematology</td>
<td>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.</td>
</tr>
<tr>
<td>821</td>
<td>Advanced Clinical Laboratory Practice</td>
<td>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.</td>
</tr>
<tr>
<td>830</td>
<td>Concepts in Molecular Biology</td>
<td>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.</td>
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<tr>
<td>831</td>
<td>Clinical Application of Molecular Biology</td>
<td>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.</td>
</tr>
<tr>
<td>832</td>
<td>Molecular Pathology Laboratory</td>
<td>Spring. 2(0-4) P: BLD 831 or concurrently SA: MT 831L, MT 832 Equipment operation, DNA extraction and measurement, electrophoresis, hybridization and transfer, amplification and detection including techniques and automated sequencing. Clinical applications.</td>
</tr>
<tr>
<td>835</td>
<td>Hemostasis, Thrombosis and Effective Resource Management</td>
<td>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.</td>
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<tr>
<td>836</td>
<td>Adverse Transfusion Outcomes: Detection, Monitoring and Prevention</td>
<td>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.</td>
</tr>
<tr>
<td>837</td>
<td>Transfusion Service Operations and Management</td>
<td>Fall, Spring. 1(1-0) R: Clinical transfusion service practical experience. Management and operational practices needed to meet both the fiscal and regulatory oversight of a transfusion service.</td>
</tr>
<tr>
<td>842</td>
<td>Managing Biomedical Laboratory Operations</td>
<td>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.</td>
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<tr>
<td>844</td>
<td>Topics in Biomedical Laboratory Operations</td>
<td>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.</td>
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<tr>
<td>846</td>
<td>Decision Processes for Biomedical Laboratory Operations</td>
<td>Fall, Spring. 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.</td>
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<tr>
<td>850</td>
<td>Concepts in Immunodiagnostics</td>
<td>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.</td>
</tr>
<tr>
<td>851</td>
<td>Clinical Application of Immunodiagnostic Principles</td>
<td>Spring, Summer. 2(2-0) P: BLD 850 SA: MT 851 Immunodiagnostic theories and principles applied to clinical assay development and method evaluation.</td>
</tr>
<tr>
<td>852</td>
<td>Immunodiagnostics Laboratory</td>
<td>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.</td>
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<tr>
<td>890</td>
<td>Selected Problems in Clinical Laboratory Science</td>
<td>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.</td>
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<tr>
<td>895</td>
<td>Projects in Biomedical Laboratory Operations</td>
<td>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 master’s 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.</td>
</tr>
<tr>
<td>899</td>
<td>Master's Thesis Research</td>
<td>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.</td>
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