

Clinical Laboratory Science

DeVry's Clinical Laboratory Science program prepares graduates for positions in hospital, medical, physician and commercial laboratories as clinical laboratory scientists in areas such as hematology/hemostasis, immunohematology, immunology, clinical chemistry and microbiology (including molecular diagnostics). Through analysis of body fluids, tissues and cells, clinical laboratory scientists play crucial roles in detecting, diagnosing and treating disease and providing test results to other healthcare professionals. DeVry's CLS program uses a combination of didactic and clinical education to help students develop a wide range of professional skills needed to function in an atmosphere of inquiry and innovation.

Program Objectives

The Clinical Laboratory Science program is designed to produce graduates who:

- Exhibit independent judgment in applying principles of preanalytical, analytical and postanalytical concepts; developing tests, techniques and procedures; and evaluations, including interpretive diagnostics in all areas of the clinical laboratory such as hematology, clinical chemistry, immunohematology, microbiology, immunology, hemostasis, body fluids, phlebotomy, molecular and emerging diagnostics.
- Identify and correct, when appropriate, sources of biohazards and unsafe lab practices in compliance with federal, state and local regulations.
- Demonstrate proficiency in operating, maintaining, troubleshooting, managing and evaluating a variety of lab equipment.
- Evaluate published studies through understanding and application of research design and practice as they relate to clinical laboratory science.
- Apply information management systems to enable timely, accurate and cost-effective reporting of lab-generated information.
- Demonstrate understanding and applications of human resource and financial management, regulatory compliance, budgeting, and quality assurance and improvement to ensure timely, accurate and cost-effective reporting and appropriate use of lab-generated information.

DeVry accomplishes these goals by:

- Providing an academic program with a solid foundation in the arts and sciences, with strong emphasis on the natural sciences, including the more specialized areas of microbiology, cell biology, immunology, organic chemistry and biochemistry.
- Incorporating into each science and clinical science course a strong lab or clinical component, including use of appropriate hardware and software for testing and analyzing biological samples.
- Integrating general competencies such as applied research, written and oral communication, critical thinking, problem-solving and team skills into science and non-science courses.

Program details

Degree: Bachelor of Science in Clinical Laboratory Science

Semesters: 9 full time

Minimum credit hours to graduate: 132

Each lettered group below represents a graduation requirement, with any alternate choices.

Course Area	Minimum Credit Hours
Communication Skills	14
(a) one of: ENGL-112; ENGL-220H	
(b) ENGL-135	
(c) ENGL-206	
(d) one of: ENGL-230; SPCH-275; SPCH-277; SPCH-279; SPCH-282	
Humanities	9
(a) one of: HUMN-420; HUMN-422; HUMN-424; HUMN-427; HUMN-428	
(b) HUMN-460	
(c) HUMN-432	
Social Sciences – select one of the following groups	9
(a) all of: ECON-312; PSYC-110; SOCS-350 or SOCS-410	
(b) all of: ECON-312; PSYC-285; SOCS-185 or SOCS-187	
Personal and Professional Development	5
(a) all of: CARD-405; COLL-148	
Mathematics and Sciences	51
(a) all of: MATH-114; MATH-221	
(b) all of: BIOS-140; BIOS-245; BIOS-350; BIOS-380; BIOS-390; BIOS-420; BIOS-430; BIOS-480; CHEM-130; CHEM-140; CHEM-225	
Clinical Laboratory Science	44
(a) all of: CLS-100; CLS-220; CLS-399; CLS-410; CLS-411; CLS-420; CLS-421; CLS-430; CLS-431; CLS-440; CLS-441; CLS-442; CLS-450; CLS-499	

Course Descriptions

BIOS-245 Cell Biology with Lab

This introductory course focuses on structural organization and processes of eukaryotic cells. Topics include fundamental molecular, cellular and genetic processes common to all mammalian cells. In the lab, students employ methodologies and techniques commonly used in modern cell biology, with an emphasis on clinical relevance. Prerequisite: CHEM-130 / 5-4

BIOS-350 Human Anatomy and Physiology with Lab

This course covers functional organization of the human body and control of the “internal environment.” General anatomy and physiology of the muscular, digestive, cardiovascular, respiratory, nervous and excretory systems are examined, with emphasis on quantitative methods for analyzing and understanding physiological systems. Lab work includes observation and experimentation related to clinical topics. Prerequisite: BIOS-245 / 5-4

BIOS-380 Introduction to Biochemistry with Lab

This course examines theory and application of biochemical principles. Topics include basic structures of the major classes of biological molecules, including carbohydrates, lipids, proteins and nucleic acids, as well as exploration of central metabolic activities of living organisms. Lab exercises relate to topics discussed. Prerequisite: CHEM-225 / 5-4

BIOS-390 Molecular Biology with Lab

This course focuses on molecular mechanisms of cellular processes. Topics covered include DNA replication, genetic recombination, transcription, gene regulation, protein synthesis, genomics and proteomics. Molecular methods used to analyze these processes are also covered. Lab exercises relate to topics discussed. Prerequisites: BIOS-245 and CHEM-225 / 5-4

BIOS-420 Microbiology I with Lab

This course, the first in a two-course sequence, pertains to study of clinically significant microorganisms, including bacteria and fungi. Identifying pathogenic microbes and basic microbiology practices is emphasized. Lab exercises develop technical skill in media culture, asepsis and isolation of pathogenic microorganisms. Prerequisite: BIOS-350 / 5-4

BIOS-430 Microbiology II with Lab

This continuation of BIOS-420 covers principles, procedures and applications of introductory clinical microbiology. Lab work emphasizes diagnostic tests and practices related to study of microorganisms. Prerequisite: BIOS-420 / 5-4

BIOS-480 Immunology

This course examines concepts of immunology as related to antigen presentation, immunoglobulin structure, host defense mechanisms, allergies and autoimmunity, with particular emphasis on use of the antigen-antibody reaction in pathogen detection. Prerequisites: BIOS-390 and BIOS-430 / 3-3

CHEM-130 General Chemistry I with Lab

This course covers fundamental principles and laws involved in chemical change. Topics include measurement nomenclature, stoichiometry, atomic structure, bonding, properties of gases, liquids and solids, and solution calculations. Lab exercises relate to topics discussed. Prerequisite: MATH-114 / 5-4

CHEM-140 General Chemistry II with Lab

Students in this course continue their study of fundamental principles and laws involved in chemical change. Topics include acids and bases, bonding theory, electrochemistry, equilibrium, thermodynamics, kinetics and nuclear chemistry. Lab exercises relate to topics discussed. Prerequisite: CHEM-130 / 5-4

CHEM-225 Fundamentals of Organic Chemistry with Lab

This course presents fundamentals of organic chemistry, with emphasis on structure, nomenclature and reactions as applied to organic compounds. Topics discussed include compound nomenclature, stereochemistry, alkanes, alkenes, alkynes, haloalkanes, alcohols, ethers, epoxides, carbonyl containing compounds, aromatics and spectroscopy. Biochemical molecules are introduced, with their organic functional groups. Laboratory exercises relate to and support the topics discussed. Prerequisite: CHEM-140 / 5-4

CLS-100 Laboratory Science Career Entry Exploration and Phlebotomy

Students explore career opportunities associated with professions in pathology, the science which seeks to understand changes in function and structure of organs, tissues, cells and their body fluids that lead to disease and death. Students interact with other members of the healthcare team to understand the role of the clinical laboratory scientist. Special emphasis is placed on the practice of phlebotomy and securing specimens for testing. Prerequisite: Admission to the Clinical Laboratory Science program / 2-2

CLS-220 Laboratory Information Systems

This course helps familiarize students with computer architecture, tools, network topologies and devices that support modern healthcare organizations. Examined are design and implementation of computer infrastructure, as related to accessing medical databases, as well as transfer and manipulation of medical data over communication networks. Prerequisite: Admission to the Clinical Laboratory Science program / 3-3

CLS-399 Preprofessional Practice for the Clinical Laboratory

Students in this course assess professional and personal goals as they prepare for preceptorship in clinical laboratory practice. Students perform an individualized health assessment in terms of vaccinations and accepting personal responsibility in adhering to safe practices; apply rules and regulations of health information; incorporate behavior principles of safety and infection control; and model the role of the clinical laboratory scientist. To enroll in this course, students must meet the requirement stated in *Additional Academic and Administrative Requirements for Students in the Clinical Laboratory Science Program*. Prerequisites: BIOS-480 and ENGL-135 / 2-2

CLS-410 Clinical Chemistry I

This clinical course describes principles and procedures for performing clinical lab tests for carbohydrates, lipids, proteins, heme derivatives, enzymes, liver function, urinalysis, spinal fluid, electrolytes, acid-base blood gases, therapeutic drug monitoring, toxicology, endocrine systems and trace elements. Immunoassays, nucleic acid probes, tumor markers and inherited metabolic disorders are introduced. Application of statistical analysis to principles of quality assurance and quality control are incorporated into routine practice. Corequisite: CLS-399 / 7-4

CLS-411 Clinical Chemistry II

In this clinical course, molecular and genetic basis of inherited metabolic disorders, immunologic disorders, tumor markers and other chemistry-related tests are discussed in the context of health and disease. Techniques for identifying and resolving variations and discrepancies in test results and procedures are discussed. Students design and perform method evaluation studies; focus on quality assurance and management; gain experience in evaluating lab data; assess tests for validity and accuracy; and document corrective action. They also become familiar with a variety of lab instruments. Prerequisite: CLS-410 / 6-3

CLS-420 Clinical Microbiology I

This clinical course applies basic scientific diagnostic principles and lab examination to clinically significant bacteria, parasites, fungi and viruses. Students identify medically relevant aerobic gram-positive and -negative cocci, gram-positive and -negative bacilli, and anaerobes through morphological and biochemical characteristics. Mycobacterium, Chlamydia, Mycoplasma and other viruses are discussed, as are blood and tissue protozoa, intestinal and urogenital protozoa, and intestinal and tissue helminthes. Prerequisite: CLS-399 / 7-4

CLS-421 Clinical Microbiology II

This clinical course examines the relationship between the host and microbe concepts of resistance; application of molecular techniques to the diagnosis, quantification and monitoring of infectious diseases; recognition of uncommon organisms; and the role of epidemiology in institutions and the community. Students design and evaluate new protocols and procedures, interpret complex concepts and explain them to other members of the healthcare team, and resolve discrepancies. Prerequisite: CLS-420 / 6-3

CLS-430 Hematology and Hemostasis I

This clinical course examines hematopoiesis including erythropoiesis, leukopoiesis and platelets; morphology and function; production and destruction; metabolism; and related disease states. Lab procedures include cell morphology and enumeration, and quantification of coagulation parameters. Students evaluate, interpret and report test results, including criteria by which specimens should be referred for further review. Microscopy is studied, including basic principles, components, functions, adjustments, focus features and maintenance. Prerequisite: CLS-399 / 7-4

CLS-431 Hematology and Hemostasis II

This clinical course examines hematopathology with classification of anemias, hemoglobinopathies, hemoglobin defects, leukocyte disorders, cytochemistry, histochemistry, cytogenetics, classification of leukemias, myeloproliferative and lymphoproliferative disorders, myelodysplastic syndromes and leukocyte neoplasia. Hemostasis examines pathophysiology including vascular purpuras, platelet disorders, hemophilia and thrombotic disorders. Prerequisite: CLS-430 / 6-3

CLS-440 Clinical Immunology

This clinical course examines immunochemistry and immunobiology, which play an evolving role in diagnosing health and disease. Immunocytology through the hematopoietic and lymphoid systems is discussed. Clinical lab techniques using immunological principles such as precipitation, agglutination and hemagglutination are addressed. Concepts of phagocytosis, allergy, hypersensitivity, autoimmune disease, transplantation, tumor immunology, and natural resistance and acquired immunity are explained in terms of patient symptoms and lab tests.

Prerequisite: CLS-399 / 6-3

CLS-441 Immunoematology I

This clinical course addresses how blood group genetics, characteristics of blood group systems and related principles of immunoematology influence blood bank practices and transfusion services. Donor criteria, as well as collecting and processing blood and other tissue, are examined. Prerequisites: CLS-431 and CLS-440 / 7-4

CLS-442 Immunoematology II

This clinical course explores advanced concepts in genetics and immunology as applied to immunoematology. Indications for transfusions, component therapy, and adverse effects of transfusions are discussed. Federal and state regulations and current standards of practice are examined, as is accreditation in blood and other tissue banking. Prerequisite: CLS-441 / 6-3

CLS-450 Clinical Laboratory Operations and Management

This course examines principles of lab management, including fiscal and regulatory aspects. Quality control and assessment as tools for excellence in lab services are examined. Use of lab information systems as management resources, and for business and strategic planning, is introduced. Human resource management is discussed in the context of professional practice.

Prerequisites: CLS-399 and senior status / 3-3

CLS-499 Professional Education and Research

This course explores methods and teaching techniques to prepare clinical lab scientists to educate healthcare professionals, patients and the public. The course details the role of program assessment, planning, delivery and evaluation impact on continuing education in staff and professional development. Clinical laboratory science journals and articles are reviewed.

Students become familiar with solid and flawed research design. Prerequisites: CLS-399 and senior status / 3-3

HUMN-460 Bioethics

This course explores rapidly advancing frontiers of biomedical and genetics research, where science, religion, ethics and public policy intersect. Issues, concerns and interrelationships are examined through readings, case studies and class discussions. Students analyze political, economic and complex ethical and public policy issues centering on such topics as stem cell research, cloning, gene therapy and other genetics-related issues. Prerequisite: ENGL-135 / 3-3

Accreditation

The process of applying for accreditation from the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS) for DeVry's Clinical Laboratory Science program is expected to be completed prior to graduation of the first class of students. Application typically occurs once the program is fully operational.

Alternate Admission Requirements for Clinical Laboratory Science Program

Applicants must meet at least one of the following requirements in lieu of meeting those outlined in the following sections of the DeVry University academic catalog: *Basic and Prerequisite Skills Evaluation Requirement, Prior Educational Performance, Basic and Prerequisite Skills Evaluation, Basic and Prerequisite Skills Evaluation Deadline, Basic and Prerequisite Skills Evaluation Results* and *Course Diagnostic Tests*.

CLS programs applicants must meet one of the following:

- Earned an associate degree in the natural or clinical laboratory sciences, or a clinical laboratory technician certificate, from a DeVry-recognized postsecondary institution.
- Earned a minimum of 12 semester-credit hours of qualifying academic work, with at least a C average, from a DeVry-recognized postsecondary institution, and they must have completed college courses that include labs, in both biology and chemistry, with grades of B or better.
- Completed one year each of high school biology and chemistry, with grades of C or better, and they must also have a minimum composite ACT score of 21 or minimum SAT scores of 540 in Math and 510 in Verbal/Critical Reading.

To be considered for admission, applicants should make sure all required admission materials are received by DeVry at least eight weeks prior to the desired class start date.

NOTE: Because clinical positions are limited, the number of applicants accepted for a particular starting class may be limited. In addition, accepted applicants who do not start with their specified class are not guaranteed acceptance for a particular class starting at a later date. Should the number of qualified applicants exceed the number of clinical positions available for a starting class, acceptance to that class will be determined by a point system based on applicants' admission test scores as well as other factors such as prior work experience in a clinical setting and prior education in related subjects.

Healthcare Practicum and Clinical Coursework Requirements

Certain DeVry programs require students to successfully complete practicum or clinical coursework at an affiliated healthcare site. Before accepting students, such healthcare sites require a physical exam, proof of freedom from communicable disease, a criminal background check and/or a drug screen. Random drug screens may be required. Students rejected by a practicum or clinical site for any reason cannot finish their programs' required coursework and therefore cannot graduate.

Applicants to, and students in, programs with practicum or clinical coursework components must comply with DeVry's requirements for their program. Failure to fully disclose a criminal record, failure to comply with background and/or drug screening requirements, or failure to have a satisfactory outcome may result in denial of admission to or dismissal from the program.

Additional Graduation Requirement for Clinical Laboratory Science Program Students

To graduate, students in the Clinical Laboratory Science program must fulfill the following graduation requirement in addition to fulfilling general graduation requirements:

- Earn a grade of B or better in each CLS clinical course after no more than two attempts of the course.

Additional Academic and Administrative Requirements for Clinical Laboratory Science Program Students

Course-Area GPA Requirement for Mathematics and Sciences Courses

A student must maintain a course-area GPA of at least 2.50 in all courses listed in the Mathematics and Sciences course area of the program details. If the course-area GPA is less than 2.50 for two consecutive semesters, the student must participate in an academic advising session prior to enrolling in the following semester. When advising results in a realistic academic plan to restore the course-area GPA to at least 2.50 within two additional semesters, the student may continue. If the course-area GPA is less than 2.50 after the second additional semester or any subsequent semester, the student may be dismissed from the program. Students may attempt a course no more than twice.

Requirements for Enrolling in CLS-399, Preprofessional Practice for the Clinical Laboratory

CLS students must meet the following requirements prior to the first class session of CLS-399.

- Provide documentation of the following personal health statuses. Documentation must be received from the student's healthcare provider.
 - Standard history and physical examination performed by the student's family or school physician within one year prior to the start date of CLS-399.
 - A PPD intermediate skin test within one year prior to the start date of CLS-399, except for students who received the BCG vaccine.
 - Chest X-ray for students whose PPD test results are positive or whose examining physician requests the X-ray.
 - Records of completed courses of immunization that include Rubella. (Rubella titer is accepted in lieu of Rubella immunization.)
 - Evidence of Varicella immune status by titer.
 - Proof of acceptable vaccination for, or lab evidence of immunity to, measles (students born after 1956).
 - Evidence of Hepatitis B vaccination. Students unable to receive the Hepatitis B vaccine series must sign a waiver and submit it to their academic advisor. Waivers become part of students' health records.
 - Declaration of the student's general ability to function in a clinical setting.

- Successfully complete all courses in the Mathematics and Sciences course area with a minimum course-area GPA of 2.50.
- Undergo a criminal background check no more than 90 days prior to the first day of class. This check must be arranged through DeVry's Human Resources department and is at students' expense. Students whose results prevent them from participating in clinical activities cannot finish their program's required coursework and therefore cannot graduate.
- Be tested for illegal substance use no more than 90 days prior to the first day of class. This screening must be arranged through DeVry's Human Resources department and is at students' expense. Students whose test results are positive cannot finish the program's required coursework and therefore cannot graduate.
- Provide evidence of current CPR certification
- Provide evidence of successful completion of a DeVry-recognized phlebotomy course.

If the student does not remain continuously enrolled after meeting the above requirements, updated documentation may be required.

Requirements for Enrolling in Clinical Coursework

To enroll and participate in clinical coursework, students must:

- Purchase a prescribed uniform (scrubs and lab coats) to be worn during clinical rotations. Individual clinical facilities may have additional requirements.
- Successfully complete CLS-399 as well as receive a positive recommendation from the CLS program's clinical program director. This requirement is not applicable for enrollment in CLS-410, Clinical Chemistry I, when it is taken concurrently with CLS-399. In determining students' readiness for additional clinical coursework, the director will assess candidates' technical competency, emotional stability and maturity, interpersonal and communication skills, and ability to relate effectively to other healthcare professionals.

Individual clinical facilities may have additional requirements. CLS students will be informed of these requirements.