Cleveland Clinic
School of Health Professions
Medical Laboratory Science Program

Course Descriptions

MLS5101 - Bacteriology I ***Clock Hours: 87***

Lectures introduce specimen collection, transport, processing, and storage as well as quality assurance and quality control. Additional lectures will cover medically relevant aerobic gram-positive bacteria. Laboratory work emphasizes isolation, identification, and antibiotic susceptibility testing of aerobic gram-positive bacteria.

Upon completion of the lectures, exams and laboratory exercises, the student will be able to explain the criteria for specimen collection, transport, processing, and storage of most specimen types as well as quality assurance and quality control as it applies to the microbiology laboratory. The student will also be able to isolate, identify, and perform susceptibility testing on clinically significant aerobic gram-positive bacteria.

MLS5102 - Bacteriology II ***Clock Hours: 94***

Lectures present the medically relevant aerobic gram-negative bacteria, anaerobic bacteria, and viruses. Laboratory work emphasizes the strategies for isolation and identification of clinically significant aerobic gram-negative bacteria and anaerobes.

Upon completion of the lectures, exams and laboratory exercises, the student will be able to isolate, identify, and perform susceptibility testing on clinically significant aerobic gram-negative bacteria and anaerobes. The student will also be able to summarize clinically significant viruses and various viral testing methods.

Pre-requisite: MLS5101

MLS5103 - Mycology and Mycobacteriology ***Clock Hours: 46***

Lectures introduce clinically significant yeasts, molds, and other fungi. Additional lectures will cover the medically important mycobacteria. Special topics will focus on infection prevention. Laboratory work will emphasize the isolation and identification of fungi and mycobacteria as well as susceptibility testing of mycobacteria.

Upon completion of the lectures, exams and laboratory exercises, the student will be able to describe the process of cultivation and identification of mycobacteria, yeasts, molds, and other fungi. Additionally, the student will be able to explain the impact of the microbiology laboratory on infection control.

MLS5104 - Parasitology ***Clock Hours: 54***

Lectures cover life cycles, diagnostic morphology, and pathology of human parasites. The course also emphasizes the detection and microscopic identification of diagnostic forms of parasites and detection of blood in fecal specimens.

Upon completion of the lectures, exams and laboratory exercises, the student will summarize clinically significant parasites and be able to detect and identify cysts, trophozoites, eggs, and larvae in human specimens.

ML5201 - Hematology I ***Clock Hours: 88***

Lectures and reading assignments cover the basic methods of manual and automated hematology testing as well as the production, function, and morphology of hematopoietic cells. The various causes and

presentations of anemias are also covered. The course also covers manual and automated enumeration and identification of the cellular components of blood and performance of diagnostic test procedures. Laboratory work will give the student hands-on experience with instrumentation and manual methods to assist with the understanding of troubleshooting, quality control, and result interpretation.

Upon completion of the lectures, exams, and laboratory exercises, the student will describe the function of hematology analyzers, operate analyzers, perform diagnostic laboratory determinations, analyze the results, and diagnose anemias of various disease origins.

MLS5202 - Hematology II ***Clock Hours: 88***

Lectures cover the production and function of hemoglobins, the identification of diseases associated with abnormal hemoglobins, and the principles of laboratory tests employed in their diagnosis. The course also covers morphology of white blood cells, discussion of the diagnostic features of hematologic disorders and principles of laboratory tests employed in their diagnosis. Additionally, specimen collection, manual and automated enumeration and identification of white blood cells, and performance of diagnostic test procedures are also discussed and/or practiced. Laboratory work will give the student hands-on experience with instrumentation and manual methods to assist with the understanding of troubleshooting, quality control and result interpretation.

Upon completion of the lectures, exams and laboratory exercises, the student will describe the production and function of hemoglobins, white blood cells, and the disorders which affect them. They will also exhibit the ability to perform diagnostic laboratory determinations and interpret and correlate the results and apply the knowledge to examine and correlate test results to disease conditions.

Pre-requisite: MLS5201

MLS5203 - Hemostasis and Thrombosis ***Clock Hours: 44***

Lectures cover the process of hemostasis, hemorrhagic and thrombotic disorders and the principles and performance of laboratory procedures used in the diagnosing and monitoring disorders. Laboratory work will give the student hands-on experience with instrumentation and manual methods to assist with the understanding of troubleshooting, quality control and result interpretation.

Upon completion of the lectures, exams and laboratory exercises, the student will evaluate the hemostasis of the coagulation system including the coagulation, fibrinolysis and the production and function of platelets and disorders that affect them, exhibit the ability to perform diagnostic laboratory determinations and correlate the results and apply the knowledge to examine and correlate test results to disease conditions.

MLS5204 - Urinalysis and Body Fluids Analysis ***Clock Hours: 47***

Lectures cover the physiology and clinical importance of examining urine and body fluids. The course also covers the anatomy and physiology of the kidney in health and disease and the chemical and microscopic examination of urine and body fluids. Laboratory work will give the student hands-on experience with instrumentation and manual methods to assist with the understanding of troubleshooting, quality control and result interpretation.

Upon completion of the lectures, exams and laboratory exercises, the student will describe the characteristics and components of body fluids and urine, illustrate and explain kidney anatomy, kidney function and dysfunction, describe specimen collection, processing, and handling and will apply the knowledge of the principles, interpretation, QC, and clinical significance to physiochemical tests performed on urine. Additionally, the student will be able to discuss and differentiate the properties and physiologic makeup of body fluids.

MLS5301 - Immunopathology I ***Clock Hours: 80***

Lectures cover the characteristics of antigens, antibodies, their reactions and the principles of laboratory tests involving antigen-antibody reactions. Laboratory work will give the student hands-on experience with instrumentation and manual methods to assist with the understanding of troubleshooting, quality control and result interpretation.

Upon completion of the lectures, exams and laboratory exercises, the student will be able to apply the knowledge of the immune system, its components, function, dysfunction and evaluation, summarize various serodiagnostic tests, including the theory and clinical importance of their results and discover the correlation between serologic, hematologic, urinalysis, chemistry and microbiologic results.

MLS5302 - Immunopathology II ***Clock Hours: 74***

Lectures cover the function and dysfunction of the immune mechanism and the laboratory tests used to measure its integrity. A survey of infectious diseases for which serologic testing is of diagnostic importance is also covered. Laboratory work will give the student hands-on experience with instrumentation and manual methods to assist with the understanding of troubleshooting, quality control and result interpretation.

Upon completion of the lectures, exams and laboratory exercises, the student will be able to apply the knowledge of the immune system, its components, function, dysfunction and evaluation, summarize various serodiagnostic tests, including the theory and clinical importance of their results and discover the correlation between serologic, hematologic, urinalysis, chemistry and microbiologic results.

Pre-requisite: MLS5301

MLS5401 - Immunohematology I ***Clock Hours: 87***

Lectures cover the ABO and Rh blood group systems as well as other common blood group systems including their inheritance, antigen and antibody characteristics, and clinical significance, the identification, resolution, and cause of ABO type discrepancies, and serologic procedures performed prior to blood transfusion. Laboratory work will give the student hands-on experience with instrumentation and manual methods to assist with the understanding of troubleshooting, quality control, and result interpretation.

Upon completion of the lectures, exams, and laboratory exercises, the student will explain the principle of tests performed in the blood bank and their importance to the physician and the patient. They will be able to recognize antigen and antibody characteristics of various blood group systems and explain how these might affect patient care. The student will also identify ABO type discrepancy and resolve them patient.

MLS5402 - Immunohematology II ***Clock Hours: 87***

Lectures cover the collection and processing of donor units, donor screening, component preparation, transfusion therapy, and adverse effects of blood transfusion. Additionally, Hemolytic Disease of the Fetus and Newborn, various types of autoimmune hemolytic anemia, the HLA blood group system, hematopoietic stem cell transplantation, and some molecular testing methods are investigated. Laboratory work will give the student hands-on experience with instrumentation and manual methods to assist with the understanding of troubleshooting, quality control, and result interpretation.

Upon completion of the lectures, exams, and laboratory exercises, the student will explain the causes and sources of error in the tests performed. They will be able to identify and describe adverse effects of blood transfusion using a variety of test methods. The student will explain the process of donor screening and

component preparation and its importance in providing safe blood products for patients. The student will explain the significance of hemolytic disease of the fetus and newborn and autoimmune hemolytic anemia and perform testing to help identify them. The student will also describe the significance of hematopoietic stem cell transplantation and HLA and molecular testing.

MLS5501 - Chemistry I ***Clock Hours: 118***

Lectures, reading assignments and hands-on practice are used to present basic laboratory principles of medical laboratory science techniques including quality control, laboratory statistics, pipetting, glassware and function verification/preventative maintenance (FVPM). Safety including basic knowledge of various chemical and biological hazards, proper methods of handling and disposing of them, body fluid precautions and laboratory safety is also covered. The correct use of appropriate safety equipment and techniques is stressed during daily laboratory assignments.

The homeostasis of the human body with respect to acid-base balance, blood gases, water balance and electrolytes are examined as are the testing methodologies and requirements for specimen handling. The enzymatic processes of the patient and their pathological malfunctions are discussed and the testing explained. The substrates on which the enzymes act and the use of enzymes as reagents are additionally explained.

A survey of laboratory methods used to measure various classes of chemicals, their interpretation and clinical application is also covered. Laboratory work will give the student hands-on experience with instrumentation and manual methods to assist with the understanding of troubleshooting, quality control and result interpretation.

Upon completion of the lectures, exams and laboratory exercises, the student will be able to describe the biochemistry, physiology and measurement of various classes of chemicals and explain how to interpret and correlate the laboratory test results. The student will be able to apply quality control principles, reagent preparation, and to correlate the principles of laboratory calculations.

MLS5502 - Chemistry II ***Clock Hours: 118***

Lectures, reading assignments and hands-on practice are used to guide the student through a survey of the proteins of the human body. The non-protein nitrogens, lipids and vitamins are explained and the historical and more recent testing are described and practiced in the student lab with an aim to diagnose both chronic and acute conditions. Exogenous substances both prescribed and illicit will affect the body in numerous ways and how the body acts on the substances is defined. The specifics of the processes are examined and the testing discussed with an emphasis placed especially on the purposes both for taking therapeutic drugs and testing for various analytes. The regulation of complex systems of the body are carried out by the endocrine system. Several of the most important endocrine axes are diagramed pathological increases and decreases in hormones or their precursors are explained and diagnosed both in case studies and in the student lab.

A survey of laboratory methods used to measure various classes of chemicals, their interpretation and clinical application is also covered. Laboratory work will give the student hands-on experience with instrumentation to assist with the understanding of troubleshooting, quality control and result interpretation.

Upon completion of the lectures, exams and laboratory exercises, the student will be able to describe the biochemistry, physiology and measurement of various classes of chemicals and explain how to interpret and correlate the laboratory test results. The student will be able to apply quality control principles, reagent preparation, and to correlate the principles of laboratory calculations.

Pre-requisite: MLS5501

MLS5601 - Laboratory Operations I ***Clock Hours: 89***

Lectures and demonstration are used to present basic laboratory principles of venipuncture. The student will learn to effectively obtain blood specimens using the multi-sample evacuated tube system. Knowledge and understanding of medical terminology and jargon is a necessary part of effective communication skills. Self-instructional textbook assignments, a written exam and day-to-day exposure during lab activities enable the student to develop these skills.

Lectures and reading assignments cover the ethics and principles of clinical research, governmental regulations and their associated organizations, and basics of data analysis. Students will complete a written research project, using testing data to illustrate the methods used when validating a test in the clinical laboratory.

Upon completion of the lectures, exams, laboratory exercises and projects, the student will be able to apply the process learned to future test validation and research projects. In addition, the student will describe the most effective way for obtaining blood specimens from a patient.

MLS5602 - Laboratory Operations II ***Clock Hours: 107***

Lectures and reading assignments throughout the year cover the basics of management, leadership and educational principles. In order to demonstrate the practical application of these principles as they apply to laboratory management and education, the student is required to complete a capstone project.

Upon completion of the lectures, exams and projects, the student will differentiate the principles of management and define operational processes as they pertain to the laboratory.

MLS5603 - Laboratory Operations III ***Clock Hours: 47***

The last weeks of the program are devoted to a review of the year's work, integrating the knowledge from all coursework through case studies and successful completion of the program's comprehensive examinations.

Upon completion of the exams and other assignments, the student will successfully apply the knowledge gained during the program for the comprehensive exams and extrapolate that knowledge to the ASCP BOC exam.

MLS5701 - Molecular Diagnostics ***Clock Hours: 72***

Lectures and reading assignments cover principles of molecular biology and genetics, nucleic acid isolation and quality assessment, a broad range of molecular techniques common to molecular diagnostics services, cytogenetic studies and fluorescent in-situ hybridization. Laboratory exercises cover micro-pipetting, PCR master mix preparation, high resolution melt curve genotyping analysis, karyotyping and FISH scoring.

Upon completion of lectures, exams and laboratory exercises, the student will be able to correlate genomic aberrations at different resolutions with neoplastic or hereditary diseases. In addition, the student will explain the pre-analytic, analytic and post-analytic components as well as compare and contrast the advantages and limitations of selected techniques in the cytogenomics and molecular biology field.