Medical Laboratory Science

Taylor Health Science Building, 2nd Floor
435-879-4971

http://health.dixie.edu/mls/

To find faculty and staff phone numbers and email addresses, please consult the University Directory (http://www.dixie.edu/directory/directory.php).

Program Director
Cara Calvo, MS, MLS(ASCP)SH

Health Sciences Advisor
Cindy Clark

Dean
Eliezer Bermúdez, PhD

Department Chair
Drew Wilcox, PTA, MHA

Administrative Assistant
Kathryn Preiss

Program Description
Dixie State University offers a course of study leading to a Bachelor of Science in Medical Laboratory Science degree. During the first two years or pre-professional phase of study, a student completes a minimum of 58 semester hours of coursework. The coursework includes but is not limited to: a) general education courses, including a statistic course; b) biology requisites that must include a course in microbiology and courses in human anatomy and physiology; and c) cognates in chemistry. After completion of the pre-professional phase of study and, through a competitive application process, a student may be selected to enter the final two years of study or the MLS professional program. Admission selection decisions are made without regard to race, ethnicity, color, national origin, age, status as a person with a disability, religion, sexual orientation, gender identity/expression, and protected veteran’s status.

The MLS professional program is admission-limited meaning that, through a competitive application process, one cohort of no more than 12 students is admitted to the professional program per year. The start date for the program is the first day of classes of the DSU fall semester. Admitted students spend three semesters completing MLS-specific courses on the DSU campus. Upon successful completion of these courses, students are then assigned to one or more program-affiliated medical laboratories to complete a semester-long clinical internship. During this internship, students spend 40-hours per week advancing their knowledge and skills performing a wide variety of medical lab tests in a contemporary accredited medical laboratory under the supervision of professionally credentialled Medical Laboratory Scientists. Graduates are eligible to take the Medical Laboratory Scientist (MLS) national certification examination offered by the American Society for Clinical Pathology (ASCP).

Our vision is that the Dixie State University Medical Laboratory Science Program be a model of excellence in medical laboratory science education, graduating MLS who meet the workforce demands of today and tomorrow.

The mission of the Dixie State University Medical Laboratory Science Program is to graduate professionally accomplished MLS scholars, committed to life-long learning and prepared to meet current and future workforce needs in medical laboratory science.

The goals of the DSU MLS program are to:

1. Provide a curriculum that meets current and emergent pedagogical and professional development needs of students.
2. Establish and sustain partnerships with local and regional community medical laboratories that provide exceptional learning experiences for our MLS students.
3. Innovate learning experiences and provide opportunities that maximize every program student’s potential to achieve MLS career entry-level competencies.
4. Graduate knowledgeable and skilled Medical Laboratory Scientists who meet the workforce needs of our local community, Utah, and the underserved regions of the country.
5. Help advance MLS pedagogy and growth of the MLS profession.

Essential Requirements
The DSU MLS program has established non-academic standards of performance defined as essential requirements. Through their professional conduct, program students represent Dixie State University and more importantly the MLS profession and the MLS Program. Accordingly, DSU MLS
program students must possess knowledge, skills, attitudes to work in a wide-ranging variety of settings where laboratory testing is performed. Consequently, to be admitted and maintain enrollment, participate in, and successfully complete the MLS program, a student must meet the program’s essential requirements. They are as follows:

Expectations of Mastery and Skill in Information Acquisition and Communication

A MLS professional program student must demonstrate the ability to acquire and to effectively communicate information in written and in spoken English. Specifically, a MLS program student must be able to:

1. Read for comprehension and follow verbal and written instructions, and thus demonstrate mastery of MLS coursework content at a level expected of a career-entry MLS.
2. Competently utilize technology to research, investigate, acquire and present information obtained by observation and experimentation.
3. Use strategies that minimize miscommunication.
4. At all times and in all circumstances, follow established procedures to safeguard protected patient information communicated by non-electronic and electronic means.

Expectations of Motor and Sensory Functions

A MLS professional program student must demonstrate sufficient motor and sensory function to execute movements required to carry out work assignments in the preanalytical, analytical, and postanalytical phases of laboratory testing. Specifically, a MLS program student must be able to:

1. Distinguish the physical attributes, including color, shape, and size, of objects both macroscopically and microscopically.
2. Demonstrate sufficient dexterity to manipulate specimens, laboratory tools, equipment and instrumentation including but not limited to computer touch-screens, keyboards and handheld calculators, necessary to obtain and to report test results by non-electronic and electronic means.
3. Show adequate mobility to attend to duties in the various locations of the medical laboratory work environment.
4. Use sensory skills to acquire and apply information presented by various means and media, including but not limited to tactile, visual and non-visual.
5. Perform sustained, often repetitive physical activity that may require sitting, standing and/or walking for prolonged periods of time.
6. Accurately read and record numbers, letters and symbols displayed in print whether transmitted through non-electronic, electronic or other technological media.
7. Demonstrate proficiency performing a wide range of tests in areas of the contemporary medical laboratory including but not limited to hematology, clinical chemistry, immunohematology, microbiology, molecular and emerging diagnostics.

Expectations of Professionalism

A MLS professional program student must be able to demonstrate an image of professionalism through behavior, speech, and grooming. Specifically, a program student must be able to:

1. Always adhere to medical laboratory safety protocols when working with various sample types including blood, urine, and other body fluids and tissues, with infectious organisms, and with hazardous chemicals.
2. Demonstrate the ability to work with focused attention on safety and accuracy whatever the work environment circumstances, and to objectively evaluate information and take responsibility for subsequent decisions when mistakes may have a high impact on patient care.
3. Adapt to changing work environments, maintain a professional demeanor, and remain focused despite distracting situations.
4. Demonstrate attributes that include integrity, responsibility, and tolerance.
5. Speak, act and perform all work in an ethical manner.
6. Show respect for self and others.
7. Work independently as well as actively engage cooperatively with others, performing professional obligations in a timely, responsible manner.
8. Prioritize tasks and accept responsibility for work performed independently and as a team member.
9. Assess his or her work performance, willingly accept constructive criticism, and look for ways to improve both knowledge and skill.

Accreditation

The Medical Laboratory Science program is accredited by the National Accrediting Agency for Clinical Laboratory Science (NAACLS). NAACLS can be contacted at:

NAACLS
5600 North River Road, Suite 720
Rosemont, IL 60018
Phone: 773-714-8880
Facilities
The Dixie State University MLS program office and classroom laboratories are located on the second floor of the Russell C. Taylor Health Science Building, located at 1526 South Medical Center Drive, St. George, UT 84790.

Clubs
Admitted program students may choose to join a number of professional societies including the American Society for Clinical Laboratory Science (ASCLS) and the American Society for Clinical Pathology (ASCP).

Course Prefixes
- MLS

Degrees and Certificates
- Bachelor of Science in Medical Laboratory Science (catalog.dixie.edu/programs/medicallaboratoryscience/bachelor_of_science_in_medical_laboratory_science)
- Phlebotomy Certificate (catalog.dixie.edu/programs/medicallaboratoryscience/phlebotomy-certificate)

Program Admission
“Our vision is that the Dixie State University Medical Laboratory Science Program be a model of excellence in medical laboratory science education, graduating medical laboratory scientists who meet the workforce demands of today and tomorrow.”

https://health.dixie.edu/mls/program-admissions/

To be admitted to the MLS Professional Program, a student must, at a minimum:

1. be admitted to DSU as a degree-seeking student and have completed a minimum of 58 semester credits
2. have a cumulative GPA of 2.50
3. have a GPA of 2.00 for all math and science courses
4. complete all MLS professional program prerequisites BEFORE the fall term start date. The prerequisites are as follows:

- Completed DSU general education requirements; **NOTE: A previously earned degree may fulfill the DSU general education requirements, but per Utah Board of Regents policy, courses must be equivalent to DSU’s minimum General Education standards in English, Mathematics, and American Institutions.**
- Completed two college-level math classes one of which must be statistics;
- Completed 16-semester credits (or 24-quarter credits) in college-level Biology classes which must include at a minimum: 1) a microbiology course; the microbiology course must include a laboratory component either integral to the course or taken separately; and 2) a human anatomy and/or physiology course; the course(s) must include a laboratory component either integral to the course(s) or taken separately; and,
- Completed a minimum of 10-semester credits (or 15-quarter credits) in college-level Chemistry classes which must include one course in organic or biochemistry with a lab component either integral to the course or taken separately.

**NOTE:** Program prerequisites do not have to be completed to APPLY to the MLS professional program.
Program Learning Outcomes*
Upon completion of the DSU MLS program, graduates will with:

1. **TECHNICAL SKILL**: Competently perform a full range of testing encompassing the pre-analytical, analytical, and post-analytical components of contemporary laboratory services in areas that include clinical chemistry, hematology/hemostasis, immunology, immunohematology/transfusion medicine, microbiology, urine and body fluid analysis, and emerging diagnostics;

2. **RESPONSIVE LEADERSHIP**: Apply management concepts and leadership skills, taking responsibility for analysis and decision-making, and the effective communication of valid test information wherever laboratory testing is researched, developed or performed;

3. **INNOVATIVE PURPOSE**: Actively participate in the development, implementation, and evaluation of test systems and interpretive algorithms;

4. **PRACTICED SCHOLARSHIP**: Possess relevant experience in research design and practice.

5. **STRENGTH OF CHARACTER**: Demonstrate ethical and moral attitudes, principles of lawful conduct, and commitment to continuing professional development necessary for gaining and maintaining the confidence of patients, professional associates, and the community.

6. **HEURISTIC KNOWLEDGE**: Adhere to safety, governmental regulations and standards as applied to medical laboratory practice; and,

7. **NONPARTISAN DECORUM**: Project an image of professionalism, respecting the feelings and needs of others, protecting the confidence of patient information, and never allowing personal concerns and biases to interfere with the welfare of patients nor the work of colleagues and members of the healthcare team caring for patients.

---

*Modified to align with the NAACLS Standards for Accredited & Approved Programs, Unique Standards for MLS: “Description of the Medical Laboratory Scientist Profession” and “Curricular Requirements”, revised 11/2016.

**Career Information**

**What is a medical laboratory science professional?**

“Medical laboratory science professionals, often called medical laboratorians, are vital healthcare detectives, uncovering and providing laboratory information from laboratory analyses that assist physicians in patient diagnosis and treatment, as well as in disease monitoring or prevention (maintenance of health). We use sophisticated biomedical instrumentation and technology, computers, and methods requiring manual dexterity to perform laboratory testing on blood and body fluids. Laboratory testing encompasses such disciplines as clinical chemistry, hematology, immunology, immunohematology, microbiology, and molecular biology. Medical laboratory science professionals generate accurate laboratory data that are needed to aid in detecting cancer, heart attacks, diabetes, infectious mononucleosis, and identification of bacteria or viruses that cause infections, as well as in detecting drugs of abuse. In addition, we monitor testing quality and consult with other members of the healthcare team. Medical laboratory scientists have an extensive theoretical knowledge base. Therefore they not only perform laboratory procedures including very sophisticated analyses, but also evaluate/interpret the results, integrate data, problem solve, consult, conduct research and develop new test methods.”

**Learn More**

[How do I become a medical laboratory professional?](http://www.ascls.org/careers-ascls/how-do-i-become-a-laboratory-professional)

[How do I become a medical laboratory professional?](https://www.youtube.com/watch?v=aU8vyqHCy5w&hd=1)

**Job Outlook**

Employment of medical laboratory technologists is projected to grow 12 percent from 2016 to 2026, faster the average for all occupations. Employment of medical laboratory technicians is projected to grow 14 percent from 2016 to 2026, faster than the average for all occupations.
An increase in the aging population is expected to lead to a greater need to diagnose medical conditions, such as cancer or type 2 diabetes, through laboratory procedures. Prenatal testing for various types of genetic conditions also is increasingly common. Medical laboratory technologists and technicians will be in demand to use and maintain the equipment needed for diagnosis and treatment.

Salary Range*

The median annual wage for medical laboratory scientists was $61,070 in May 2016. The lowest 10 percent earned less than $41,550, and the highest 10 percent earned more than $85,160.

* From the American Society for Clinical Laboratory Science (ASCLS) Career Center web page


Courses

MLS 3310. Immunohematology I. 5 Hours.
Required course for students in the Bachelor of Science Medical Laboratory Science Professional Program. Comprehensive study of the science and applied concepts of blood banking and transfusion service practices. The study of blood groups, their antigens and antibodies, is discussed in detail as are test methods and transfusion protocols, including donor selection, component preparation, quality management and compliance issues. In lab, students learn to perform a variety of tests that are prerequisite to the transfusion of blood and blood products. Course fee required. Prerequisite: Admission to the Dixie State University Bachelor of Science in Medical Laboratory Science professional program. SP.

MLS 3312. Clinical Immunology. 4 Hours.
Required course for students admitted to the Bachelor of Science in Medical Laboratory Science professional program. A comprehensive study of the human immune system and the medical laboratory techniques used to assess immune responsiveness in health and during times of illness and disease. Lectures focus on innate and adaptive immunity, antibody structure and function, and the role of the complement system and cytokines in immune responsiveness. The immunologic manifestation of infectious disease, hypersensitivity, autoimmune diseases, transplantation immunity, tumor immunology, and immunodeficiency diseases will be discussed in detail. Using serological methods, electrophoresis, and molecular techniques, students test samples and correlate results with states of health and disease. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Comply with established lab safety and governmental regulations and standards applicable to the clinical immunology laboratory. 2. Evaluate and interpret laboratory test data while recognizing factors that affect procedure and results. 3. Demonstrate written and oral communication skills that ensure accurate reporting of test results. 4. Describe the humoral and cellular components of the innate and adaptive immune systems. 5. Explain the different immune related pathologies such as hypersensitivity, autoimmunity, tumor immunology and immunodeficiencies. 6. Describe antibody and antigen interactions and structure. 7. Explain the list of immunoassay formats, uses, and troubleshooting. 8. Collect and safely handle biological specimens for analysis. 9. Perform accurate laboratory testing of body fluids, cells, and other substances. 10. Perform a valid ELISA screen using appropriate quality controls. Course fee required. Prerequisite: Admission to the Dixie State University Bachelor of Science in Medical Laboratory Science professional program. FA.

MLS 3314. Diagnostic Microbiology I. 5 Hours.
Required course for students in the BS in Medical Laboratory Science professional program. Comprehensive topical study introduces students to clinically significant bacteria including epidemiology, pathogenicity, and procedures for the traditional laboratory identification and antimicrobial testing. Clinically significant pathogens of interest include: Staphylococcus, Streptococcus, Neisseria, Gram-Positive Bacilli, Enterobacteriaceae, Gram-Negative non-fermentors and other miscellaneous bacteria. The laboratory exercises focus on traditional and evolving methods of identification of bacteria of medical interest. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Comply with safety and governmental regulations and standards applicable to the medical microbiology laboratory. 2. Judge the acceptability of quality control and test result data. 3. Discuss the utility of blood, chocolate, and MacConkey agars to identify bacterial isolates of medical interest. 4. Describe the mechanism of action of the different classes of antimicrobials. 5. Choose the correct laboratory approach to study, culture, identify and work with microbes studied in this course. 6. List the general characteristics of organisms that belong to the family Enterobacteriaceae. 7. Demonstrate effective written and oral communication skills that ensure accurate reporting of test results in the medical microbiology laboratory. 8. Explain and demonstrate the gram stain reaction of each cell wall type. 9. Compare the characteristics of staphylococci to streptococci and other gram-positive cocci. 10. Compare the general characteristics of the aerobic gram-positive bacilli. 11. Identify the major pathogens and virulence factors associated with Neisseria species. 12. Recognize, describe, and differentiate select microbe phenotypes studied in the course by accurately interpreting, when applicable, gram stain reactivity, select biochemical test results, microscopic morphology, and growth characteristics on routine primary and selective culture media. 13. Explain the role microbes play in human health and disease. 14. Differentiate miscellaneous bacterial groups by cell morphology, biochemical reactions, growth conditions and fermentation characteristics. 15. Demonstrate proper technique for isolating potential pathogens isolated from patient specimens. 16. Determine the acceptability of a specimen for testing by diagnostic microbiology methods. 17. Differentiate between prokaryotic and eukaryotic cell types. Apply knowledge, from specific facts to complete theories, and demonstrate appropriate use of techniques and procedures required to study, identify, and safely work with microbes. Course fee required. Prerequisite: Admission to the Dixie State University Bachelor of Science Program in Medical Laboratory Science. FA.
**MLS 3330. Clinical Chemistry. 5 Hours.**  
Required course for students in the Bachelor of Science Medical Laboratory Science professional program. Focuses on clinical chemistry and quality control utilizing manual and automated laboratory procedures. Emphasis on blood and body fluid assessments of carbohydrates, bilirubin, non-protein nitrogen testing, electrolytes, acid/base balance, lipids, hemoglobin, and electrophoresis. Laboratory section will facilitate student learning by students applying theory to laboratory assays. At the successful conclusion of this course, students will be able to:  
**COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to:**  
1. Demonstrate effective written and oral communication skills that ensure accurate reporting of test results in the clinical chemistry laboratory.  
2. Perform accurate laboratory testing of body fluids, cells, and other substances.  
3. Comply with safety and governmental regulations and standards applicable to clinical chemistry laboratory.  
4. Evaluate correctly acceptability of quality control and test result data.  
5. Perform mathematical calculations and apply statistical functions to interpret test results associated with clinical chemistry testing.  
6. Perform and interpret manual and automated clinical chemistry tests on blood, serum, plasma, and other body fluids. Test of interest include glucose, BUN, creatinine, total protein and albumin.  
7. Name and describe the role of the components of a basic spectrophotometer and compare to more complex instrumentation.  
8. Perform and interpret the results of automated chemistry lipoprotein test for low-density lipoprotein, high-density lipoprotein, triglycerides, and total cholesterol.  
10. Recognize and interpret common serum enzymes profiles of medical interest and identify the organ of origination of each enzyme.  
11. Compare and contrast typical and atypical serum protein electrophoresis scans.  

Course fee required. Prerequisite: Admission to the Dixie State University Bachelor of Science Program in Medical Laboratory Science.

**MLS 3555. Research Seminar. 2 Hours.**  
Required course for students in the Bachelor of Science program in Medical Laboratory Science. Addresses research methods in the clinical sciences and reviews accepted policies from the National Institutes of Health on informed consent, institutional review boards, and clinical trials. Students will read and interpret studies in the clinical laboratory sciences, comment on problems with studies, and note the further work needed in the respective area of research. Students will present a study, highlighting the research questions answered, methods employed, and relevance to other studies.  
**COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to:**  
1. Criticize published research and compare various research studies.  
2. Write an original research paper on a topic directly related to Medical Laboratory Science.  
3. List the steps in writing and revising a research paper.  
4. Understand and apply the power of statistics in research study.  
5. Present a published research study highlighting research question, methods, results, and limitations of study.  
6. Write and submit an abstract based on a research project to be performed in class.  
7. Plan and implement a research project including budget, background, methods, and hypothesis.  
8. Demonstrate written and oral communication skills.  
9. Evaluate correctly acceptability of quality control and test result data.  

Prerequisite: Admission to the Dixie State University Bachelor of Science Program in Medical Laboratory Science.

**MLS 3850. Urinalysis and Body Fluids. 2 Hours.**  
Required course for students admitted to the Bachelor of Science in Medical Laboratory Science professional program. In-depth study of the physiology, formation and composition, and medical laboratory analysis of urine and other body fluids including cerebrospinal fluid, seminal fluid, serous fluids, synovial fluid, amniotic fluid, bronchoaveolar lavages and bronchial washings, and vaginal secretions. In lab, students learn to perform macroscopic (physical and chemical) and microscopic analysis on clinical samples, interpret test results, and correlate results with states of human health and disease.  
**COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to:**  
1. Follow through appropriate lab testing quality assurance activities, including quality control protocols and safety practices, as a foundation for exemplary patient care.  
2. Correctly use conventional medical terminology and nomenclature to report test results of body fluids’ analyses including but not limited to urine, cerebrospinal fluid, synovial fluid, and semen analyses.  
3. Relate the process of urine formation, including the effect of the hormones aldosterone, renin, and vasopressin, to the quantity and quality of urine produced.  
4. Effectively communicate instructions to patients or to healthcare providers whenever the following body fluid samples need to be collected: clean-catch urine, seminal fluid, and vaginal secretions.  
5. Judge the acceptability of each of the following body fluid specimens submitted for analysis by medical laboratory methods: urine, seminal fluid, vaginal secretions, and cerebrospinal fluid.  
6. Explain the analytical principle and the clinical utility for each medical laboratory test performed during routine analysis of urine, cerebrospinal fluid, synovial fluid, vaginal secretions, semen, serous fluids, and bronchial lavages and washings.  
7. Recommend the appropriate body fluid specimen needed to obtain diagnostically relevant results whenever the following diseases or conditions are suspected: pregnancy, urinary tract infection, meningitis, postvasectomy, infertility, gout, bacterial vaginosis, and effusion formation (pleural, pericardial or ascites).  
8. Demonstrate competency using a light microscope to analyze synovial fluid for crystals and to perform a microscopic analysis of urine sediment, semen, vaginal secretions, and cerebrospinal fluid, obtaining diagnostically relevant results.  
9. Competently perform a wide range of analyses on urine, cerebrospinal fluid, synovial fluid, semen, vaginal secretions, and serous fluids to aid diagnosis of disease, screen asymptomatic populations for undetected disorders, and monitor the progress of disease and the effectiveness of therapy.  
10. Correlate test results, from the analysis of urine and other body fluids, with pathophysiologic processes to recommend additional tests that may aid a diagnosis, confirm a prognosis, and/or affirm therapy.  
11. Recall reference ranges for common tests performed on urine, cerebrospinal fluid, synovial fluid, and semen.  
12. Apply knowledge of urinalysis and the analysis of body fluids, from basic facts, policies, protocols, and procedures to complete theories and concepts, to analyze topic-specific case studies and propose valid solutions.  

Course fee required. Prerequisite: Admission to the Dixie State University Bachelor of Science in Medical Laboratory Science professional program.
**MLS 4110. Laboratory Management/Edu. 2 Hours.**

Students will learn managerial problem solving, finance, and budgeting, Lean and Six Sigma techniques, leadership styles, and education/training relevant to the clinical laboratory. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to:**

1. Recommend laboratory process improvements based on patient/customer needs and cost benefit analysis.
2. Uphold professional standards of conduct as a member and an advisor within multidisciplinary healthcare teams.
3. Adapt effective communication and leadership styles to challenging medical laboratory work situations.
4. Synthesize knowledge of laboratory financial management to analyze and propose viable solutions to fiscal problems in the contemporary medical laboratory.
5. Synthesize knowledge of laboratory financial management to analyze and propose viable solutions to fiscal problems in the contemporary medical laboratory.
6. Identify and evaluate elements that impact the effective management of medical laboratory staffing resources.
7. Apply knowledge of key components of planning to set short-term and long-term career goals.
8. Use knowledge of educational methodologies and terminology to construct and effectively deliver an educational unit to users and providers of laboratory services. Prerequisite: Admission to the Dixie State University Bachelor of Science Program in Medical Laboratory Science. FA.

**MLS 4200. Clinical Chemistry and Molecular Diagnostics. 4 Hours.**

Required course for students admitted to the BS in Medical Laboratory Science professional program. Second of two courses covering essential practices related to the pre-analytical, analytical, and post-analytical components of the clinical chemistry laboratory service. Lectures focus on the pathophysiology of a variety of diseases including diabetes, liver disease, kidney disease, various endocrine disorders including thyroid disease, and on the specialized services of the clinical chemistry lab including toxicology, therapeutic drug monitoring, and molecular diagnostics. The use of molecular techniques with interest in instrumentation and evolving technology are discussed in detail. Laboratory exercises facilitate student skill development performing assays and correlating test results to states of health and disease. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to:**

1. Use effective written and oral communication skills that ensure accurate reporting of test results in the clinical chemistry laboratory.
2. Adhere to the safety and governmental regulations and standards applicable to clinical chemistry laboratory.
3. Evaluate correctly acceptability of quality control and test result data.
4. Identify and discuss the functions of key hormones produced by the hypothalamus and pituitary gland.
5. Describe functions and hormones found in the hypothalamus and pituitary gland and identify disease associated with abnormalities of these hormones.
6. Categorize the different types of diabetes mellitus and identify common symptoms and analytes of each.
7. Discuss the synthesis and secretion of thyroxine.
8. Recognize the importance of the liver and kidney in detoxification and associate with various disease states.
9. Perform appropriate quality control measures for instrumentation, including automation.
10. Demonstrate competency performing a select range of tests studied in this course.
11. Differentiate between the clinical goals and purposes of therapeutic drugs as opposed to toxicology.
12. Demonstrate a working knowledge of the principles of molecular biology and identify molecular techniques used in contemporary clinical chemistry laboratory. Course fee required. Prerequisite: Admission to the Dixie State University Bachelor of Science in Medical Laboratory Science professional program. FA.

**MLS 4300. Clinical Hematology. 5 Hours.**

Required course for students admitted to the Bachelor of Science in Medical Laboratory Science professional program. Lecture and laboratory coverage of the theories, concepts and practical aspects central to the study of blood and blood forming tissues by medical laboratory methods. Lectures focus on the structure, function, kinetics, senescence and destruction. Hematologic diseases including the etiology and pathophysiology of anemia, and neoplastic and nonmalignant leukocyte disorders are discussed in detail. In lab, students use manual methods and automation to analyze clinical samples and correlate results with states of health and disease. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to:**

1. Follow through with appropriate hematology laboratory quality assurance activities, including quality control protocols and safety practices, as a foundation for exemplary patient care.
2. Correctly use conventional clinical hematology terminology and nomenclature to report test results.
3. Apply knowledge of the monophyletic stem cell theory to describe human hematopoiesis, including a discussion of anatomic sites and cells produced.
4. For each blood cell studied in this course, relate structure to function.
5. Critique the use of molecular techniques in the diagnosis, prognosis and therapy monitoring of hematologic disorders.
6. Recognize key morphologic characteristics at each stage of maturation for the following blood cells, in order to correctly identify and classify them during differential analysis: Red Cells, Granulocytes: Segmentated Neutrophils, Eosinophils, Basophils, Monocytes, Lymphocytes - includes plasma cells, and Platelets.
7. Distinguish each erythrocyte and leukocyte disorder discussed in lecture according to etiology, pathophysiology, clinical presentation, key laboratory findings, and treatment options.
8. Describe current trends and applications of automated blood cell differential analysis citing specific examples to illustrate.
9. Appraise, with explanation, a specimen as acceptable for testing in a contemporary hematology laboratory.
10. Competently perform a range of hematology tests and procedures essential to the diagnosis, prognosis, and monitoring of therapy for the hematologic diseases and conditions discussed in class.
11. Assess the role of point of care testing (POCT) in the contemporary hematology laboratory evaluation of diseases and disorders of the blood.
12. Synthesize knowledge of hematology and the medical laboratory evaluation of primary and secondary hematologic disorders to propose valid solutions to case study problems. Course fee required. Prerequisite: Admission to the Dixie State University Bachelor of Science in Medical Laboratory Science professional program. SP.
MLS 4320. Hemostasis. 4 Hours.
Required course for students admitted to the Bachelor of Science in Medical Laboratory Science professional program. Theories and concepts of hemostasis are presented, including plasma and cell-based models of normal coagulation and fibrinolysis. Hemorrhagic diseases and thrombotic disorders will be covered and laboratory tests critical to the diagnosis, prognosis, and to monitoring treatment of these conditions are discussed in detail. In the lab, students use manual methods and technology to analyze clinical samples to detect, differentiate, and quantify coagulation abnormalities. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Describe the nature, origin, and function of key tissue and plasma factors necessary for hemostasis. 2. Discuss the physiology of hemostasis including a thorough explanation of the role of platelets, blood vessels, and essential plasma serine proteases in forming a blood clot and its subsequent dissolution. 3. Summarize the laboratory evaluation and monitoring of congenital and acquired bleeding and thrombotic conditions and diseases in terms of key lab tests, test principles, specimen requirements, and test reference ranges. 4. Distinguish each hemorrhagic and thrombotic condition and disease studied in the course according to etiology, pathophysiology, clinical presentation, key laboratory findings, and treatment options. 5. Justify the use of molecular techniques in the diagnosis, prognosis and monitoring of the treatment of hemostatic disorders. 6. Competently perform a range of tests and procedures, including accurately interpreting and reporting results used to evaluate hemostasis and anticoagulant therapy. 7. Assess the purpose of anti-thrombotic drug therapy and differentiate anticoagulant from anti-platelet therapy. 8. Analyze various anticoagulant therapy scenarios to recommend appropriate lab tests to monitor dosing, recognize appropriate testing frequency, and identify test results indicating inappropriate dosing. 9. Describe the principle of platelet aggregometry and interpret normal and common abnormal aggregometric test patterns with 100% accuracy. 10. Use knowledge of hemostasis and the laboratory assessment of coagulation and thrombophilia to propose solutions to case study problems. Course fee required. Prerequisite: Admission to the Dixie State University Bachelor of Science in Medical Laboratory Science professional program. FA.

MLS 4330. Clinical Chemistry Practice. 4 Hours.
Required course for students admitted to the Bachelor of Science in Medical Laboratory Science professional program. Practical experience emphasizing application of knowledge and skills to perform a wide variety of testing in a contemporary clinical chemistry/immunology laboratory and further develop discipline-specific competency. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Competently perform a full range of testing in the clinical chemistry/immunology laboratory encompassing the pre-analytical, analytical, and post-analytical phases of testing. 2. Demonstrate proficiency to problem-solve, troubleshoot, interpret and accurately report results, and use statistical approaches to evaluate test data including quality control result. 3. Show responsibility for testing and decision-making. 4. Follow through with safety and governmental regulations and standards as applied to the work performed in the clinical chemistry/immunology laboratory, including protecting the confidence of patient information. 5. Responsibly used technology to accurately report test results. 6. Demonstrated the ability to effectively communicate with laboratory staff and, when appropriate, with members of the healthcare team and the public. 7. Projected an image of professionalism in word, action, and appearance. Prerequisite: Admission to the Dixie State University Bachelor of Science Program in Medical Laboratory Science. SP.

MLS 4400. Immunohematology II. 4 Hours.
Required course for students admitted to the Bachelor of Science in Medical Laboratory Science professional program. Continued study of the science of antigen and antibody reactions and blood group systems, emphasizing decision-making and problem-solving skill development with application to blood banking practices and transfusion therapy services. Lab fee required. Science professional program. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Follow through with appropriate quality assurance activities, including quality control protocols and safety practices, as a foundation for exemplary patient care. 2. Correctly use conventional medical terminology and immunohematology-specific nomenclature to effectively report test results. 3. Evaluate quality control data and use the results to validate blood bank testing outcomes. 4. Question inconsistent test data in order to ensure reporting of valid results. 5. With minimal supervision, competently perform a full range of assays, procedures and protocols that facilitate the safe, timely, and effective transfusion of blood and/or blood products. 6. Synthesize knowledge of immunohematology and transfusion practices, from basic facts, policies, protocols, and procedures to complete theories, to analyze case studies and propose valid solutions to complex antibodies problems. Course fee required. Prerequisite: Admission to the Dixie State University Bachelor of Science in Medical Laboratory Science professional program. FA.

MLS 4410. Blood Banking Practice. 4 Hours.
Required course for students admitted to the Bachelor of Science in Medical Laboratory Science professional program. Practical experience emphasizing application of knowledge and skills to perform a wide variety of testing in a contemporary blood bank and further develop discipline-specific competency. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. With minimal supervision, competently perform a broad range of routine testing in accordance with standard transfusion service protocols and procedures in a contemporary blood bank laboratory. 2. Under supervision, correctly use equipment and operate instruments found a contemporary medical laboratory. 3. Accept responsibility for analysis and decision-making about testing performed in a contemporary blood bank laboratory. 4. Follow through with applicable regulations and standards of practice that define quality improvement/performance within a contemporary blood bank laboratory/transfusion service. 5. Project and maintain an image of professionalism in word and action, and perform work with focused attention on safety, accuracy, and quality. 6. Assess nonverbal and verbal communications to enable effective consultative interactions with healthcare professionals and, when appropriate, the public including patients. 7. Work autonomously and cooperatively with others, effectively manage time, and prudently use available resources to deliver cost-effective, value-added, accurate, and timely blood bank lab test results. Prerequisite: Admission to the Dixie State University Bachelor of Science Program in Medical Laboratory Science. SP.
MLS 4414. Clinical Microbiology Practice. 4 Hours.
Required course for students admitted to the Bachelor of Science in Medical Laboratory Science professional program. Practical experience emphasizing application of knowledge and skills to perform a wide variety of testing in a contemporary medical microbiology laboratory and further develop discipline-specific competency. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Competently perform a full range of testing in the clinical microbiology laboratory encompassing pre-analytical, analytical, and post-analytical phases of testing in bacteriology and, to the extent available, testing in the areas of parasitology, mycology and virology. 2. Demonstrate proficiency to problem-solve, troubleshoot, interpret and accurately report results, and use statistical approaches to evaluate test data including quality control results. 3. Show responsibility for analysis and decision-making. 4. Follow safety and governmental regulations and standards as applied to the work performed in a clinical microbiology laboratory, including protecting the confidence of patient information. 5. Adeptly use technology to accurately report test results. 6. Demonstrate the ability to effectively communicate with members of the laboratory, and when appropriate, members of the healthcare team and the public. 7. Project an image of professionalism in word, action, and appearance. Prerequisite: Admission to the Dixie State University Bachelor of Science Program in Medical Laboratory Science. SP.

MLS 4423. Clinical Hematology Practice. 4 Hours.
Required course for students admitted to the Bachelor of Science in Medical Laboratory Science professional program. Practical experience emphasizing application of knowledge and skills to perform a wide variety of testing in a contemporary clinical hematology/hemostasis laboratory and further develop discipline-specific competency. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Competently perform a full range of testing encompassing the pre-analytical, analytical, and post-analytical phases of testing in hematology and hemostasis. 2. Demonstrate proficiency to problem-solve, troubleshoot, interpret and accurately report results, and use statistical approaches to evaluate test data including quality control results. 3. Show responsibility for testing outcomes and decision-making. 4. Follow safety and governmental regulations and standards as applied to the work performed in a clinical hematology laboratory, including protecting the confidence of patient information. 5. Demonstrated responsible use of technology to accurately report test results. 6. Demonstrated effective communication with the medical laboratory staff and, when appropriate, with members of the healthcare team and the public. 7. Projected an image of professionalism in word, action, and appearance. Prerequisite: Admission to the Dixie State University Bachelor of Science Program in Medical Laboratory Science. SP.

MLS 4600. Diagnostic Microbiology II. 4 Hours.
Required course for students admitted to the BS in Medical Laboratory Science professional program. Continued comprehensive study of diagnostic microbiology focusing on clinically significant pathogens including Anaerobes, Spirochetes, Chlamydia, Mycobacteria, medically important fungi, viruses and parasites. Student will further develop competency using traditional manual microbiological methods and evolving techniques, including molecular assays, to identify and aid the diagnosis, prognosis, and therapy monitoring of infections caused by the microbes discussed in this course. **COURSE LEARNING OUTCOMES (CLOs) At the successful conclusion of this course, students will be able to: 1. Demonstrate written and oral communication skills that ensure accurate reporting of test results. 2. Perform accurate laboratory testing of body fluids, cells, and other substances. 3. Comply with established lab safety regulations. 4. Demonstrate proper technique for isolating potential pathogens in patient specimen. 5. Evaluate correctly acceptability of quality control and test result data. 6. Recognize common anaerobe bacterial infections in the human and characteristics that allow for endogenous infection. 7. Compare and contrast properties of mycobacterial infections with other kinds of bacterial infections. 8. Describe basic morphology and physiology of parasites, viruses, and fungi. 9. Understand the life cycle of parasites of medical importance in relation to transmission, prevention and control. Course fee required. Prerequisite: Admission to the Dixie State University Bachelor of Science in Medical Laboratory Science professional program. FA.